Independent Peer Review of the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) Puget Sound Habitat Conservation Calculator and the integral Puget Sound Nearshore Habitat Values Model

prepared on behalf of the Center for Independent Experts (CIE)

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1. Executive Summary

The National Marine Fisheries Service (NMFS), part of the National Oceanographic and Atmospheric Administration (NOAA), is responsible for overseeing the protection of the United States oceans, fisheries, and their habitats, including administering the *Endangered Species Act* (ESA). NMFS scientists developed the '*Puget Sound Nearshore Habitat Conservation Calculator*' (hereafter referred to as Nearshore Calculator) as an assessment tool to evaluate the cumulative impacts of various anthropogenic activities on ESA-listed species and their habitat in the Puget Sound region to make assessments more efficient, reproduceable, and scientifically robust. Several Pacific Salmon species and Southern Resident killer whale are listed as threatened or endangered under the ESA, and their survival depends on nearshore and marine environments. However, the nearshore habitats face challenges due to habitat loss and degradation from development, which has particularly impacted the early marine survival of listed Pacific Salmon. Subsequently, the Nearshore Calculator plays a critical role in assessing the impact of human activities on these habitats and listed species, aiding in the conservation efforts.

In this report, I provide my review of the Nearshore Calculator with the focus on the evaluation if the tool is analytically and scientifically sound and uses the best available science. In addition, I offer recommendations for specific improvements. I focussed my assessment on the Nearshore Calculator and in addition consulted the provided accompanying support materials. To my knowledge the tool is based on the most current and reliable scientific information available on this subject and I found the Nearshore Calculator a very well-developed tool with a very detailed description of the model development and uncertainties as well as transparency on the model parametrisation. However, there is always opportunity for model refinements, and I would recommend including the described uncertainty around the model parameter and interactions between environmental stressors into the mathematic analysis. Overall, my assessment is that this modeling framework is well-constructed and adequately validated. I would like to felicitate the research team for developing this comprehensive decision-making support tool.

2. Background and Description of Reviewer Role

To provide context for my review, I briefly describe my relevant background and my approach to conducting this review.

I currently hold the position of an associated professor at the Institut national de la recherche scientifique (INRS) Centre Eau, Terre et Environnement (ETE) in Québec, Canada where I am the lead of the Riverine Ecology Laboratory. My interest in fish ecology began during my undergraduate studies while working as an intern at the National Park of the Wadden Sea. After completing an undergraduate degree at University of Tübingen, Germany, I studied Marine Biology and Fisheries Science at the School of Ocean Sciences at the University of Bangor, Wales. I then earned a MSc in Hydrobiology and Fisheries Science at the University of Hamburg, Germany and a PhD in Fish Ecology from the Université de Montréal, Canada. I was able to gain further experience on Atlantic salmon habitat during my postdoctoral fellowships at Fisheries and Oceans Canada in St. John's, Canada and on Pacific salmon fish passage issues at NOAA NMFS Northwest Fisheries Science Center in Seattle, USA. Prior to my current appointment, I worked as a research scientist for Fisheries and Oceans Canada, where I had to chance to participate on many scientific review process of management tools developed by the department. During this time, I also served as Adjunct Professor at the University of Alberta and the University of Saskatchewan.

I have broad research interests in conservation biology, habitat assessment and restoration, and fish bioenergetics. My research examines the effects of environmental stressors on fish behavior and energetics. I conduct research on fish migration and survival in relation to fish passage, hydropeaking, and climate change using diverse telemetry methods. Over the last decade, I worked on applied issues of fish and habitat conservation in relation to natural and anthropogenic changes of flow and climate regimes to provide scientific advice for species at risk and fish habitat protection and restoration. I participated in the development of several habitat assessment tools such as the Bioenergetics Habitat Model, the Cumulative Effects Model for Prioritizing Recovery Actions (CEMPRA) and the Framework of the Identification of Riparian Critical Habitat. I am currently a member of the Groupe de recherche interuniversitaire en limnologie (GRIL), Resources Aquatiques Québec (RAQ), the Centre interuniversitaire de recherche sur le saumon atlantique (CIRSA), and the Freshwater Fishes Specialist Subcommittee of the Committee on the Status of Endangered Wildlife of Canada (COSEWIC).

In conducting my review, I initiated the process by thoroughly reviewing the provided primary review materials and background materials (see complete list in the Performance Work Statement). Subsequently, I carried out my review in accordance with the Terms of Reference outlined in Appendix 2. During the review process, I concentrated on assessing the tool's strengths and weaknesses while also taking into account aspects of uncertainty. Beyond identifying weaknesses, I aimed to pinpoint opportunities for enhancement.

3. Summary of Findings

3.1. Analytically Sound Process

a) Are the underlying relationships that Nearshore Calculator and the Nearshore Habitat Values Model are built upon (e.g., duration of aquatic access, functional pathways, indicators/metrics) sufficient and well-founded for evaluating effects of changes to nearshore habitat conditions on salmonids, given the stated goals and objectives? Is the analytical approach based on a valid list of habitat attributes (physical and biological functions)?

The Nearshore Calculator is conceptualised for two target species: Puget Sound Chinook Salmon and Hood Canal Summer Run Chum Salmon with the objective to provide an efficient and transparent way to estimate the impacts of habitat alterations on the target species. The guidance document on the Nearshore Calculator provides a wealth of detailed information on the model history, objectives, and development. I appreciated the glossary and abbreviation list that facilitate the comprehension of the functioning of this complex tool. I found that the Nearshore Calculator and all its components are very well described. The underlying relationships are well-documented. For example, the duration of aquatic access, which is defined at tidal inundation and categorised by four different nearshore zones, is a sound approach to quantify the habitat availability. Similarly, the indicator effect pathways that describe how indicators likely affect physical and biological features and subsequently the viability of the target species are well-thought through. The indicator metric scores range from 0 to 1 with a score of 1 describing the condition with the highest service, which is the approach regularly applied in habitat assessments. The indicator values are within an acceptable range and make logical sense in relation to each other, but I can't assert that these are the exact values. However, the authors do provide a detailed description on the certainty addressing this issue. I would have preferred if the description of the uncertainty would have been mathematically incorporated into the modelling tool.

The tool is based on four physical and biological functions: 1) unobstructed rearing and migration corridors; 2) forage including aquatic invertebrates and fish; 3) natural cover such as submerged aquatic vegetation and large wood; and 4) water quality. In my opinion, these functions capture the most relevant functions for the two target species.

b) Are there ways to strengthen the functional relationships the Nearshore Calculator is based on?

Certainly, the Nearshore Calculator is a model and there is always room for refinement. Subsequently, enhancing the functional relationships with additional empirical data or more interaction terms could potentially further improve the accuracy of model outputs and its utility. But in general, I found the presented functional pathways are well supported by scientific literature and I believe the tool is effectively fulfilling its objectives to support the conservation and management efforts in nearshore areas for the target species.

I appreciate the careful consideration put into the elevation zones and their accessibility. The connection between these elevation zones and the potential habitat service values is also clearly explained. Nevertheless, I encountered challenges in specifying the precise values for each habitat service. It could be beneficial to include a sensitivity analysis to

gain a better understanding of how the overall model output is affected by variations in individual habitat service values, which would enhance user confidence.

The strength of the Nearshore Calculator is the integration of spatial and temporal cumulative effects, however, it remained unclear with the model accounts sufficiently for synergistic or antagonistic interactions among stressors. There is a potential issue with compounded uncertainties within the model, necessitating a critical evaluation of the approach before accepting its conclusions and the approach itself. I would suggest that it is imperative to explicitly report variances and sources of uncertainty at each relevant stage of the modeling process and in the final outputs.

c) Include in your findings a description of strengths and weaknesses. For weaknesses, please outline possible solutions considering the stated goals and the data availability, and if possible, provide references.

I find the strength of the Nearshore Calculator is its tight integration into the regulatory framework under the *Endangered Species Act*. Given the multiple socio-economic pressures on the nearshore habitat, which has been directly linked to juvenile salmon survival, it is crucial to have an effective tool that allows for rapid and transparent assessment of the impacts of potential developments on the costal habitat and subsequently survival of the endangered species.

The assessment of the before-and-after-effects on the physical and biological features is achieved through a habitat equivalency analysis that considers the different habitat types. The authors have gone to great effort to parameterise the indicators and metrics with the best available knowledge and scientific evidence. In addition, time and duration of the impact as well as offset are considered in the calculation. Furthermore, the effects on habitat quality and quantity are then linked to incremental population-scale effects.

Furthermore, I find the concept of the elevation zones and associated accessibility well thought out. The link of the elevation zones to the potential habitat service values has also been well described. As mentioned before, I found it difficult to comment on the exact values for each of the habitat services. Adding a sensitivity analysis to understand better how sensitive the overall model output is to changes in the individual habitat service values might be of value to assure users.

More description could be added on the last step of the calculation on how the evaluation of site-specific conditions using the indicator effect pathways were linked to viable salmonid population parameters (e.g., species growth, survival, and abundance; Figures 3-7, 3-8, 3-10). The identified indicator effect pathways, however, appear well chosen.

From a more applied perspective, another strength of the calculator is that it easily accessible from a webpage for stakeholders and support is provided to users of the calculator by NMFS staff members. The Nearshore Calculator Workbook describes well the structure and function of the Excel spreadsheets.

The axis on the stressor-response curves and service loss functions in Figure 4-4 should be enlarged.

I appreciated the thorough sections on ‘Uncertainties’ that clearly outline what the Nearshore Calculator can and cannot be used for and where the limitations are and what

the model assumptions are as well as on ‘Research Needs’ where open research gaps concerning metrics values and stressor-response functions are pointed out.

3.2. Scientifically Sound Process

a) Does the Nearshore Calculator systematically and appropriately incorporate and interpret the highest priority and best available scientific information given the stated goals and objectives?

Yes, the Nearshore Calculator appropriately incorporates and interprets the best available scientific information. Albeit the fact that no systematic literature appears to have been conducted, the authors seem to have undertaken a tremendous amount of literature research and consultations to have arrived with the best currently available scientific information to support the stated objectives. The applied methodology is based on established scientific principles and best practices relevant to fish habitat assessments. A particular asset of the tool is the transparency of the calculations as well as in the documentation of the habitat values allowing users to understand how it processes the information to reach its conclusions. Interestingly, the tool has already undergone rounds of peer review, which provides additional assurance of its scientific validity. Another asset is that the model will receive regular updates to incorporate new scientific findings or data, which demonstrates the organisation’s commitment to continue using the best available information.

b) Indicate if and what relevant information is missing, provide references.

After careful review of the provided documents, the only variables I would suggest adding more explicitly to the tool, particular in light of climate change, are water temperature and dissolved oxygen concentration and its interplay with water temperature. Deoxygenation has been observed rivers, lakes, and oceans around the world (Breitberg et al. 2018: Jane et al. 2021; Zhi et al. 2023). High water temperatures and low oxygen concentrations in the nearshore habitat may potentially impacting salmon fitness. Otherwise, I cannot pinpoint to any specific references that I think need to be added to the guidance document to improve its comprehensiveness and reliability.

c) Indicate if interpretations need to be refined, and if possible, provide references.

Having thoroughly examined the provided documents, I am unable to identify any interpretation that I believe should be changed or refined to enhance its accuracy.

3.3. Useful/Realistic Output

a) Does the Nearshore Calculator generate reasonable and well-supported quantifications of the impacts (positive, negative, neutral) to nearshore habitats and salmon?

The model serves as a valuable resource for proponents and managers to evaluate impacts of developments on juvenile salmon habitat and vital rates and explore scenarios aimed at preserving or restoring populations. Just like any model, it's essential to interpret the

output while considering the foundational assumptions, constraints, and varying levels of uncertainty.

The examples of model output seem to provide reasonable model predictions. However, given the uncertainties about the functions and metrics, monitoring studies using a Before After Control Impact (BACI) design should be conducted to validate the tool by comparing predicted model outcomes to the monitoring results. This research design allows to compare conditions before and after the development with control groups for comparison.

b) If warranted, include in your findings a description of where the Nearshore Calculator likely over- or under-estimates impacts or benefits to salmon and their habitat.

The report provides a list of uncertainties and their likely influence on juvenile salmon and their (see Table 6-1). The presented arguments for potential over- and underestimations all appear logical and coherent. I have no further concerns on over- or underestimations due to uncertainties.

c) If warranted, outline possible solutions for better supported quantifications and if possible, provide references.

Considering the inherent uncertainties, I recommend adopting a precautionary principle for the regulatory decision making to avoid harm. Furthermore, using an adaptive management approach and continuously monitoring, reporting, and analyzing the effects of development activities would enhance our understanding of the impacts of developments on salmon and help to further refine the Nearshore Calculator and its outcomes over time.

4. Conclusions and Recommendations

Due to development pressures, protecting and restoring Puget Sound's nearshore habitat is challenging. However, the quality and quantity of estuarine and nearshore habitats play a crucial role in the early marine survival of salmonids. In order to inform regulatory decision making the NMFS Science Team has developed a comprehensive and well-documented Nearshore Calculator to estimate the effects of development on the nearshore habitat. The tool provides a rapid and repeatable assessment of the potential impacts of a development. It is important to emphasize that just as with any model, the effectiveness and usefulness of the Nearshore Calculator tool heavily rely on the quality and appropriateness of the data employed for its parameterization. I would like to applaud the endeavours undertaken by the authors to integrate the most relevant scientific information available in the tool development and its parametrisation, and I encourage its implementations a management tool.

In conclusion, I consider the Nearshore Calculator to be a robust modeling framework with appropriate parametrisation, but there are opportunities for refinement. I recommend the following actions: Due to existence of model and data uncertainties, I would recommend that the Nearshore Calculator is accompanied by a monitoring and adaptive management plan that would allow for model validation and continued assessment of the tool performance and improvement. This would also permit the model to be refined and adjusted to a changing environment due to Global Warming, particular in regard to oxy-thermal variations.

5. References

Breitburg, D. et al. (2018) Declining oxygen in the global ocean and coastal waters. Science 359, eaam7240. https://www.science.org/doi/10.1126/science.aam7240

Jane, S.F., Hansen, G.J.A., Kraemer, B.M. et al. (2021) Widespread deoxygenation of temperate lakes. Nature 594, 66–70. https://doi.org/10.1038/s41586-021-03550-y

Zhi, W., Klingler, C., Liu, J. et al. (2023) Widespread deoxygenation in warming rivers. Nat. Clim. Chang. 13, 1105–1113. https://doi.org/10.1038/s41558-023-01793-3

Appendix 1: Bibliography

1. Main documents
    a. Ehinger et al. 2023. Nearshore Calculator Scientific rationale.
    b. Nearshore calculator Excel Spreadsheet
    c. Nearshore Habitat Values Model Excel Spreadsheet
2. Background documents
    a. User guide
    b. Cereghino et al. 2023. Estimation of Typical High Intertidal Beach-Face Slope in Puget Sound. NOAA Process Report.
    c. Ehinger et al. 2015. Use of The Puget Sound Nearshore Habitat Values Model with Habitat Equivalency Analysis for Characterizing Impacts and Avoidance Measures for Projects that Adversely Affect Critical Habitat of ESA-Listed Chinook and Chum Salmon. NMFS Internal Document.
    d. Lambert and Chamberlin. 2023. Beach nourishment in Puget Sound: status, use, and habitat impacts.
    e. Salish Sea Nearshore Programmatic Biological Opinion
3. Additional documents
    a. CIE Example overwater structure replacement PowerPoint Presentation

Appendix 2: Performance Work Statement

Performance Work Statement (PWS)
National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Center for Independent Experts (CIE) Program
External Independent Peer Review
Under Contract #1305M219DNFFK0025

CIE Desk Review of the Puget Sound Nearshore Conservation Calculator and the integral Puget Sound Nearshore Habitat Values Model

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards[1].

Scope

NMFS is requesting peer review of the Puget Sound Nearshore Conservation Calculator (Nearshore Calculator) and the integral Puget Sound Nearshore Habitat Values Model to strengthen the quality and credibility of the agency's science and improve stakeholder's trust that the agency is basing policy decisions on the best scientific information available.

NMFS designated critical habitat for Puget Sound (PS) salmonids in 2005 (70 FR 52629, Sept. 2, 2005). NMFS's designation of salmonid critical habitat describes which physical and biological features (PBFs) support the specific conservation roles of habitat. For estuarine and nearshore marine areas, essential PBFs of habitat for PS Chinook and Hood

[1] https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2005/m05-03.pdf

Canal Summer Run (HCSR) chum salmon include (1) unobstructed rearing and migration corridors; (2) forage including aquatic invertebrates and fish, supporting growth and maturation; (3) natural cover such as submerged aquatic vegetation and large wood[2]; and (4) water quality supporting juvenile and adult physiological transitions. NMFS used these PBFs as a framework for developing the Puget Nearshore Calculator, consistent with how NMFS evaluates effects on critical habitat under ESA section 7.

NMFS West Coast Region (WCR) developed the Nearshore Calculator to assist in analyzing the impact of proposed local development action in nearshore marine habitats within Puget Sound, Washington. The Nearshore Calculator is based on Habitat Equivalency Analysis (HEA) (Described in section 3 of Ehinger et al. 2023). The Nearshore Calculator is an easy-to-use interface for the Nearshore Habitat Values Model (NHVM). NMFS WCR designed the NHVM to consistently determine habitat service values to be used as input parameters in HEA.

For use as an analysis tool for ESA consultations, the Nearshore Calculator is based on evaluation of the PBFs and the conservation roles of those features - survival, growth, and maturation – and likely effects of proposed actions on population level viability (abundance, productivity, spatial structure, and diversity, or "VSP"[3]) for salmonids. The Nearshore Calculator quantifies changes to PBFs of listed salmonid habitat and considers how these changes likely affect salmonid growth, development, and VSP and as a corollary, the relative conservation value of an area of habitat. The formal structure and science-based quantitative assessment results in a more predictable quantification of the impacts of actions during an ESA consultation, which is valuable because it improves consistency, efficiency, and transparency. Finally, the Nearshore Calculator is amenable to revision based on new science.

NMFS requests that the CIE reviewers conduct a peer review of the scientific information and framework of the Nearshore Calculator based on the Terms of Reference (TORs) referenced below.

The specified format and contents of the individual peer review reports are found in Annex 1. The Terms of Reference (TORs) of the peer review are listed in Annex 2.

Requirements

NMFS requests five (5) reviewers to conduct an impartial and independent peer review in accordance with the performance work statement (PWS) and the TORs below. Each reviewer should have working knowledge and recent experience in a minimum of three of the following areas:

[2] The description of the estuarine PBFs further outlines "These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean." https://www.federalregister.gov/d/05-16391

[3] The process NMFS typically uses to evaluate impacts on listed salmonids uses the viable salmonid population (VSP) concept (McElhany et al. 2000). McElhany et al. (2000) identified four parameters to evaluate the viability of a population: abundance, population growth rate, population spatial structure, and diversity. When analyzing the effects of actions on listed species as part of an ESA section 7 consultation, NMFS usually analyzes the effects on each of these parameters.

(1) Salmon ecology.

(2) Marine nearshore ecology and/or conservation biology.

(3) Development of models preferably in the context of making decisions to avoid, minimize, or mitigate potential impacts.

(4) Science of valuing habitat for fishes based on ecological functions and services.

(5) Quantifying effects of physical changes (like the installation of shoreline armoring) on habitat conditions and functions.

(6) Quantifying effects of changes in habitat condition (structure & functions including vegetation, prey productions, water quality) on fish (preferably salmon) growth and survival.

In addition, knowledge and experience with Habitat Equivalency Analysis is helpful, though not required. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Tasks for Reviewers

Each CIE reviewer shall complete the following tasks in accordance with the PWS and Schedule of Milestones and Deliverables herein.

1. Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send by electronic mail or make available at an FTP site to the CIE reviewer all necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE on where to send documents. The CIE reviewer shall read all documents in preparation for the peer review:

Main Documents:

● Nearshore Calculator Scientific rationale (central document providing background and information for quantifications developed for Nearshore Calculator) 145 pages + appendices (Ehinger et al. 2023)

● Nearshore Calculator – Excel Spreadsheet, available on NOAAs web page.

● Annotated and updated Excel Nearshore Habitat Values Model.

Background Documents:

● User Guide (provides instruction on how to populate fields and get impact/benefit results from calculator) – available on NOAAs web page at: https://www.fisheries.noaa.gov/resource/tool-app/puget-sound-nearshore-conservation-calculator, 60 pages.

● Cereghino et al. 2023 – (describes GIS layers developed to identify Highest Astronomical Tide (HAT) lines in Puget Sound) 45 pages.

● Historic document Ehinger et al. 2015 on previous model version.

● Lambert and Chamberlin. 2023. Beach nourishment in Puget Sound: status, use, and habitat impacts - in final review by authors.

● Salish Sea Nearshore Programmatic (SSNP) Biological Opinion

2. Webinar: Approximately two weeks after the CIE reviewers receive the pre-review documents, they will participate in a webinar with the NMFS Project Contact and Nearshore Calculator team members to address any clarifications that the reviewers may need regarding the TORs or the review process. The NMFS Project Contact will provide the information for the arrangements for this webinar.

3. Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the PWS and TORs and shall not serve in any other role unless specified herein. Modifications to the PWS and TORs cannot be made during the peer review, and any PWS or TORs modifications prior to the peer review shall be approved by the Contracting Officer's Representative (COR) and the CIE contractor.

4. Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the PWS. Each CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each CIE reviewer shall complete the independent peer review addressing each TOR as described in **Annex 2**.

Place of Performance

Each CIE reviewer shall conduct an independent peer review as a desk review; therefore, no travel is required.

Period of Performance

The period of performance shall be from the time of award through September 2023. The CIE reviewers' duties shall not exceed 10 days to complete all required tasks.

Schedule of Milestones and Deliverables

The contractor shall complete the tasks and deliverables in accordance with the following schedule. Within two weeks of award	Contractor selects and confirms reviewers
No later than two weeks prior to the review	Contractor provides the pre-review documents to the reviewers
October 2023	Each reviewer conducts an independent peer review as a desk review
Within two weeks after review	Reviewers submit draft peer-review reports to the contractor for quality assurance and review

Within three weeks of receiving draft reports	Contractor submits five (5) final independent Peer-Review reports to the Government

Applicable Performance Standards

The acceptance of the contract deliverables shall be based on three performance standards:

(1) The reports shall be completed in accordance with the required formatting and content; (2) The reports shall address each TOR as specified; and (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel

Since this is a desk review travel is neither required nor authorized for this contract.

Restricted or Limited Use of Data

The contractors may be required to sign and adhere to a non-disclosure agreement.

Project Contact:

Kim Kratz
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NMFS, West Coast Region
1201 NE Lloyd Blvd, Suite 1100, Portland, OR 97232

Annex 1: Peer Review Report Requirements

1. The report must be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specifically whether the Nearshore Calculator represents the best available science and if not, what specific improvements you recommend.
2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each TOR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the TORs.
3. The reviewer report shall include the following appendices: 1. Appendix 1: Bibliography of materials provided for review; 2. Appendix 2: A copy of the CIE Performance Work Statement.

Annex 2: Terms of Reference (TOR) for the Peer Review

The reviewers will provide input on the following questions. During your evaluation, please keep in mind that the Nearshore Calculator must use the best available science, *Endangered Species Act* consultations cannot be delayed until better science becomes available, and the Nearshore Calculator can be modified over time as additional science becomes available.

1. Analytically sound process:

a) Are the underlying relationships that Nearshore Calculator and the NHVM are built upon (e.g., duration of aquatic access, functional pathways, indicators/metrics) sufficient and well-founded for evaluating effects of changes to nearshore habitat conditions on salmonids, given the stated goals and objectives? Is the analytical approach based on a valid list of habitat attributes (physical and biological functions)?

b) Are there ways to strengthen the functional relationships the Nearshore Calculator is based on?

c) Include in your findings a description of strengths and weaknesses.

d) For weaknesses, please outline possible solutions considering the stated goals and the data availability, and if possible, provide references.

2. Scientifically sound process:

a) Does the Nearshore Calculator systematically and appropriately incorporate and interpret the highest priority and best available scientific information given the stated goals and objectives?

b) Indicate if and what relevant information is missing, provide references.

c) Indicate if interpretations need to be refined, and if possible, provide references.

3. Useful/realistic output:

a) Does the Nearshore Calculator generate reasonable and well-supported quantifications of the impacts (positive, negative, neutral) to nearshore habitats and salmon?

b) If warranted, include in your findings a description of where the Nearshore Calculator likely over- or under-estimates impacts or benefits to salmon and their habitat.

c) If warranted, outline possible solutions for better supported quantifications and if possible, provide references.