

## YELLOWTAIL ROCKFISH RETENTION WITHIN THE NON-TRAWL RCA IN THE SALMON TROLL FISHERY NORTH OF 40°10' N. LAT. ANALYSIS

This report summarizes background analysis of the open access trip limit available to salmon trollers for yellowtail rockfish north of 40° 10' N. lat. Because of staff changes affecting the number of available analysts for the 2021-2022 management measures, the Washington Department of Fish and Wildlife volunteered to conduct the analysis. The report was authored by Corey Niles and provided to the Groundfish Management Team and Council staff for help in their deliberations on the potential effects of changing the trip limit. Their summary analysis is found in Agenda Item G.6, Attachment 2,— Management Measure Analytical Document.

### **1.1 The Current Trip Limit and relation to the non-trawl RCA**

The current limit reads:

*Salmon trollers may retain and land up to 1 lb of yellowtail rockfish for every 2 lbs of salmon landed, with a cumulative limit of 200 lb/month, both within and outside of the RCA. This limit is within the 200 lb per month combined limit for minor shelf rockfish, widow rockfish and yellowtail rockfish, and not in addition to that limit.<sup>1</sup>*

This language is set within the paragraph describing the open access troll trip limits. Those trip limits are structured around two types of trip: (1) those where *some* trolling occurs within the non-trawl Rockfish Conservation Area (RCA) and (2) those where *no* trolling happens within the RCA.

The yellowtail to salmon ratio and 200 lb monthly limit apply to both types of trip. This stands in contrast to the lingcod per Chinook allowance, which only applies to trips where some fishing occurs within the RCA. For trips that fish within the RCA, yellowtail and lingcod are the only groundfish that trollers are permitted to retain on those trips.

#### **1.1.1 Recommended Structure of the Alternatives**

The current salmon troll yellowtail allowance has three main elements: (1) the allowable ratio of yellowtail to salmon per trip, (2) the cumulative monthly limit for yellowtail rockfish; and (3) the additional species included in that monthly limit.

On the first, the recommendation was to create alternatives that would offer the Council the choice to either keep and adjust the ratio or to eliminate it entirely so that trollers would fish subject only to a monthly limit. On the second, the recommendation was to consider raising the monthly limit to be consistent with changes in the general open access trip limits. On that same rationale, the recommendation is to drop the third component as because it is no longer consistent with the general open access trip limits.

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<sup>1</sup> See rows 32 and 33 in the current Table 3 (North) ([https://www.ecfr.gov/cgi-bin/text-idx?SID=344b49f64f2a0abc4f73d26a83c3b282&mc=true&node=ap50.13.660\\_1333.1&rgn=div9](https://www.ecfr.gov/cgi-bin/text-idx?SID=344b49f64f2a0abc4f73d26a83c3b282&mc=true&node=ap50.13.660_1333.1&rgn=div9)).

#### 1.1.1.1 The Yellowtail to Chinook ratio

The ratio component of the trip limit is the main mechanism for limiting the opportunity to target yellowtail. Eliminating it would allow trollers more opportunity to target yellowtail, to the extent that targeting would be possible and profitable. As shown below, there appears to be opportunity for targeting under the current ratio as few trips land the maximum allowable now.

The existing 1 lb of yellowtail to 2 lbs of salmon ratio not been adjusted since it was established. This and other factors add to the difficulty of projecting how the fishery would respond to an adjustment. The recommendation would therefore include making the ratio adjustable through inseason or more routine action. Adjustments based on post-season catches and expectations for troll effort in the coming salmon season are more likely to be necessary or appropriate than adjustments within a season.

#### 1.1.1.2 The Monthly Limit

The 200 lbs per month limit currently in place was set when yellowtail was part of a multi-stock trip limit. With the 2017-2018 management cycle, the Council created a monthly limit specific to yellowtail, which is currently set at 500 lb.

The intent of the original language was to not allow trollers fish over and above what they could land when fishing open access outside of the salmon troll fishery. This same intent could be met by holding salmon trollers to the 500 lb yellowtail monthly limit and dropping the reference to shelf rockfish and widow rockfish. If the Council were to raise the open access limit, a troll-specific monthly limit could be appropriate. Keeping with existing practice, the troll monthly limit would not be additive to the general open access monthly limit.

#### 1.1.1.3 Options Proposed

The current salmon troll yellowtail allowance has three main elements: (1) the allowable ratio of yellowtail to salmon per trip, (2) the cumulative monthly limit for yellowtail rockfish; and (3) the additional species included in that monthly limit (Table 1). The analysis structures the Options so that the Council could choose to keep and adjust the ratio or eliminate it so that trollers would fish subject only to a monthly limit. The recommendation is to drop the third component, for the reasons described below. The Options proposed include

**Table 1. Options for potential yellowtail retention amounts (lbs.) by non-groundfish (salmon trollers) north of 40°10' N. lat.**

| <b>Option</b> | <b>Ratio (per trip)</b>             | <b>Monthly Limit</b> |
|---------------|-------------------------------------|----------------------|
| 1             | 1 lb yellowtail per 2 lbs of salmon | 500 lbs              |
| 2             | 1 lb yellowtail per 1 lb salmon     | 500 lbs              |
| 3             | No ratio – any salmon on board      | 500 lbs              |

### 1.1.2 History and Original Intent of the Trip Limit

The current limit was analyzed by the GMT in 2001 at the request of Washington salmon trollers.<sup>2</sup> The request was for an increase of the existing 100 lb per month limit. To evaluate the request, the GMT considered landings for 1997-1999 and noted the following major patterns:

- The “vast majority of salmon troll landings during [that] period contained no yellowtail rockfish.”
- On those that did contain yellowtail, the per trip landing averaged 50-75 lbs and “[m]any of the individual trips contained more than 100 lb yellowtail rockfish.”

The team assumed that the average Chinook weight was four times that of a yellowtail and advised that “a 300-lb monthly cap on salmon troll landings [would] allow most existing yellowtail rockfish bycatch to be landed in this fishery without providing significant additional incentive to target yellowtail.” More specifically, the team noted that “at least 85% of the yellowtail rockfish bycatch in this fishery were landed on trips where they represented less than 50% of the salmon poundage in the landing.” This means that the team and Council only expected 15% of trips or fewer to max out at the ratio of 1 lb of yellowtail to 2lbs of salmon (i.e. 1 lb is 50% of 2 lbs). Another reason the team offered for using the per-trip ratio was to “prevent individuals who do not routinely catch much yellowtail from making yellowtail-directed trips at the end of a month.”

The Council first recommended the allowance go into place during the May-December 2002 time period, reinstated it for May-December 2003, and then added it as an ongoing allowance as part of the 2004 annual specifications and management measures cycle. For the 2003 reinstatement, NMFS summarized the Council’s intent as wanting to provide for a “small trip limit” that would “help reduce discard in the salmon troll fishery, without providing an incentive to target yellowtail rockfish or to increase the incidental catch of canary rockfish.”<sup>3</sup>

The non-trawl RCA was established with the 2003.<sup>4</sup> Unlike off California and Oregon, the RCA was different in that no inshore areas were left open in Washington. The closure extended from shore to the seaward boundary of 100 fm and the inshore depths left open would have all been closed by state rules prohibiting commercial groundfish fishing in state waters.

The yellowtail allowance has not been revisited until now. Canary rockfish was declared rebuilt in 2015 and the Council has been revisiting restrictions that were put in place to aid its rebuilding. The troll incidental allowance for lingcod was considered and relaxed as part of the 2019-2020 management cycle. Beyond the change in situation with rockfish rebuilding, salmon trollers have requested a change based on increased encounters of yellowtail and their reduced salmon opportunities. The increased cost of VMS compliance has also been expressed as a concern.

### 1.1.3 Factors that may be relevant for evaluating the alternatives

The original intent of the trip limit provides a key factor for the Council to consider. In terms of changed circumstances and new information, eighteen or so years of data are now available on patterns of catch and

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<sup>2</sup> The material in this paragraph summarizes the discussion given in PFMC Briefing Book April 2001, Exhibit F.5.b Supplemental GMT Report: [https://www.pcouncil.org/bb/2001/0401/Ex\\_F.5.b\\_Supp\\_GMT\\_Report\\_April2001BB.pdf](https://www.pcouncil.org/bb/2001/0401/Ex_F.5.b_Supp_GMT_Report_April2001BB.pdf). The Council’s reaction to the GMT’s recommendation was not researched beyond the summary given in the Federal Register cited in the next footnote.

<sup>3</sup> This background is taken from 68 FR 23901 (<https://www.federalregister.gov/documents/2003/05/06/03-11084/fisheries-off-west-coast-states-and-in-the-western-pacific-pacific-coast-groundfish-fishery-annual>).

<sup>4</sup> <https://www.govinfo.gov/content/pkg/FR-2003-01-07/pdf/02-32756.pdf>

effort under the existing trip limit. The conservation picture for groundfish has also changed considerably with canary rockfish being declared rebuilt and yelloweye rockfish projected to rebuild much faster. The salmon troll fishery has been subject to restrictive seasons and many other changes since the early 2000s as well.

In recent cycles, the Council has been restoring fishing opportunities for yellowtail and other species limited by measures for rebuilding canary in other fishery sectors. The MSA requires the Council to share “overfishing restrictions and recovery benefits” fairly and equitably among fishery sectors.<sup>5</sup> Workload and risk aversion toward catch uncertainty have led the Council to take a cautious approach to adjusting management measures related to canary. In the 2019-2020, the Council recommended an increase to the troll trip limit for lingcod.

As noted above, that original intent was to accommodate yellowtail bycatch on 85% or more of the trips while limiting the opportunity to target. On the latter, targeting would not cause concern for the yellowtail ACL or sector allocations. However, as in the past, fairness may also be a consideration. Questions of fairness might arise in that the directed groundfish sectors are excluded from the RCA.

Regulatory discards are the trade-off to measures that prevent targeting. That is, if a trip limit is set too restrictively relative to the true rate of incidental encounter, it will force discarding of fish that could have otherwise been sold. Ensuring that regulations are proportionate to conservation need, minimizing adverse impacts on and promoting the sustained participation of fishing communities, and minimizing bycatch are all factors for the Council to consider under National Standards 7, 8, and 9 and other provisions of the Magnuson-Stevens Act. The trade-off between targeting and regulatory discards cannot be surgically balanced. Variability in rates of encounter, especially at the trip level, makes it impractical to do so.

Canary rockfish bycatch was noted as a concern when the trip limit was created, although the GMT noted low correlations between canary and yellowtail landings. If the yellowtail allowance does no more than allow trollers to retain yellowtail catch they encounter incidentally, then no additional bycatch would be expected beyond what would be expected from their pursuit of salmon. If the increase were enough to induce targeting or shifts or increases in effort, then differences in catch rates could result. Without observations on discard in the fishery, the current canary rockfish catch is unknown. The historical canary landings in the troll fishery are small.

Another factor considered by the Council in the past is that the non-trawl RCA affects regions differently. The original request for the incidental allowance came from Washington-based trawlers. Off Washington, the non-trawl RCA closes waters from shore to 100 fm thereby covering the key salmon troll grounds. In contrast, there are open nearshore areas off the other two states where trollers can fish without entering the RCA. In addition, Washington does not have a directed commercial nearshore fishery where yellowtail and lingcod can be accessed and harvested under the open access trip limits.

Lastly, the cost of vessel monitoring system (VMS) compliance is another factor of potential relevance to the Council, as discussed below.

#### **1.1.4 Available Data**

The incidental rate of encounter of yellowtail would best be evaluated using observer data. However, the salmon troll fishery is not covered by WCGOP. No current information is available to quantify discards in the sector. As in 2001, landings information therefore provides the best available data to evaluate the trip

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<sup>5</sup> Sec. 304(e)(4)(B)

limit. This introduces some complications, primarily with the interpretation of trips that bring in “zero” yellowtail. These complications are discussed further where relevant.

### 1.1.5 Yellowtail Landings

Figure 1 plots the time series of yellowtail landings by trollers north of 40° 10’N. lat beginning in 1990. The time series begins with that year because that is when yellowtail began to consistently show up on troll fish tickets.<sup>6</sup> With the exception of 1993 and 1996-1998, landings have remained below 10 mt. Since 1999, salmon troll landings of yellowtail have not exceeded 8 mt. Since 2005, landings have not exceeded 4 mt. Figure 1 illustrates the longer-term trend.

Table 2 reports landings for the last 10 years so that they can be read more precisely.

To place these landings in context, the total projected impacts across the non-trawl sectors for the yellowtail north stock are ~73 mt for 2021 and 2022. The non-trawl allocation is expected to be just under 600 mt (see Section 2.2). Without observer data, the amount of discarded yellowtail is unknown. Based on the small percentage of trips and boats retaining groundfish, it is possible that discards could equal or exceed that of the landed catch. Even if so, the total mortality from the troll is still highly unlikely to place pressure on sector allocations or the ACL.

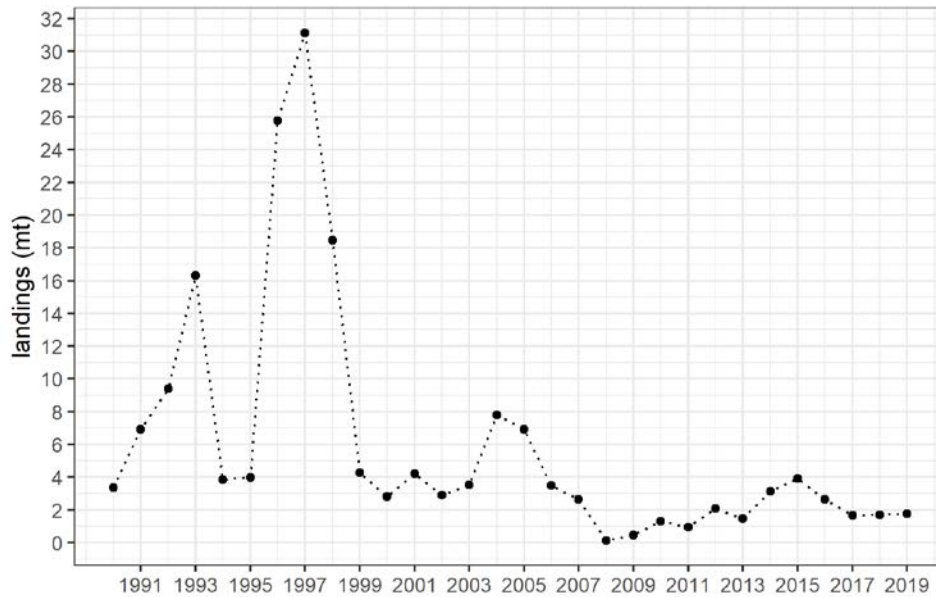


Figure 1. Annual landings of yellowtail rockfish north of 40° 10’N. lat. by salmon trollers, 1990-2019.

Table 2. Annual landings (metric tons) of yellowtail rockfish north of 40° 10’N. lat. by salmon trollers, 2010-2019.

| 2010 | 2011 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|------|------|------|------|------|------|------|------|------|------|
| 1.3  | 0.9  | 2.1  | 1.5  | 3.1  | 3.9  | 2.6  | 1.7  | 1.7  | 1.8  |

<sup>6</sup> At the time of writing, the fish ticket reporting practices and other patterns effecting catch of yellowtail in the 1990s, such as a history of the applicable open access trip limits, have not been explored. It cannot be ruled out that fish tickets from that era are mixing directed groundfish catch with incidental troll catch or if yellowtail were being consistently reported and sampled for troll landings.

### 1.1.6 Patterns in troll trips

Figure 2 shows how per trip salmon landings have changed since 1997. The trip limit is based on landings of all salmon. Chinook and coho are the main targets of the ocean troll fishery, although Chinook makes up the bulk of the landings. This is true in number of fish but especially so by weight. Over 2002-2019 Chinook made up 96.6 percent of landings by weight in areas north of 40° 10'N. lat.

One pattern that stands out in Figure 2 is the difference between the states. Washington saw much higher averages during the 1997-1999 period compared to the average over the last five seasons (754 lbs vs 449 lbs). Oregon landings were also higher over 1997-1999 but not to the same degree (394 lbs vs 288 lbs). California has seen swings but the recent average is very close to what it was in 1997-1999 (175 lbs vs 201 lbs).

Figure 3 shows the same time series for the number of trips taken per month. Washington trollers have made an average of 3 trips per month over the last five seasons compared to 2.6 over 1997-1999. Oregon has seen a decrease, dropping from 3.2 trips per month during 1997-1999 to 2.7 trips during 2015-2019. California experienced a larger drop, from 4.2 down to 2.6 trips per month.

The trips per month and average weight of salmon landed have left higher potential for yellowtail to be landed than has been witnessed. This is not unexpected given that the limit was set to accommodate yellowtail catches that would be relatively infrequent.

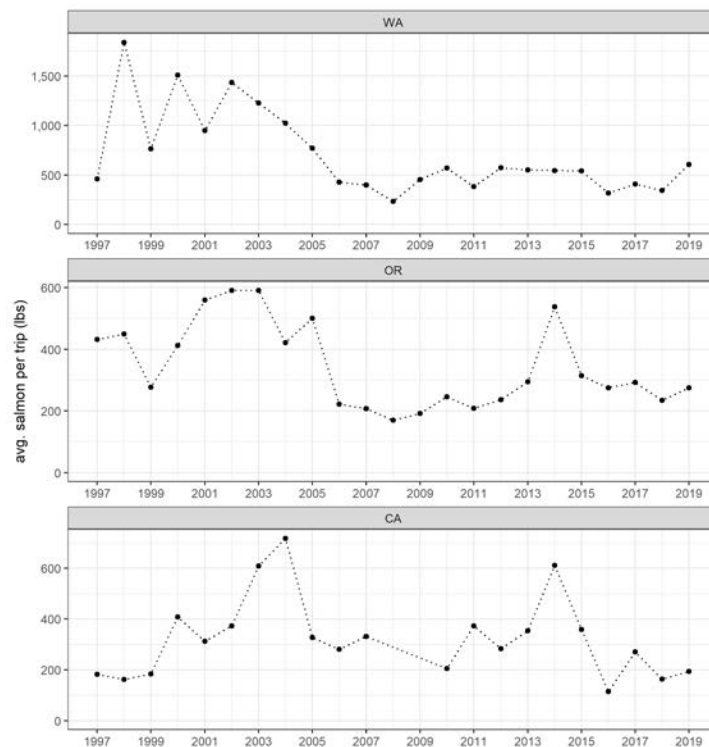
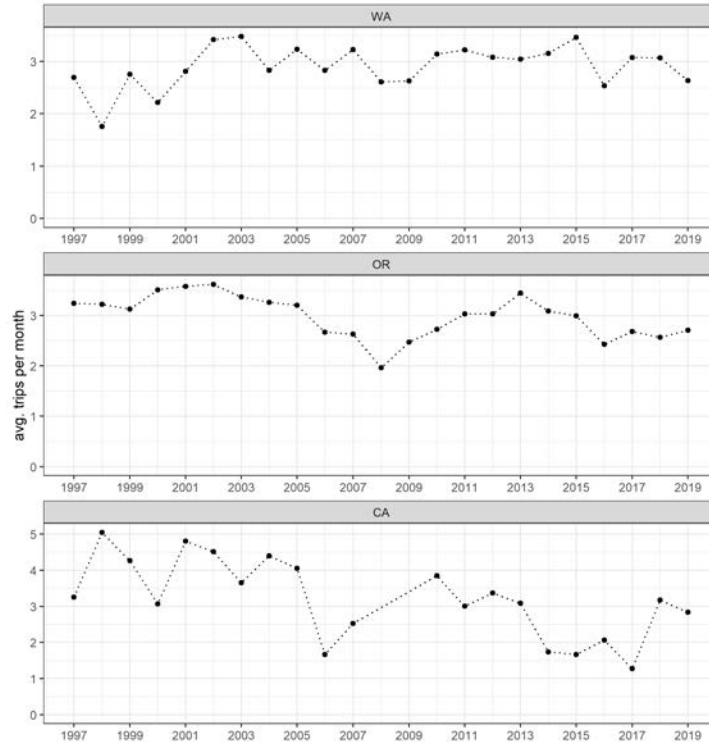


Figure 2. Average salmon landings per trip, 1997-2019, in Washington, Oregon, and California (areas North of 40° 10'N latitude). A missing point indicates a zero or fewer than three vessels.



**Figure 3. Average number of trips taken per month by troll vessels, 1997-2019 in Washington, Oregon, and California (areas North of 40° 10’N latitude). The missing points in CA in 2008 and 2009 are due to the fishery closures in those years.**

### 1.1.7 Vessels landing groundfish – Effect of VMS

Only a minority of trollers choose to take advantage of the trip limits. Figure 4 shows this by plotting the total number of troll vessels landing salmon together with the subset of those that landed some groundfish each year. As seen there, the number of boats landing groundfish has remained relatively steady compared to the swings seen with the total number of boats landing salmon. The 2015-2019 average participation has been 18.4 boats in Washington, 60.2 in Oregon, and 6.4 in California. Over 1997-1999, the corresponding averages were 28.3 for Washington, 221.3 for Oregon, and 4 for California.

VMS is a factor in that revenues that could be earned by retaining groundfish may not justify the cost. The VMS requirement went into place for open access and trollers in 2008. Drops in participation can be seen in Figure 5, yet 2008 and 2009 were also severe years because of salmon closures caused by the collapse of Sacramento River fall Chinook salmon. Trollers have also expressed concern about the requirement, which is at the proposed rule stage at the time of writing, for a higher frequency ping rate as it is expected to add to the cost. NMFS has estimated that the cost will increase to \$69-\$150 compared to the current \$37-\$65 per month.<sup>7</sup> The cost varies because of the variety of providers and contracts offered.

<sup>7</sup> 84 FR 54579 <https://www.regulations.gov/document?D=NOAA-NMFS-2019-0093-0001>



**Figure 4. Number of troll vessels landing salmon (upper lines, circles) from areas north of 40° 10' N. lat. And the subset of those landing some groundfish (lower lines, triangles). A missing point indicates either zero or a year that cannot be reported because there were fewer than three vessels.**

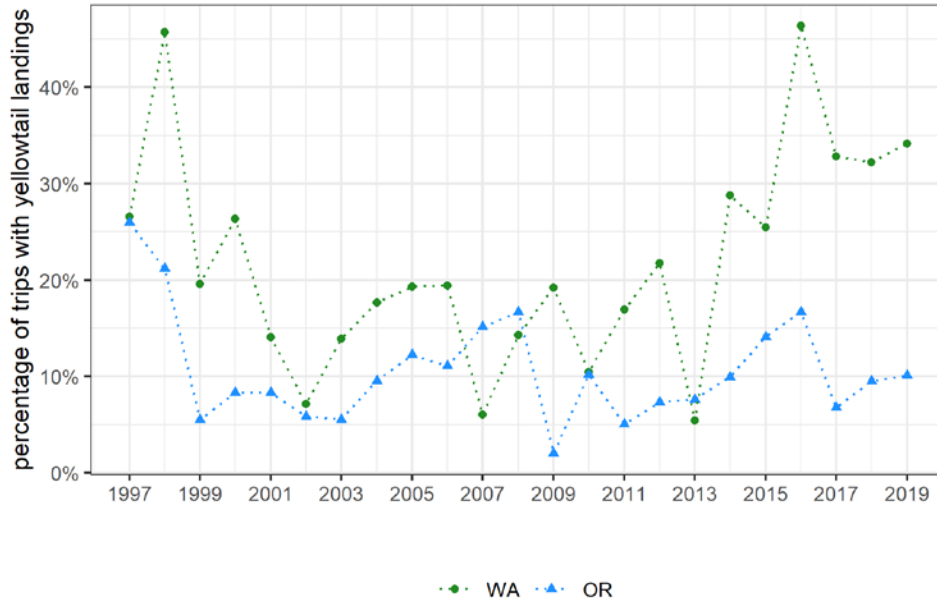
### 1.1.8 Frequency of Yellowtail landings

Again, the true rate at which yellowtail catches reaches the current ratio of 1 lb to 2 lbs of salmon is difficult to determine because there is no data available on discards. Trips where no yellowtail were caught cannot be differentiated from trips where they were caught but discarded.

As an attempt to address the issue of partial participation in the trip limit, Figure 5 reports the percentage of trips landing yellowtail using only trips from boats that retained any groundfish within the year. The assumption is that boats that retained groundfish were willing to comply with VMS and other regulations pertaining to groundfish retention. VMS is known to be a major factor in the participation rate. Yet less than half of trips brought in groundfish even before VMS was required in 2008 (Figure 5).

The 1997-1999 period considered by the GMT in their 2001 analysis experienced a higher rate of trips landing yellowtail compared to 2000-2019, especially in Washington. The frequency of yellowtail landings dropped in Washington but then began to rise some after 2014. Oregon also saw a drop from the 1997-1999 period and a more variable time series than Washington in terms of percentages. However, Oregon has seen the most vessels landing yellowtail (Figure 4). California is not shown in Figure 5 because the salmon closures there, combined with confidentiality rules (from fewer than three vessels landing yellowtail), disrupt the time series. The 2010-2019 average in California was 5.2 percent of trips landing yellowtail rockfish and the maximum was 11.6 percent.





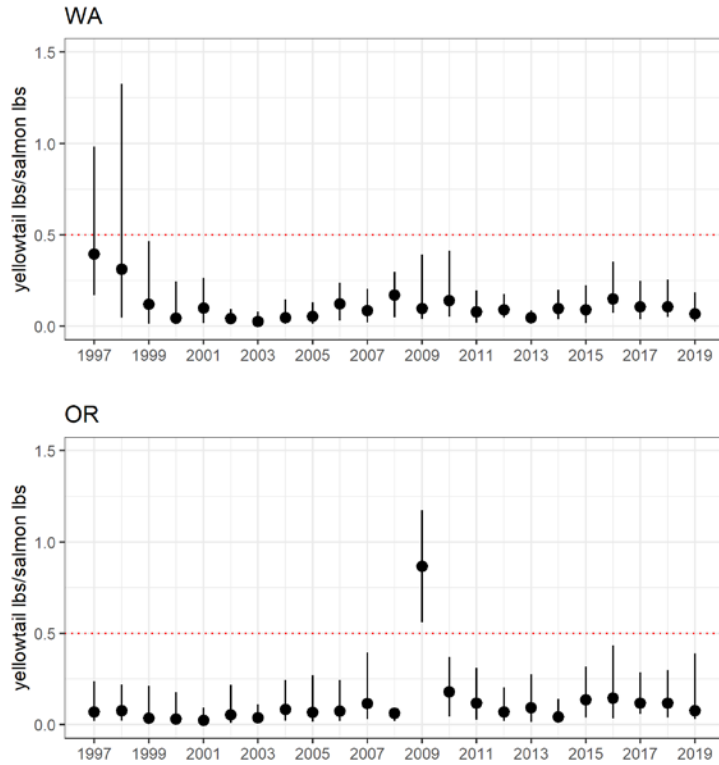
**Figure 5. Percentage of salmon troll trips landing yellowtail rockfish from areas north of 40° 10' N. latitude counting only trips made by vessels that landed troll caught groundfish within the year. California is not shown because confidentiality and low salmon years only allow a few years to be displayed.**

### 1.1.9 How limiting is the current ratio?

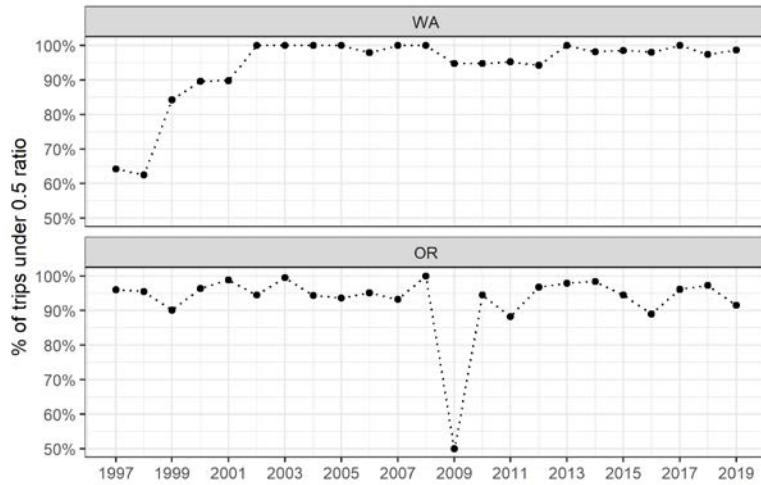
The trip limit was only originally expected to affect 15% of trips landings yellowtail (i.e. trips where any yellowtail was landed). Figure 6 evaluates how landings have compared against that expectation. The value of 0.5 on the y-axis demarcates the ratio of 1 lb of yellowtail to 2 lbs of salmon. The points identify the median value for each year (i.e. half the trips experienced a lower ratio and half higher) with the lines stretching up the 85th percentile and down to the 15th percentile. The 85th percentile corresponds to the 15% of trips affected level.

Looking at the 1997-1999 period initially considered by the GMT, more trips in Washington were hitting the 1 lb to 2 lbs ratio than now. It is the reverse in Oregon, although no year saw the 85th percentile extending above the existing ratio except for 2009. That year saw is likely an artifact of the restrictive salmon seasons and was the lowest year in terms of groundfish retention in Oregon.

Figure 7 plots the same data yet focuses on the exact percentile of trips corresponding to the 0.5 ratio (i.e. the percentage of trips that brought in yellowtail at or above the 1 lb to 2 lbs of salmon ratio). The 90% level on the y-axis means that 90% of trips landed less than the ratio and conversely, that 10% of the trips hit or exceeded the ratio. As shown, only a small percentage of trips in Washington are landing yellowtail to the max or more. During 2015-2019, less than 2 percent of trips have hit the ratio on average. In Oregon, that average is 6.3 percent of trips.



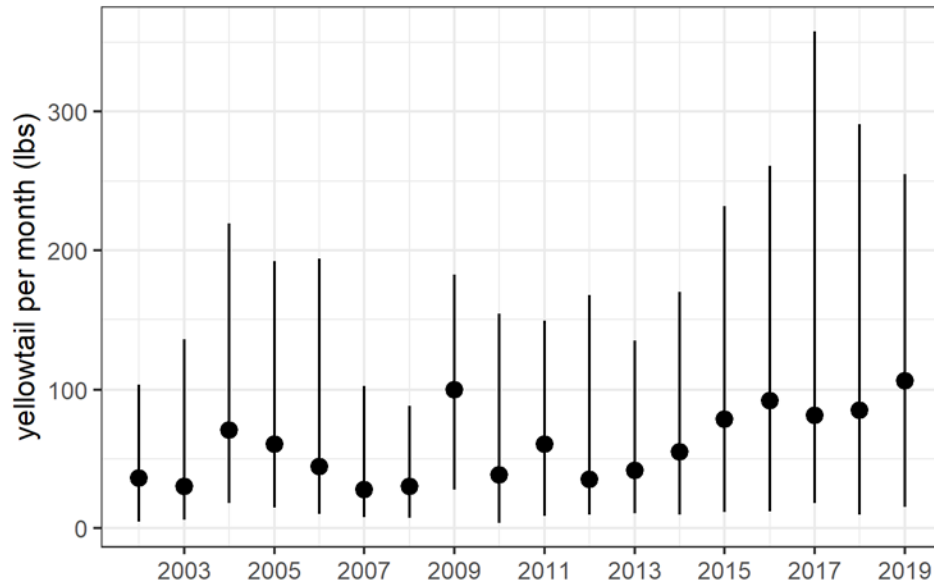
**Figure 6. Ratio of yellowtail to salmon landed in 1997-2019 with median values displayed as points and lines extending up to the 85th and down to the 15th percentile values. The data shown only include trips with yellowtail present. California is not shown because of low activity (see text).**



**Figure 7. Percentile of trips (trips with some yellowtail) to landing yellowtail corresponding to the rate of 1 lb to 2 lbs of salmon.**

### 1.1.10 Monthly Catches

Figure 8 plots the spread of monthly yellowtail landings by troll vessels, again using the median and 15th and 85th percentiles to show the variation in activity. The state by state breakdown is not shown because vessels can land into multiple states. Again, it is only a minority of the vessels that reach or approach the limit. These numbers do not incorporate landings the vessel may have made with directed open access trips.



**Figure 8. Total monthly landings of yellowtail by vessels showing the median values displayed by points and the lines stretching up to the 85th percentile and down to the 15th percentile.**

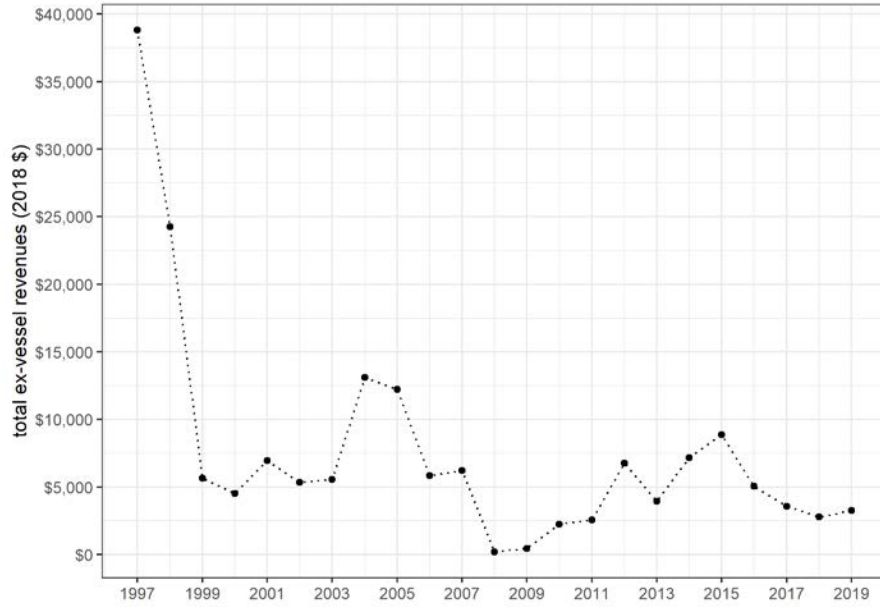
### 1.1.11 Yellowtail Revenues

The 1997-1999 period saw a large decline in the landings and revenues trollers earned from yellowtail (Figure 9).<sup>8</sup> While revenues increased from the lows of 2008 and 2009, the 2015-2019 average was only \$4,709. This compares to an average of \$6.6 million in revenue earned from salmon.

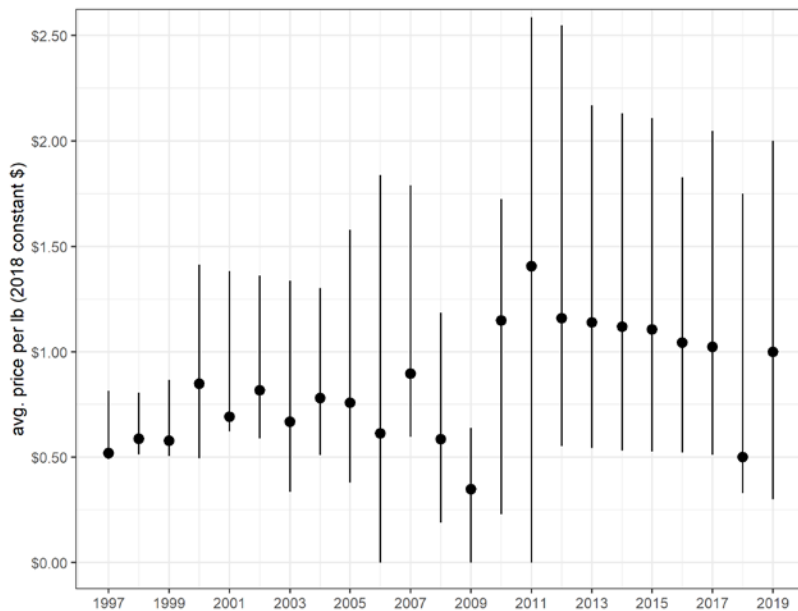
The time series of the price per lb paid for yellowtail is shown in Figure 10. Two trends stand out. First, there was a jump in the price paid beginning in 2010. Second is the variation in the price received with the upper range bringing in more than \$2.00 per lb. WDFW has received comments from trollers that demand from farmers' markets has increased recently.

Therefore, while small relative to the revenues earned in the fishery, the increase in earnings that may be possible from an increase could be enough to allow some to offset the pending VMS cost increases. A summary of monthly earnings is shown in Figure 11.

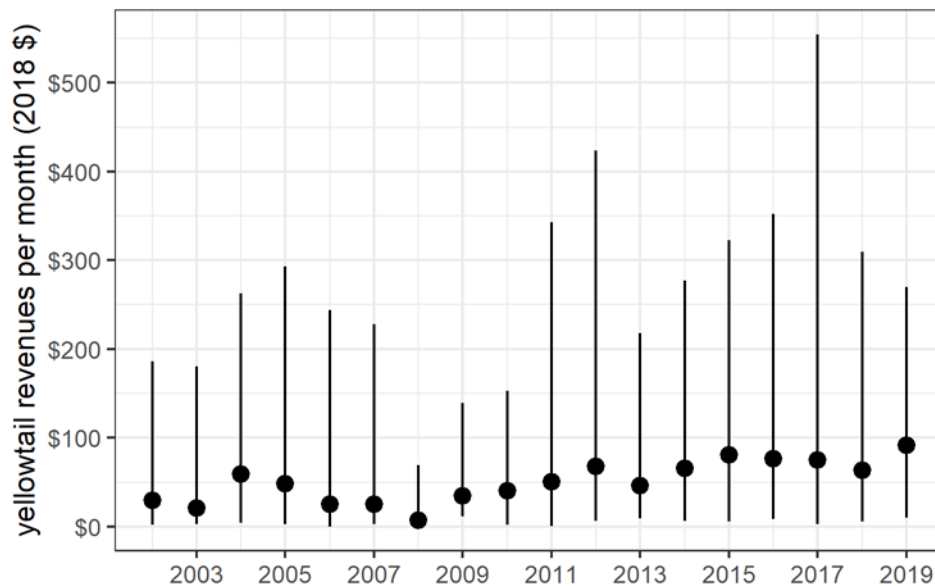
<sup>8</sup> Again, the reason for the large landings at that time has not been investigated at the time of writing and may be an artifact of fish ticket reporting practices.



**Figure 9. Total ex-vessel revenues of yellowtail rockfish north of 40° 10' N. lat. landed on salmon troll trips, all states combined, expressed in 2018 constant dollars.**



**Figure 10. Median (points) price per lb paid for yellowtail rockfish north of 40° 10' N. lat. landed on salmon troll trips, all states combined, expressed in 2018 constant dollars. The lines extend from the 5th to the 95th percentile values.**



**Figure 11. Total monthly revenues earned by vessels from yellowtail, showing median value by year (points) with the lines stretching up to the 95th percentile and down to the 5th percentile.**

### 1.1.12 Gauging the effect of an adjustment

A quantitative model for evaluating an adjustment to the trip limit was not pursued because, again, the ratio has been unchanged since going into effect. The total effort (i.e. number of trips taken) in the troll fishery correlates highly with total yellowtail catch. And that effort will be driven primarily by salmon fishing opportunities.

For a qualitative bounding of possibilities, if trollers continued to land the same proportion of the ratio (i.e. if a trip took 50 percent of the 1 lb to 2 lb ratio it would take 50 percent of a 1 lb to 1 lb ratio), then the total landings would simply increase by 2 times under Alternative 2. The doubling of catches seen in Table 2 would still result in very small landings relative to available set asides.

The percentage of trollers choosing to retain groundfish is the other major factor determining total yellowtail landings. Table 3 reports the result of another quantitative exercise intended to provide a ballpark estimate and that combines total effort and rate of participation. The numbers shown there report the results of 1,000 simulated seasons by scenario. The scenarios were created by sampling with replacement from the total effort (boat-months per season) from the last 10 years and three periods of different groundfish participation: 1990-2001, 2002-2019, and 1997-1998. The average monthly landing serves as the participation rate. As seen, the highest values reported are minor relative to the available yellowtail allocations.

Lastly, evaluating additional fishing mortality on the stock is complicated by the lack of discard data. It is possible that any increase in landings would come from fish that would have otherwise been discarded. In such circumstances, any extra mortality would come from the portion of the discarded fish that would be assumed to have survived when discarded.

**Table 3. Simulated annual yellowtail catch (mt) using average monthly landings from 1990-2001 and effort from 2010-2019. The columns identify the percentiles of the simulations falling below the metric tonnage.**

|           | 5%  | 10% | 25% | 50% | 75% | 90% | 95% |
|-----------|-----|-----|-----|-----|-----|-----|-----|
| 1990-2001 | 0.7 | 0.9 | 1.3 | 1.7 | 2.6 | 3.6 | 4.1 |
| 2002-2019 | 0.5 | 0.7 | 1.2 | 2.7 | 4.8 | 7.6 | 9.0 |
| 1997-1999 | 1.5 | 1.7 | 2.7 | 3.6 | 5.7 | 8.3 | 9.8 |

### 1.1.13 Discussion for the potential of targeting

Again, one concern expressed by the GMT in 2001 involved the situation where trollers experienced low yellowtail catches in a month and then decided to make a “clean up” trip at the end to obtain the monthly limit. Given the low per trip attainment seen in Figure 6 and Figure 7, that concern does not appear to have manifested. With the low per trip attainment, the potential to target yellowtail would have existed on the great majority of trips. Indeed, an analysis of the ratio of yellowtail to salmon landed on final trips of the month detected no statistical difference from those that occurred earlier in the month.<sup>9</sup>

All in all, the amount of salmon landed per trip has continued to allow for much more yellowtail to be landed than has been observed. Only 1.6 percent of the yellowtail that would have been allowable was landed over 2002-2019. In terms of the ability of a troller to target yellowtail, fewer than 0.5 percent of trips that landed yellowtail brought in 500 lbs or more and only 2.9 percent have been 200 lbs or larger.

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<sup>9</sup> A regression of the ratio of yellowtail to salmon against a variable indicating the last trip of the month produced an R-squared of 0.0002. The regression model only included data from boats that landed groundfish in a year and only trips that landed yellowtail.