Oregon Dungeness Crab Research Needs

MRAG Americas conducted a gap analysis in 2022 to identify how the Oregon Dungeness crab pot/trap fishery would likely fare in assessment against the MSC Standard. They identified a number of issues that should be addressed prior to entering full assessment. The following research topics could help address these issues:

- What is the relationship of the management limit reference point (LRP) to the point of recruitment impairment (PRI)?
- If coastwide stock productivity were to decline to the LRP, how effective would harvest controls taken in Oregon be in helping the coastwide stock to recover (assuming Washington and California do not reduce effort)?
- Can we incorporate uncertainty into the annual stock assessment (megalopae monitoring, crab landings, logbook CPUE)?

I describe these in detail below.

Relationship between LRP and PRI

The Fishery Management Plan for the Oregon Dungeness Crab fishery states that the "*LRP is designed and intended to notify managers when the crab population is critically low and warrants extraordinary management measures to sustain the species. The LRP is evaluated annually, within about the first eight weeks of the season, and is considered to have been reached when all of the following conditions are met:*

> *1) Fish tickets indicate landings have declined for three consecutive seasons;*
> *2) Landings are projected to decline for a fourth consecutive season (based on early season landings in the fourth season);*
> *3) Fourth season landings are projected to decline below 20% of the 20-year average; and*
> *4) Logbook catch-per-unit-effort falls below the average level predicted to have occurred over the 1980-81 through 1986-87 seasons.*

In the event that the fishery reaches the LRP, ODFW will work with industry and/or through directed research to attempt to discern the primary cause(s) of the observed decline (see Section A.IV.c for an analysis of historical landings and abundance). Based on this analysis, ODFW will implement an adaptive management response.

If ODFW determines that immediate action is in the public interest, management actions may be implemented through temporary rule within the fourth season of a decline. Subsequent actions or extension of the temporary rules beyond six months would be implemented through the standard OFWC rulemaking process. In each case, recovery criteria that are specific to the management action taken would also be established so that actions can be continued in subsequent seasons until there is sufficient evidence to determine that the population is recovering or has recovered."

The LRP is assumed to occur prior to the stock reaching PRI (the stock level below which recruitment may be impaired). MSC considers the LRP as a proxy for PRI in this case. The gap

analysis conducted by MRAG Americas concluded "The HCR cannot be said to ensure the exploitation rate is reduced as the PRI is approached, because no change in management is implemented until the limit reference point is breached."

Ability of Oregon Management to Recover Coastwide Declines

The Dungeness crab populations from the California/Mexican border to the Washington/Canadian border are considered one stock. All three states manage their crab fisheries using the 3S management approach. Only Oregon has defined a management reference point (the LRP) where management actions are triggered once productivity has declined below that point.

The gap analysis conducted by MRAG Americas concluded "Harvest is only controlled by the HCR in Oregon, so harvest in other states could offset any reductions achieved by Oregon. Therefore, not all available evidence indicates that the HCR will be effective in achieving the required harvest level **on the whole stock** as required under Principle 1." ODCC has been working with Washington/tribes to adopt similar HCRs, but there has been little interest so far. I am wondering if modeling can be conducted using environmental factors (ocean currents, temperatures, etc.) to model megalopae production and dispersal to assess the effectiveness of Oregon management actions to recover coastwide Dungeness crab populations after a decline in production.

Incorporating Uncertainty into Stock Assessments

MSC requires that the stock assessment takes uncertainty into account in order to achieve an unconditional pass. The current elements of the stock assessment (fishery landings, logbook CPUE data, megalopae monitoring) do not explicitly take uncertainty into account. For example, annual megalopae catch is used to predict a point estimate for the commercial crab landings four years later (Shanks 2020). The gap analysis concluded "Other major uncertainties have been identified, including stock productivity near the limit reference point, impacts of climate and climate change, and natural mortality (Shanks 2020, Richerson et al. 2020). None of these are yet taken into account by the assessment." Could a probabilistic model be incorporated into the megalopae monitoring to develop confidence intervals around the predicted landings?

References

MRAG, Americas. 2022. MSC Gap Analysis for the Oregon Dungeness Crab Pot/Trap Fishery. Unpublished report prepared for the Oregon Dungeness Crab Commission (ODCC) 20 September 2022. 49 pp.

Richerson K, Punt AE, Holland DS. 2020. Nearly a half century of high but sustainable exploitation in the Dungeness crab (Cancer magister) fishery. Fisheries Research 226(105528):1–11.

Shanks A. 2020. Report on the recruitment of Dungeness crab megalopae during the 2020 recruitment season. Available from https://oregondungeness.org/wp-content/uploads/2021/04/Annual-report-2020-A-Shanks.pdf.