Assessing multi-species climate vulnerability in the Gulf of Alaska

CVA Scoring Webinar: December 16, 2025

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Today's agenda:

1. Introduction to climate vulnerability assessments
2. Broad overview of our methods
3. Detailed instructions for scoring sensitivity
4. Step-by-step examples
5. Questions

Participation Timeline

- **December 16, 2025:** scoring webinar (**today!**)
  - Overview of CVA methods and how to score a species profile
  - Recorded for asynchronous viewing
- **December – January**: complete scoring of your assigned species
  - Due 1 week before scoring workshop
- **Late January/ February:** scoring workshops (3 hours each)

Workshops

- 4–6 participants per workshop
- An opportunity to compare and discuss scores with your species group
  - Forum where you will explain the rationale behind your scores
  - Not intended to garner consensus, but to identify and fix errors and increase precision in the final scores
  - You can change your scores based on new information provided in the workshop, but you do not have to!
  - Final results are anonymous

What is a climate vulnerability assessment?

Climate vulnerability assessment (CVA)

A trait-based approach that determines the likelihood that climate change will affect a species' abundance, distribution, and productivity.

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- Indicates **which** species are most and least vulnerable to climate change
- Helps determine **why** different species are at risk

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Some key outcomes:

- Information for fisheries managers and communities to respond to climate impacts and increase resilience
- Guidance on data gaps and research priorities
- Indication of target species for enhanced monitoring

Building on previous work

- Over 70 CVAs on marine fisheries have been conducted internationally
- Recent published CVAs:

  ✓ Bering Sea (Spencer et al. 2019)

  ✓ California Current (McClure et al. 2023)

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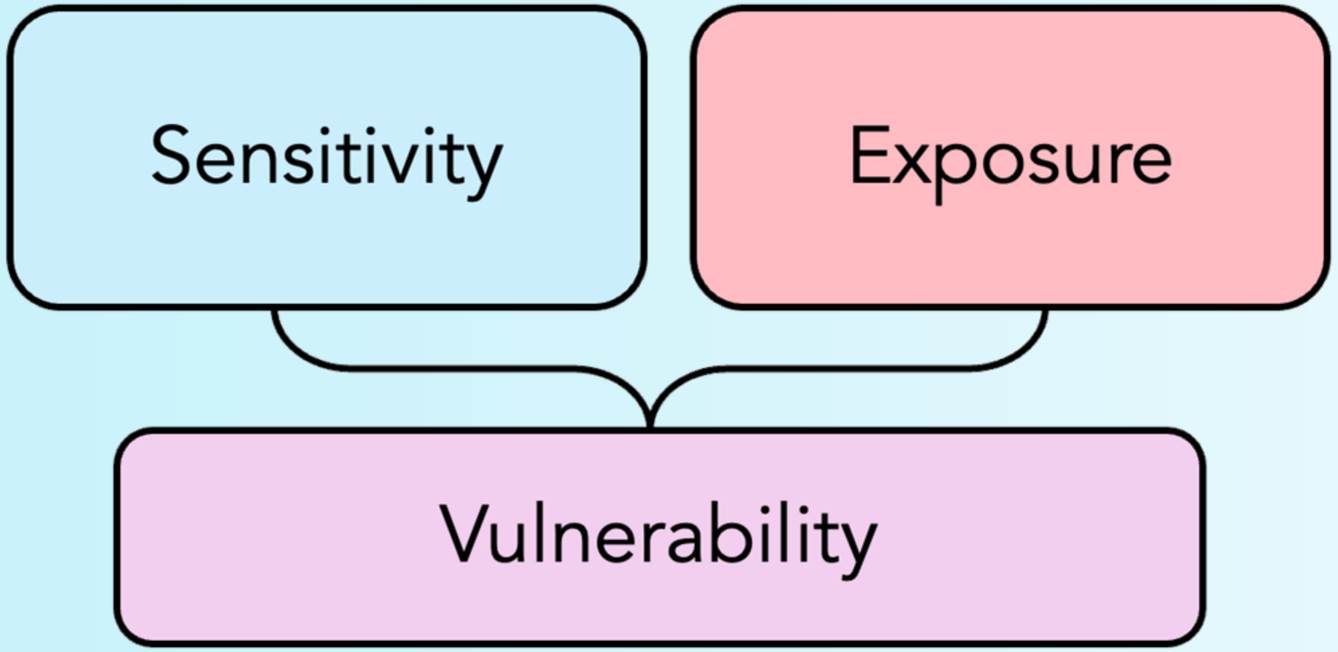
The Gulf of Alaska is the last NOAA management region to conduct a CVA for fish and invertebrates

- Identified as a priority action item in the NOAA Fisheries Climate Science Strategy and under the Gulf of Alaska Regional Action Plan

NOAA FISHERIES

Vulnerability Framework

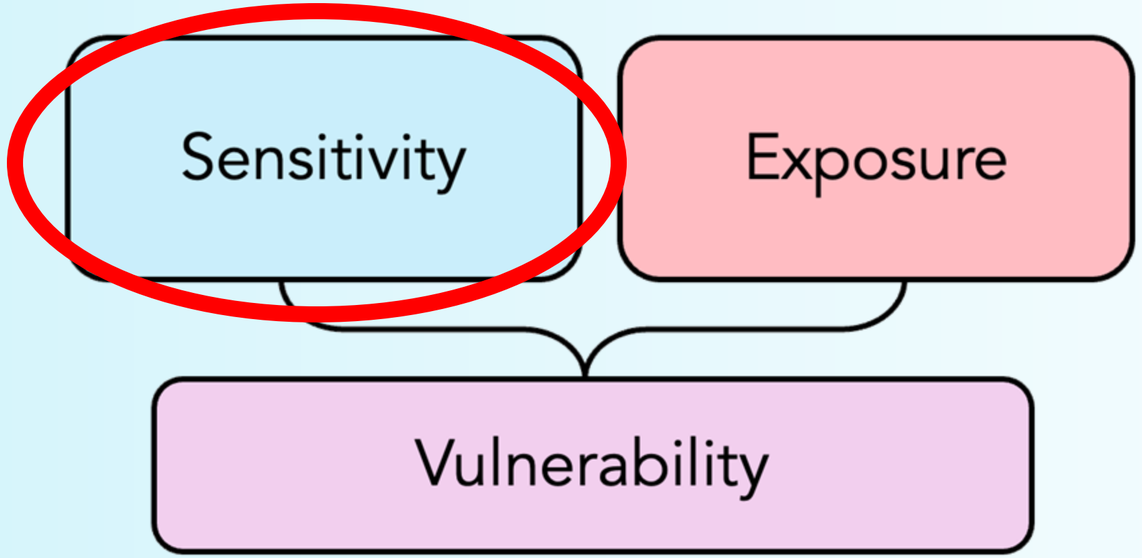


- Defined by the IPCC
- Applied widely to terrestrial and marine ecosystems, and natural and social systems

IPCC = International Panel for Climate Change

CVA Methodology

- Developed by Morrison et al. (2015) for the first NOAA CVA in the Northeast U.S. (Hare et al. 2016)
- Semi-quantitative, “rapid” approach
- Evaluates impacts over a broad range of species
- Relies on existing information and expert* opinion



**It is okay if you do not consider yourself an expert on every or any species you score!*

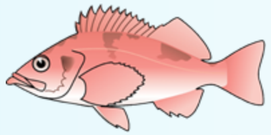
GOA focal species

We identified species that met one (or more) of the following criteria:

- ☑ Support important fisheries in the GOA
- ☑ Are managed by U.S. federal or state agencies or included in a Fishery Management Plan (FMP)
- ☑ Maintain an ecologically important niche (e.g., as forage fish)
- ☑ Are locally- or culturally-relevant nearshore species

= 56 total species


Flatfishes


Rockfishes


Crabs


Salmon


Molluscs


Other groundfishes


Elasmobranchs


Forage fish

Molluscs

Bivalve molluscs

- Geoduck clam
- Razor clam
- Weathervane scallop
- Littleneck clam

Cephalopods

- Giant Pacific octopus
- Magistrate armhook squid

Crustaceans

Crabs

- Dungeness crab
- Red king crab
- Tanner crab
- Golden king crab

Shrimps

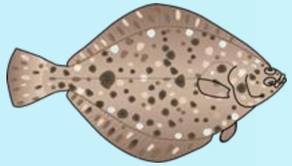
- Sidestriped shrimp
- Spot shrimp

Elasmobranchs

Elasmobranchs

- Big skate
- Longnose skate
- Alaska skate
- Pacific spiny dogfish

Flatfishes



Group 1

- Alaska plaice
- Starry flounder
- Northern rock sole
- Southern rock sole
- Yellowfin sole

Group 2

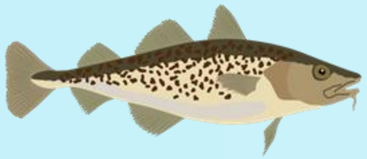
- Arrowtooth flounder
- Petrale sole
- Dover sole
- Flathead sole
- Rex sole
- Pacific halibut

Forage fishes

Forage fishes

- Capelin
- Eulachon
- Pacific sandfish
- Pacific herring
- Pacific sand lance

Groundfishes



Groundfishes

- Atka mackerel
- Walleye pollock
- Pacific cod
- Lingcod
- Giant grenadier
- Sablefish
- Plain sculpin

Rockfishes

Group 1

- Pacific ocean perch
- Dusky rockfish
- Northern rockfish
- Sharpchin rockfish
- Black rockfish
- Shortspine thornyhead

Group 2

- Yelloweye rockfish
- Redbanded rockfish
- Harlequin rockfish
- Rougheye/blackspotted rockfish
- Shortraker blackfish
- Silvergray rockfish

Salmon

Salmon

- Pink salmon
- Sockeye salmon
- Chum salmon
- Coho salmon
- Chinook salmon

Sensitivity

- **Sensitivity:** biological traits indicative of a species' ability to respond to environmental change
- We adapted 12 **sensitivity attributes** used in previous NOAA CVAs:

- Habitat Specificity
- Thermal Tolerance
- Sensitivity to OA
- Foraging Strategy
- Adult Movement
- Dispersal Capability
- Parental Investment
- Reproductive Plasticity
- Spawning Duration
- Life History Strategy
- Stock Status
- Genetic Diversity

Scoring Sensitivity

To score a species, you need three things:

1. **A species profile.**
2. Scoring guidelines for each sensitivity attribute.
3. A scoring sheet where you will input your scores for each species.

Species Profiles

- Each species included in the CVA has a “species profile,” which is a literature review that summarizes species-specific information corresponding to each sensitivity attribute
- When possible, these profiles provide stock-level information specific to the Gulf of Alaska
  - For data-limited species, information is included from other regions, at the species level, or even from a related species or taxonomic group
- Species profiles provide the information you need to score each sensitivity attribute for each species

Species Profiles

Attribute	Question	Data	Sources
Habitat specificity	What is the geographic and depth distribution of this stock for adult and juvenile life stages? What are the specific habitat requirements for adult and juvenile life stages? (E.g., What types of habitats is this stock found in? Is the species considered a habitat specialist or a habitat generalist? Does the stock rely on sensitive or disturbed habitats?)	Dusky rockfish have patchy distributions with dense aggregations on shallow (100 to 200 m) offshore banks and sparse occurrences elsewhere (Reuter 1999). Little is known about the habitat requirements of juvenile dusky rockfish, especially for those that are <250 mm and rarely caught in surveys. Juveniles are associated with biotic and abiotic structure, often over rocks and among algae (Carlson and Straty 1981, Love et al. 2002) and can be found on the continental shelf as they get older. Subadults are most common at <250 m over banks and near glacial trough edges on the continental shelf and upper slope of the GOA, from Portlock Bank and west (Pirtle et al. 2023). Adults are also known to associate with rocky and sponge-rich habitats between 40 and 50 m in the eastern GOA, sometimes resting in large vase sponges (V. O'Connell, pers. comm. via Omori et al. 2024). Adults prefer areas with vertical structure like rocky reefs, sponges, and corals—habitats that have declined in parts of the Gulf of Alaska (GOA). Mixed schools of black, dusky, and yellowtail rockfish were seen in overstory kelps in outside waters of southeastern Alaska (Rosenthal et al. 1982).	Carlson and Straty (1981) Rosenthal et al. (1982) Reuter (1999) Love et al. (2002) Pirtle et al. (2023) Omori et al. (2024)
Thermal tolerance	…	…	…

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Scoring Guidelines

- We provide scoring guidelines for each sensitivity attribute

Example: Habitat Specificity

Goal: Evaluate the relative habitat requirements for a given species while incorporating information on the type and abundance of key habitats.

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Scoring Guidelines

Example: Habitat Specificity

Goal: Evaluate the relative habitat requirements for a given species while incorporating information on the type and abundance of key habitats.

Scoring Category	Description
Low	Habitat generalist, is broadly distributed within the region of interest, uses abundant abiotic habitats, and/or relies on disturbed habitats.
Moderate	The species most often occurs in a particular abiotic habitat.
High	Relies on particular biological habitat types and/or the species is patchily distributed within the region of interest.
Very High	Habitat specialist that relies on vulnerable and/or rare biological habitats.

Scoring Guidelines

Example: Adult movement

Goal: Evaluate the capacity of adults to move to new habitats in order to maintain preferred environmental conditions if their current location changes and is no longer favorable for growth and/or survival.

Scoring Guidelines

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Goal: Evaluate the capacity of adults to move to new habitats in order to maintain preferred environmental conditions if their current location changes and is no longer favorable for growth and/or survival.

Scoring Category	Description
Low	Highly mobile and performs broad-scale movements. Little to no site fidelity.
Moderate	Moderate to high movement rates and/or some degree of site fidelity (e.g., seasonal migrations between spawning and feeding grounds).
High	Limited mobility and high site fidelity. Movement is restricted by environmental or behavioral barriers.
Very High	Sedentary or sessile.

Scoring Sensitivity

To score a species, you need three things:

1. A species profile.
2. Scoring guidelines for each sensitivity attribute.
3. **A scoring sheet where you will input your scores for each species.**

How do you score?

- Scoring of sensitivity follows a five-tally system
- For each sensitivity attribute, you will have five tallies to distribute across four scoring categories: low, moderate, high, and very high
- The spread of tallies across categories informs the uncertainty of scores (e.g., a greater spread across the scoring categories indicates greater uncertainty in that score)

How do you score?

- Scoring of sensitivity follows a five-tally system
- For each sensitivity attribute, you will have five tallies to distribute across four scoring categories: low, moderate, high, and very high

A wide spread of tallies indicates greater uncertainty

Low	Moderate	High	Very High
|	|||	|	

A narrow spread of tallies indicates greater certainty

Low	Moderate	High	Very High
||||	|		

Your scoring sheet

- For each species, you will fill in the tallies as **numbers** for each sensitivity attribute
- You do not need to put in zeros for unfilled boxes
- You must put 5 tallies in each row

Example of complete scores:

Sensitivity attribute	Low	Moderate	High	Very High
Habitat Specificity	4	1		
Thermal Tolerance		2	3	
Sensitivity to OA	1	1	2	1
Foraging Strategy	1	3	1	
Adult Movement	5			
etc.				

Your scoring sheet

- There is a comments column that we encourage you to use to:
  - Justify and provide additional context for your scores
  - Explain your level certainty or uncertainty in your scores
  - Remind you how you scored each species during the workshop

Sensitivity attribute	Low	Moderate	High	Very High	Comments
Habitat Specificity		1	2	2	closely associated with sponges; "evenly" distributed; limited information

Additional scores

Two additional parts of your scoring sheet:

1. **Data quality**
    a. Understanding what information you relied on to score each sensitivity attribute
2. **Directional effect of climate change**
    a. Your overall impression of how climate change will impact each species

Data quality

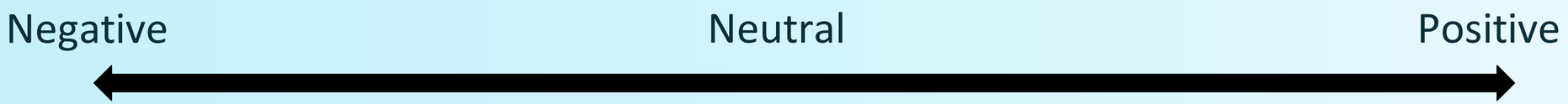
- Next to each sensitivity score, you will add a “data quality” score
- This score is based on the type and quality of information you used to score each attribute
- This score will help end users to identify data gaps and areas for future research

Data quality

Data quality	Description	Numerical score
Adequate	Based on empirical measurements, observations, or modeled results that originate from a reputable source.	3
Limited	Based on information pertaining to a different population or another species (e.g., same species in California, different species in the GOA)	2
Expert Judgment	Based on your general knowledge of the species and their role in the ecosystem.	1
None	Very little information is available and there is no basis for forming an expert opinion.	0

Directional effect of climate change

- You will also provide a score that seeks to answer the following question: **What is your overall impression of how this species will be impacted by the effects of climate change?**
- This score provides initial feedback to managers on the species included in our CVA



Directional effect of climate change

- Add your directional effect score in the **second tab** of your scoring sheet
- This scoring uses **4 tallies** (NOT 5)
- As with sensitivity, the spread of tallies indicates (un)certainty
  - Example:

Species	Negative	Neutral	Positive	Comments
species1	3	1		…
species2	1	2	1	…

Getting started

1. Make sure you are familiar with the scoring methods outlined in the scoring guideline document
2. Open your scoring sheet
3. Open your first species profile
4. Read the literature summary for the first attribute – Habitat Specificity
5. Review the scoring guidelines for Habitat Specificity
6. Distribute 5 tallies across the categories low – very high
7. Score data quality
8. Add any comments
9. Repeat!

Step-by-step examples

Next steps

- **After this webinar:** you will receive your scoring sheet, relevant species profiles, and scoring guidelines
  - Expect this to take ~2 hours to complete
  - A recording of this webinar will also be sent out for reference
  - Scoring sheets will be due 1 week before scoring workshop
- **Late January/ February:** scoring workshops (3 hours each)

General guidelines

- Refer to the scoring guidelines document for more detailed information on scoring
- Try to score at the **stock level** as much as possible
- You are encouraged to rely on the literature provided and your own expertise
  - It is okay if you are not an expert on every or any species you score – please make your best judgment!
- Please do not discuss your scores with others until your workshop
- Email me (isabelle.galko@oregonstate.edu) with any questions

Questions

Email: isabelle.galko@oregonstate.edu