

# **Do Public Values and Preferences Influence Risk Tolerance?**

## *Informing Management Strategies in the Lower Columbia River*

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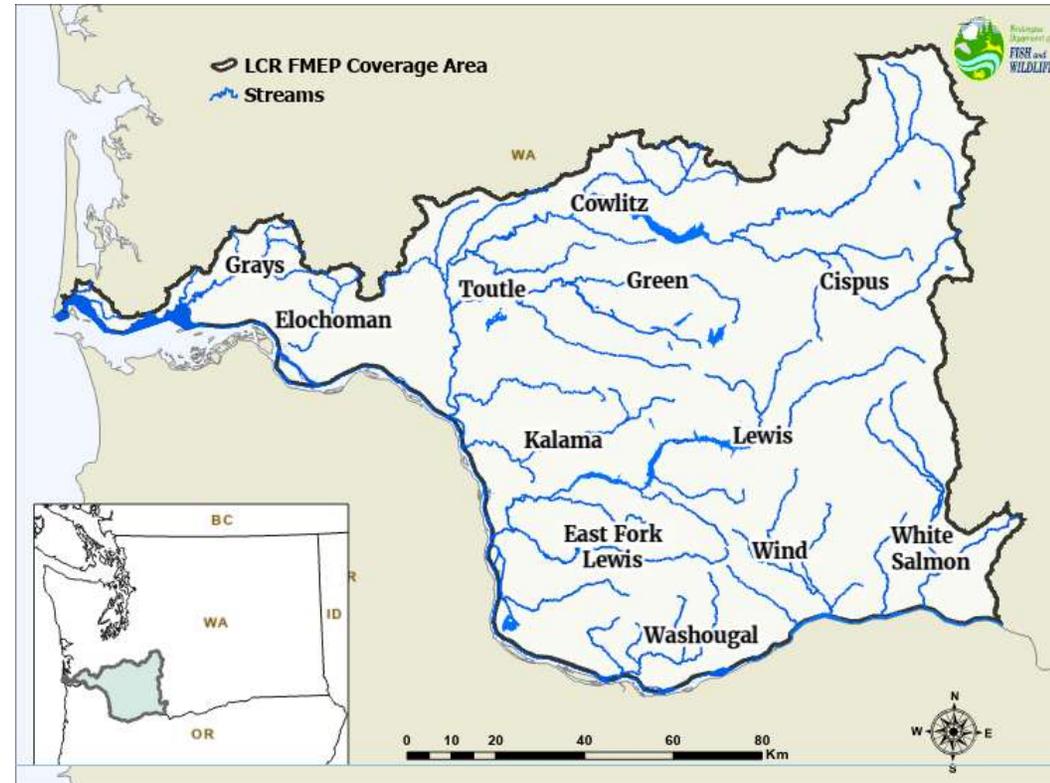
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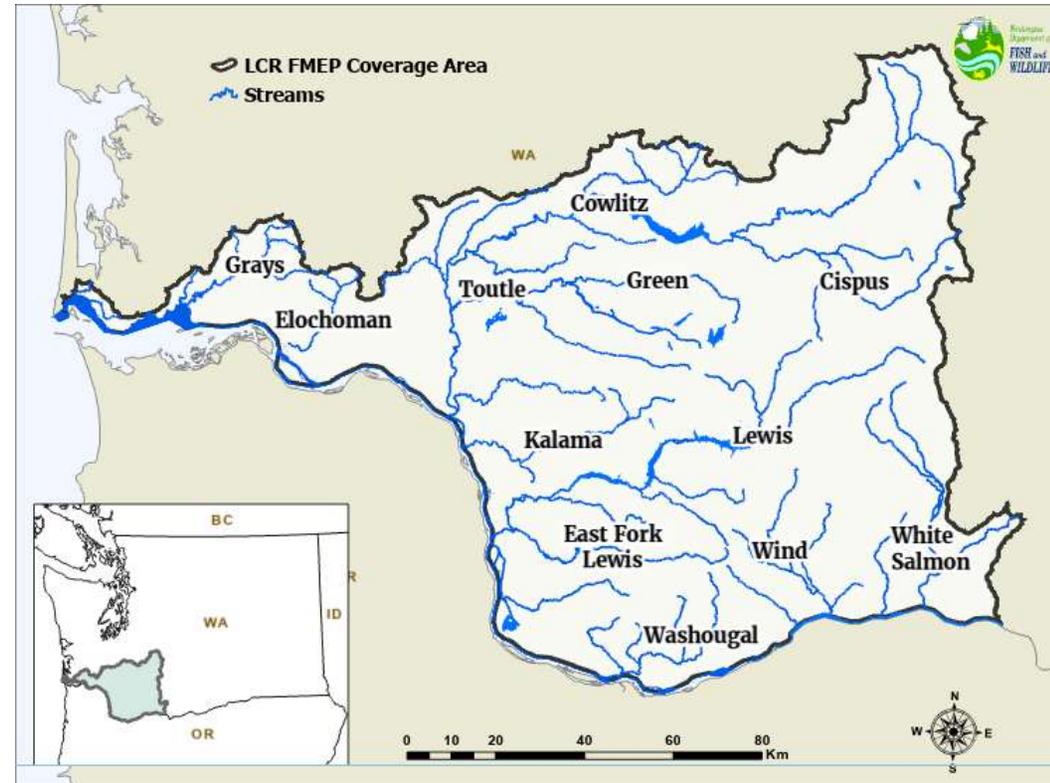
# Background

- Used a Structured Decision-Making (SDM) Process
- Updating the Lower Columbia River Tributary Fisheries Management and Evaluation Plan (FMEP)
- Sets harvest control rules (HCRs)
- Transparency and public engagement are inherent to SDM



# Background

- Not a vote
- Policy and legal sideboards for HCRs
- Understand public preferences for fishery structure and risk tolerance
- Guides targeted communication
- Structured process is repeatable and robust



# Research Questions

- 1. How do the public value measures of fishery performance, both in terms of conservation and opportunity?**
- 2. How do those values and preferences inform risk tolerance for harvest control rules?**
3. Which harvest control rules do the public prefer?
4. Do those values and preferences differ across fishery and/or demographic groups?



# Methods: Survey Structure

- 5-point Likert scale (strongly disagree – strongly agree)
  - Fishing Opportunity Preferences
  - VSP Parameters
  - Regulatory Trade-Offs
  - Management and Decision-Making
- HCR options (exploitation rates low to high)
- Demographics and fishery participation
- Open comment portal



# Participation

- Targeted anglers and non-anglers
- 4000 survey responses (most ever for this type of survey)
- 1000 YouTube views on public meeting
- Participants from around the world



<https://www.youtube.com/watch?v=ZVkZjlpasLM>





# Methods: Data Analysis

## 1. Values & Preferences

- Exploratory Factor Analysis (EFA) of value statements
- Latent Class Analysis (LCA) of respondent groups
- Cramér's V

## 2. Risk Tolerance

- Ordinal modeling of harvest control rule



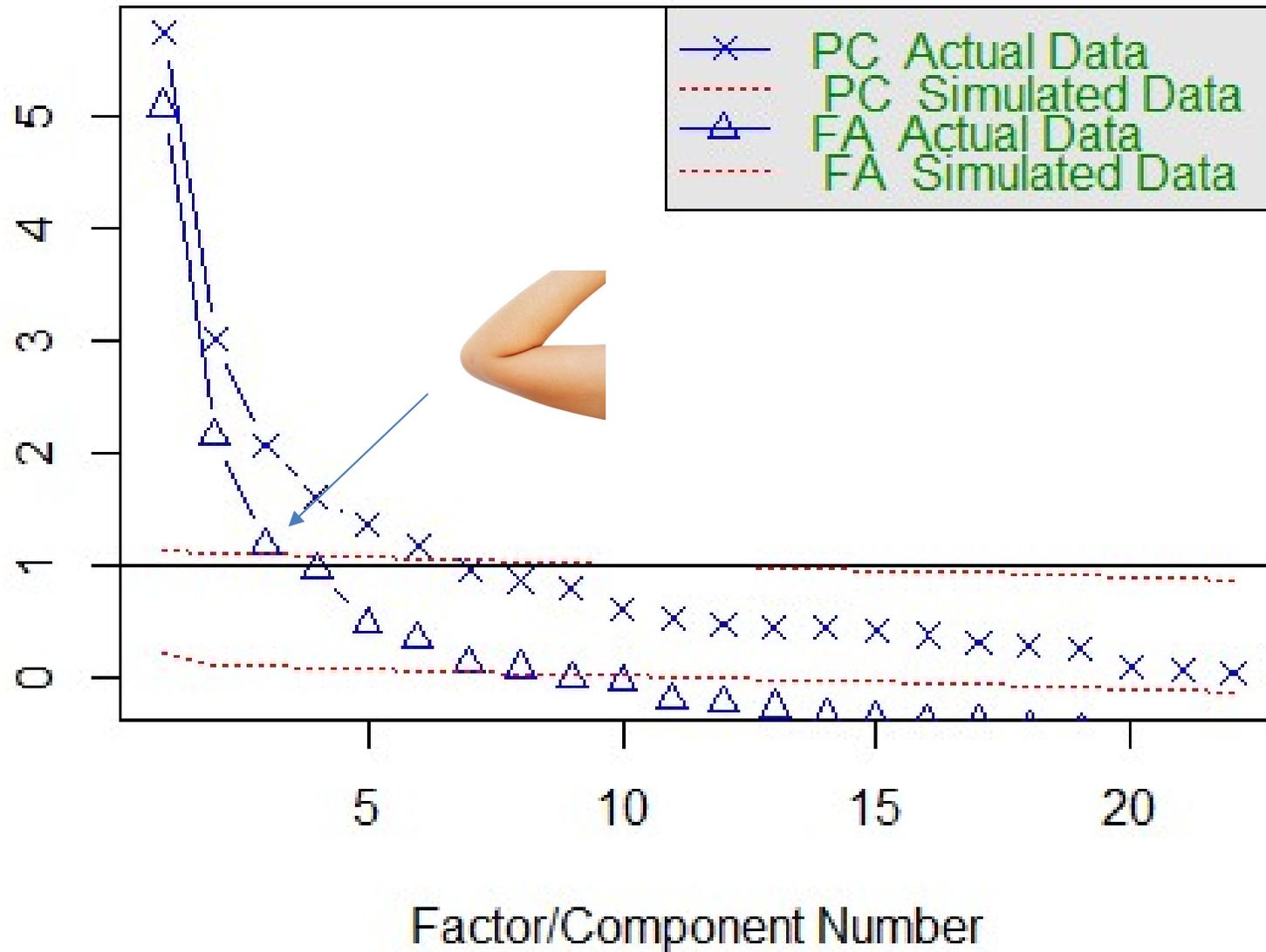
# Exploratory Factor Analysis (EFA)

- Assesses response patterns that suggest underlying attitudes
- Polychoric correlation matrix handles ordered, categorical data
- Determined the appropriate number of groups (scree plot)
- Identified three factors



eigenvalues of principal components and factor analysis

## Parallel Analysis Scree Plots



# Factor 1: Conservation and Long-Term Stewardship

Determined by these survey questions:

- Q6: Importance of geographic distribution
- Q7: Importance of sustainable reproduction
- Q8: Avoid altering natural traits
- Q13: Willingness to fish less now for future returns
- Q14: Regulations should be reviewed to achieve balance
- Q18: Decisions should be guided by science
- Q19: Managers should prioritize conservation
- Q21–X22: Science helps support opportunities & conservation



# Factor 2: Hatchery and Harvest-Oriented Opportunity Values

Determined by these survey questions:

- Q1, Q2: Value harvest of hatchery steelhead and salmon
- Q5: Value harvest of wild salmon (moderate loading)
- Q20: Managers should prioritize fishing opportunities



# Factor 3: Liberal Access Preferences and Simplified Regulations

Determined by these survey questions:

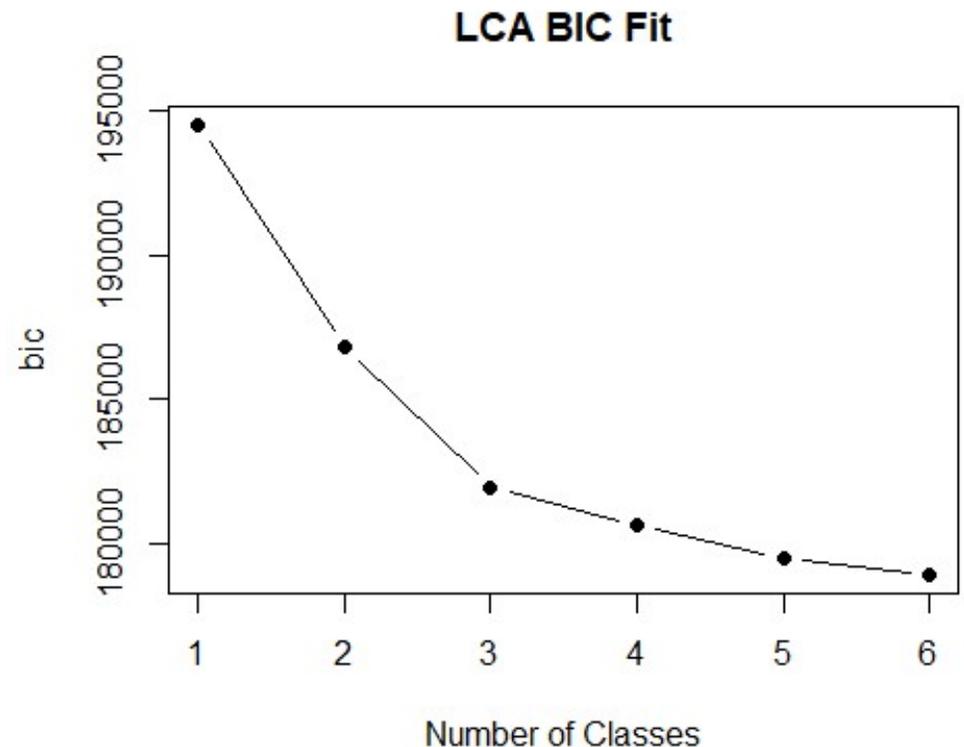
- Q3, Q4: Value catch-and-release opportunities
- Q9–Q12: Preferences for longer seasons, fewer restrictions, more open areas



# Latent Class Analysis (LCA)

- Identifies distinct classes based on similar answer profiles
- Evaluated models with different numbers of groups
- Produced 6 classes (combinations of factors)

Bayesian Information Criterion (BIC)

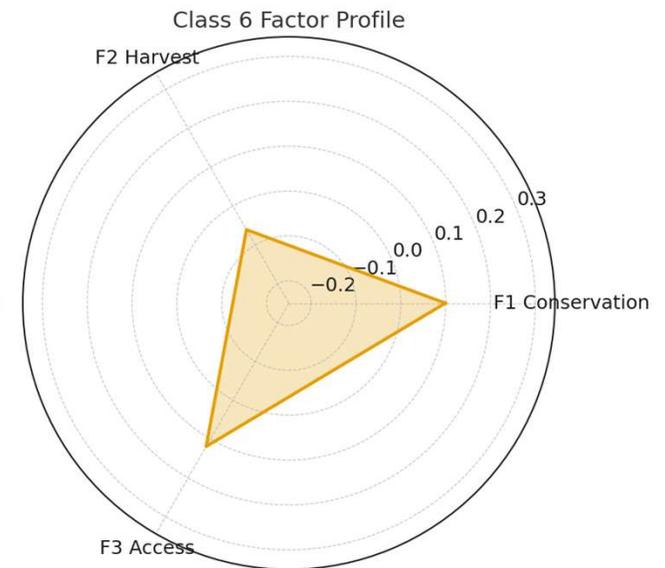
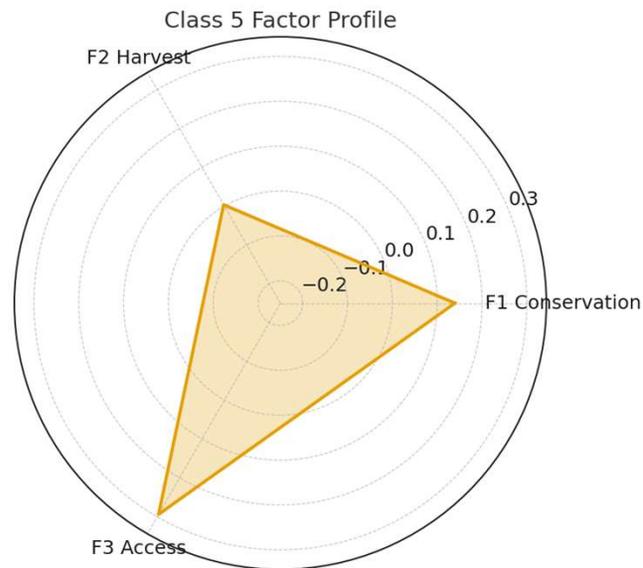
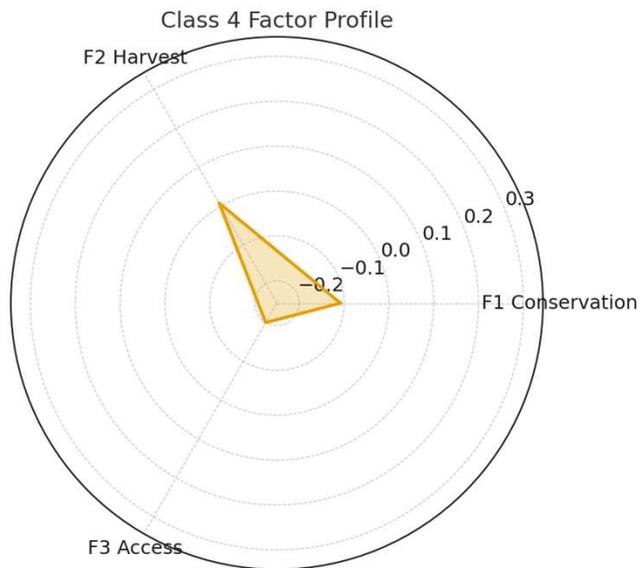
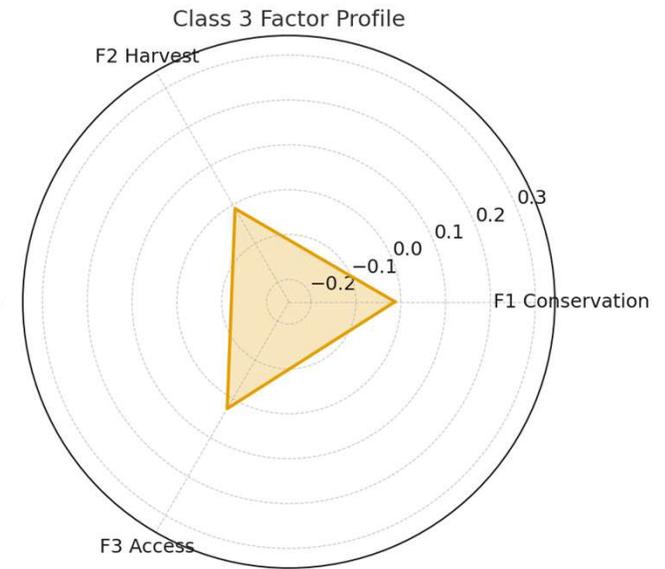
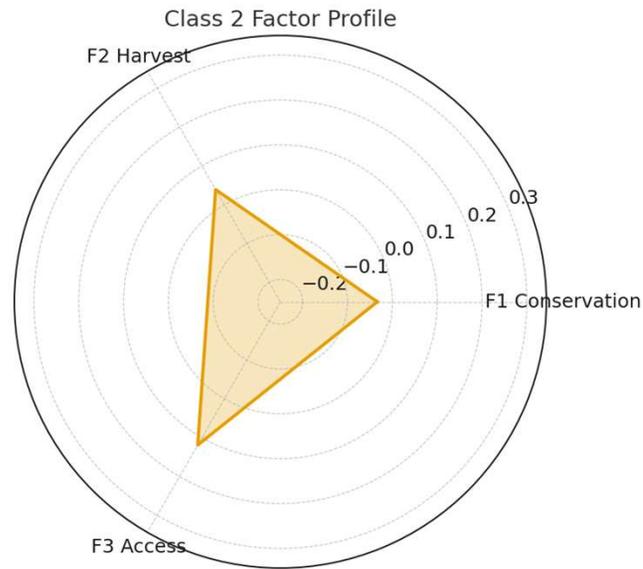
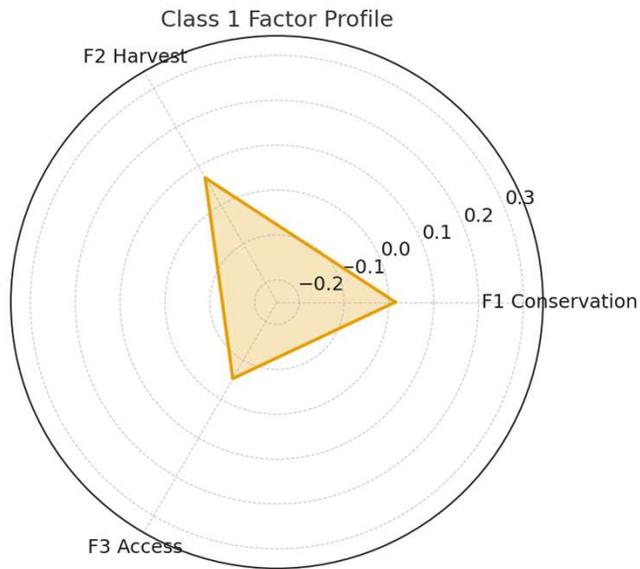


# Latent Class Summary

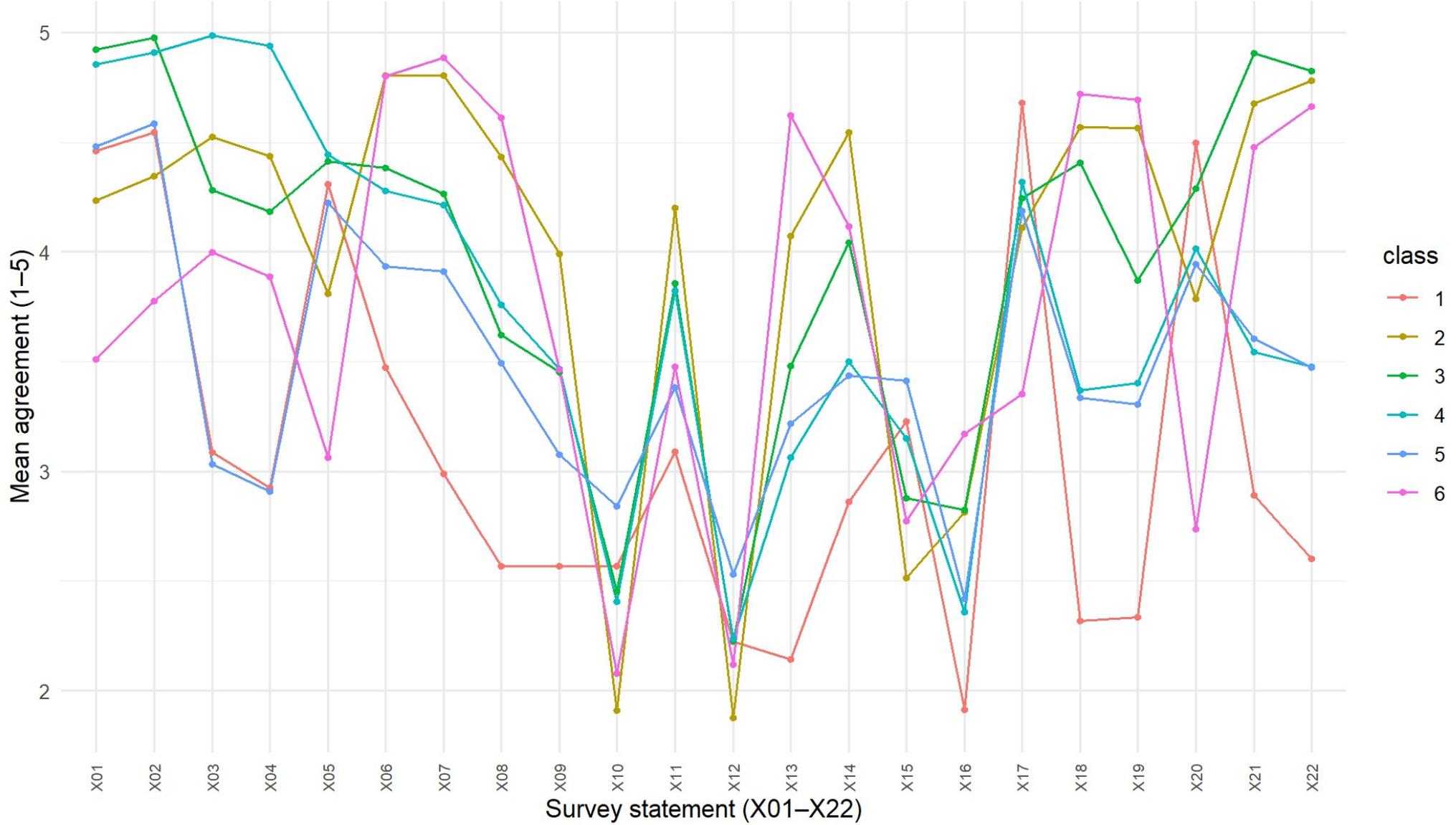
Class	<i>n</i>	Main Theme	F1 Conservation	F2 Harvest	F3 Access
1	555	Moderately pro-harvest, neutral elsewhere	+0.015	+0.070	-0.053
2	376	Access-focused, mildly pro-harvest	-0.034	+0.039	+0.119
3	551	Moderate “no strong lean” group	-0.013	-0.010	+0.025
4	576	Low across all factors, especially against flexible access	-0.108	+0.008	-0.200
5	745	High conservation + high access (strong dual-value group)	+0.140	+0.003	+0.294
6	425	Conservation-leaning, low harvest, pro-access	+0.099	-0.061	+0.119



# Latent Class Summary – Radar Plots



# Latent Class Profiles Across Likert Items



# Cramér's V: Most Influential Value Statements

Most divisive questions for class assignments

1. **Q22**: Science helps achieve conservation goals
2. **Q21**: Science helps provide opportunities
3. **Q19**: Managers should prioritize conservation
4. **Q18**: Decisions should be guided by science
5. **Q13**: Willingness to fish less now for future returns
6. **Q3/Q4**: Value catch & release opportunities
7. **Q14**: Regulations should be reviewed often to achieve balance



# HCR Ordinal Modeling

- Ordinal regression
- Predict risk tolerance (more conservation to more liberal HCR options) by class and factor
- Quantitative link between values and HCR preference



# HCR Option Questions

Opportunity metrics

Conservation metrics

## Steelhead example: Potential catch and release fishery

Options	How many of the fish can be caught in a catch and release fishery?	On average, in how many years out of 100 will the fishery be closed?	On average, in how many years out of 100 will the population be at very high risk of extinction? *	On average, in how many years out of 100 will there be enough fish to meet the Endangered Species Act recovery goal?
Option A	None	Always closed	8 years	24 years
Option B	One quarter	2 years	8 years	25 years
Option C	Half	2 years	9 years	22 years
Option D	All	2 years	12 years	18 years
Option E	All caught once, some caught twice	2 years	14 years	16 years
Option F	All caught twice	2 years	17 years	14 years

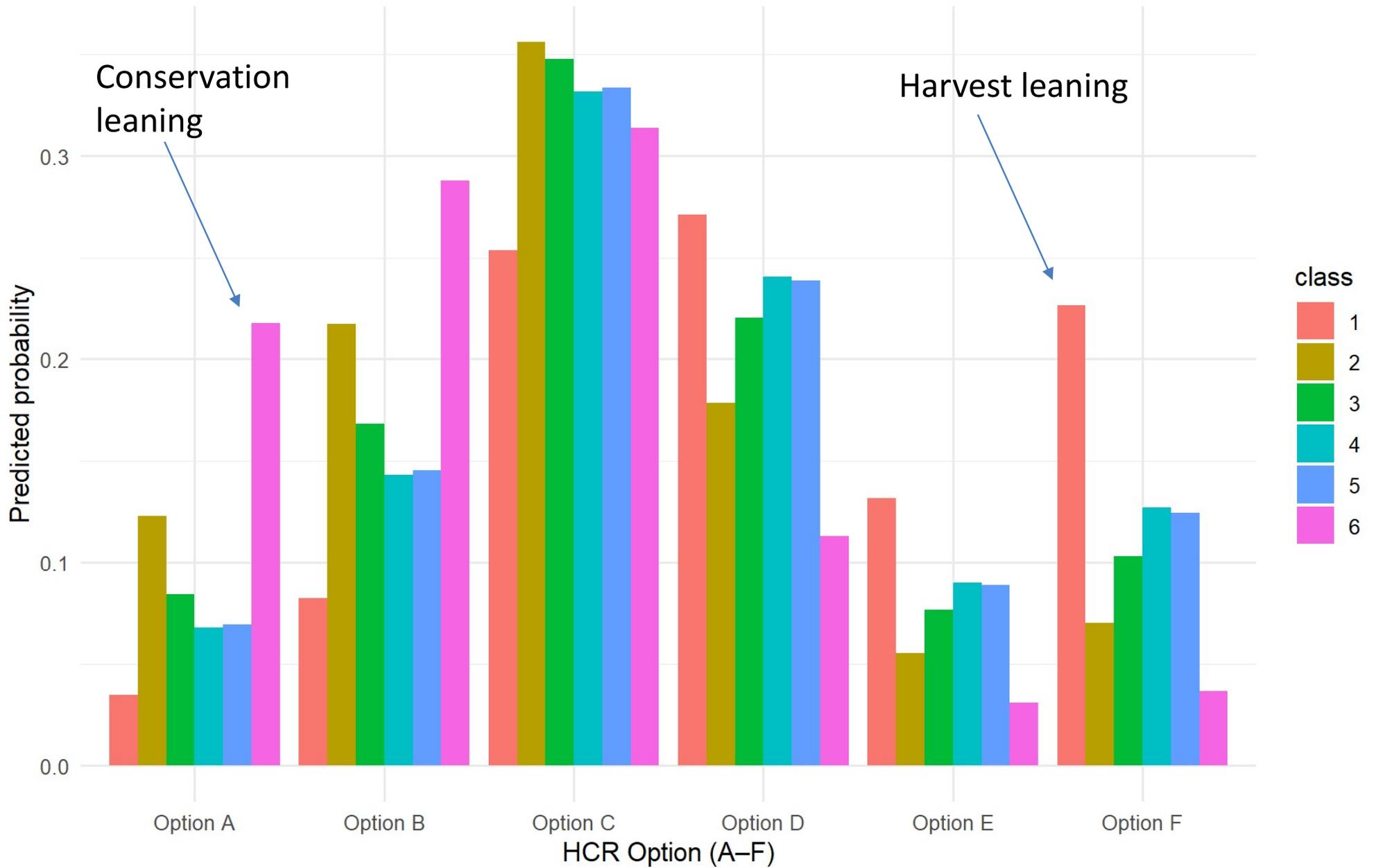
Opportunity increases

Conservation risk increases

\* Very high risk of extinction is defined at the quasi-extinction threshold (QET), which is the level below which the population is unlikely to recover. For most populations, the QET is 50 fish.



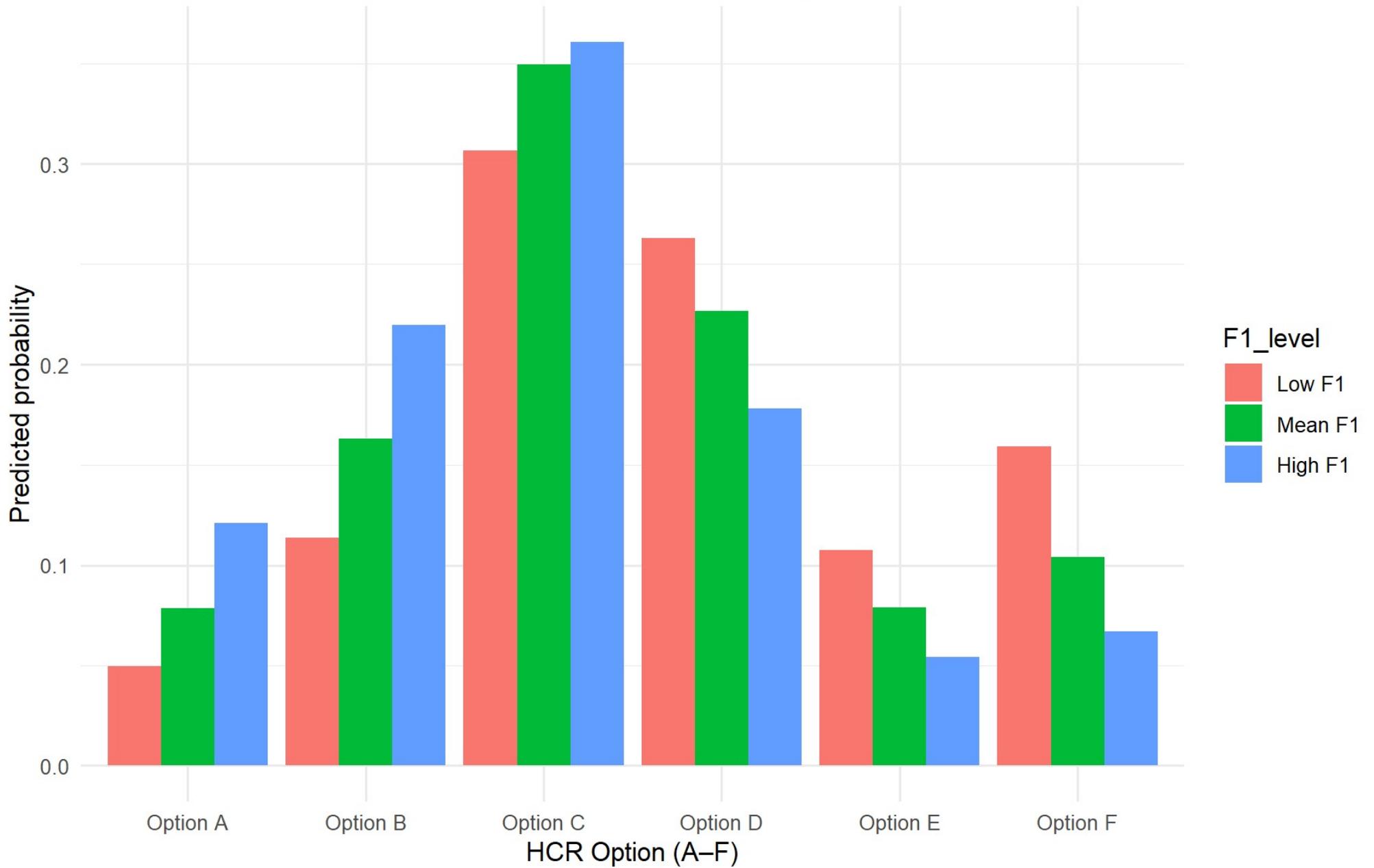
# Predicted Steelhead HCR (X23) Choice by Latent Class



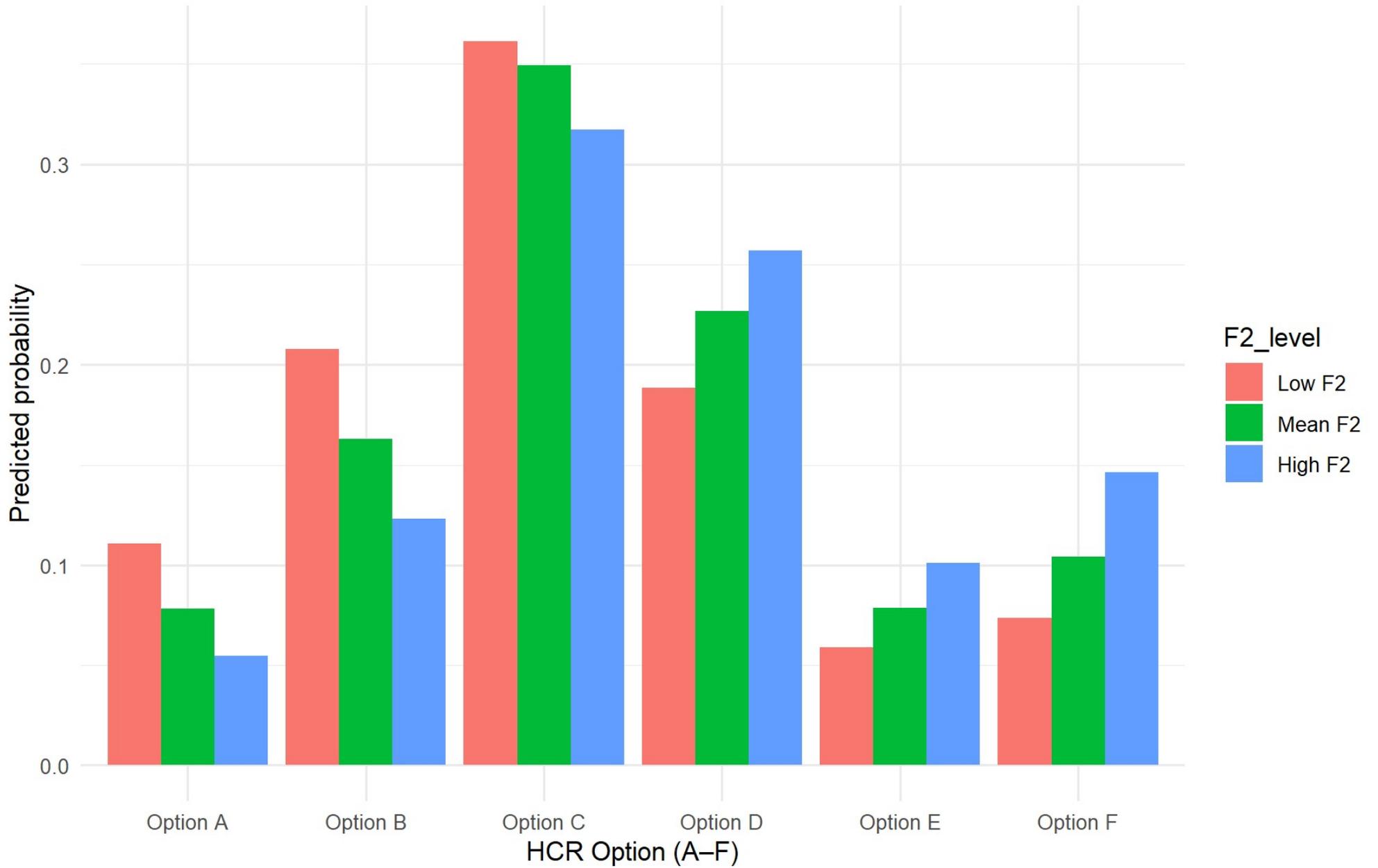
**Exploitation rate increases**



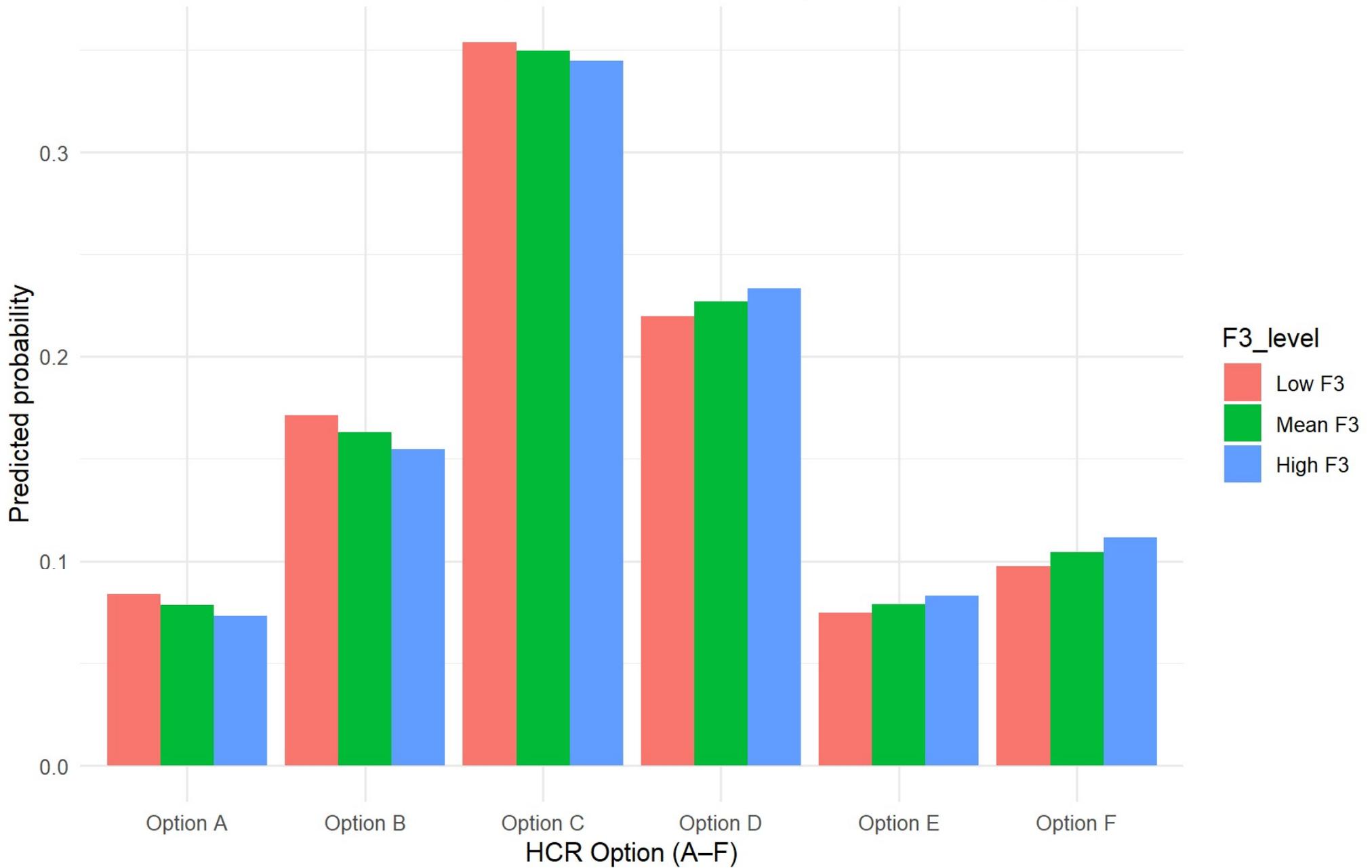
# Predicted Steelhead HCR (X23) Choices by Factor 1 (Conservation/Science)



# Predicted Steelhead HCR (X23) Choices by Factor 2 (Hatchery Harvest Orientation)



# Predicted Steelhead HCR (X23) Choices by Factor 3 (Access / Flexibility)



# Management Implication

- Helps clarify how anglers weigh conservation risk against fishing opportunity
- Anticipate where support or concern may arise when presenting policy alternatives
- Create targeted communication strategies
- Fisheries are inherently a social issue
- Results inform HCR selection for LCR tributary fisheries



# Next Steps

- Evaluate specific, manager supplied questions using the dataset
- Assess differences between demographic groups
- Refine approach
- Integrate into SDM process for management strategy evaluation





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