The worth of a herring:

EXPLICATING STAKEHOLDERS' KNOWLEDGE & VALUES IN BRITISH COLUMBIAN HERRING FISHERIES

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Fisheries management: Science vs goals

- **Descriptive research**
  - Stock assessments
  - Ecosystem modelling
  - Bio-economic modelling

- **Normative goals**
  - Conservation of species/ecosystems
  - Maximization of economic benefits
  - Distribution of economic benefits

Who sets management goals?

Often, management constrained by legislated obligations

- Maximum sustainable yield (MSY) targets
- Conservation of endangered species
- Consideration for socio-economic concerns

Top-down structure may not fit well with specific local goals

- Accommodation of socio-economic concerns easier said than done
- “Consultation” often little more than one-way announcement of intentions

Can lead to local distrust, resentment of management

- Unhelpful for all when trying to address universal concerns

Herring fisheries in British Columbia

Pacific herring (*Clupea pallasii*)

Managed by federal Department of Fisheries and Oceans (DFO)

Accessed at: http://alaskafisheries.noaa.gov/mapping/ShoreZoneMvcServices/FishAtlas/FishDisplayPage?spCode=HERRING

Herring fisheries in British Columbia

Three main sectors of fishery:

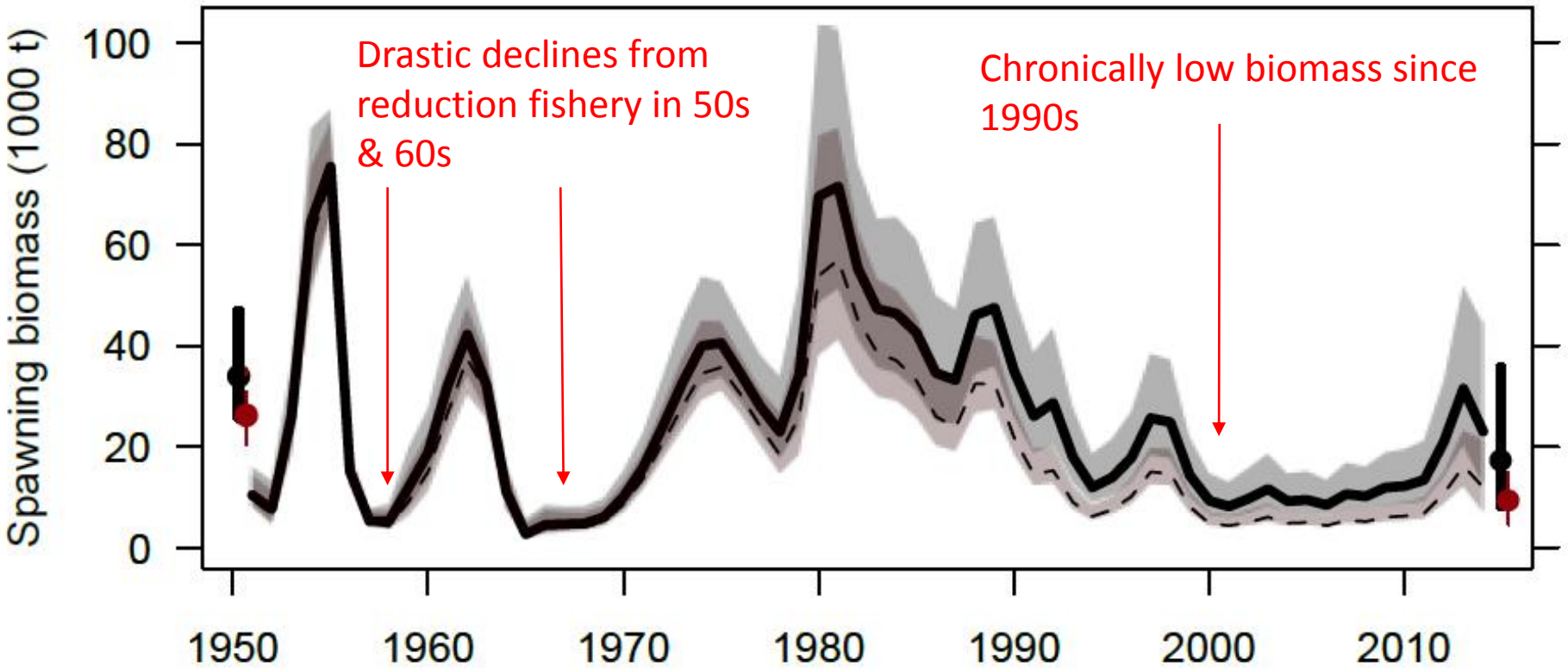
- First Nations' food, social and ceremonial use (FSC)
- Recreational
- Commercial

Three main products of commercial fishery:

- Food and bait
- Roe sacs
- Spawn-on-kelp (SOK; the only zero-mortality herring product)

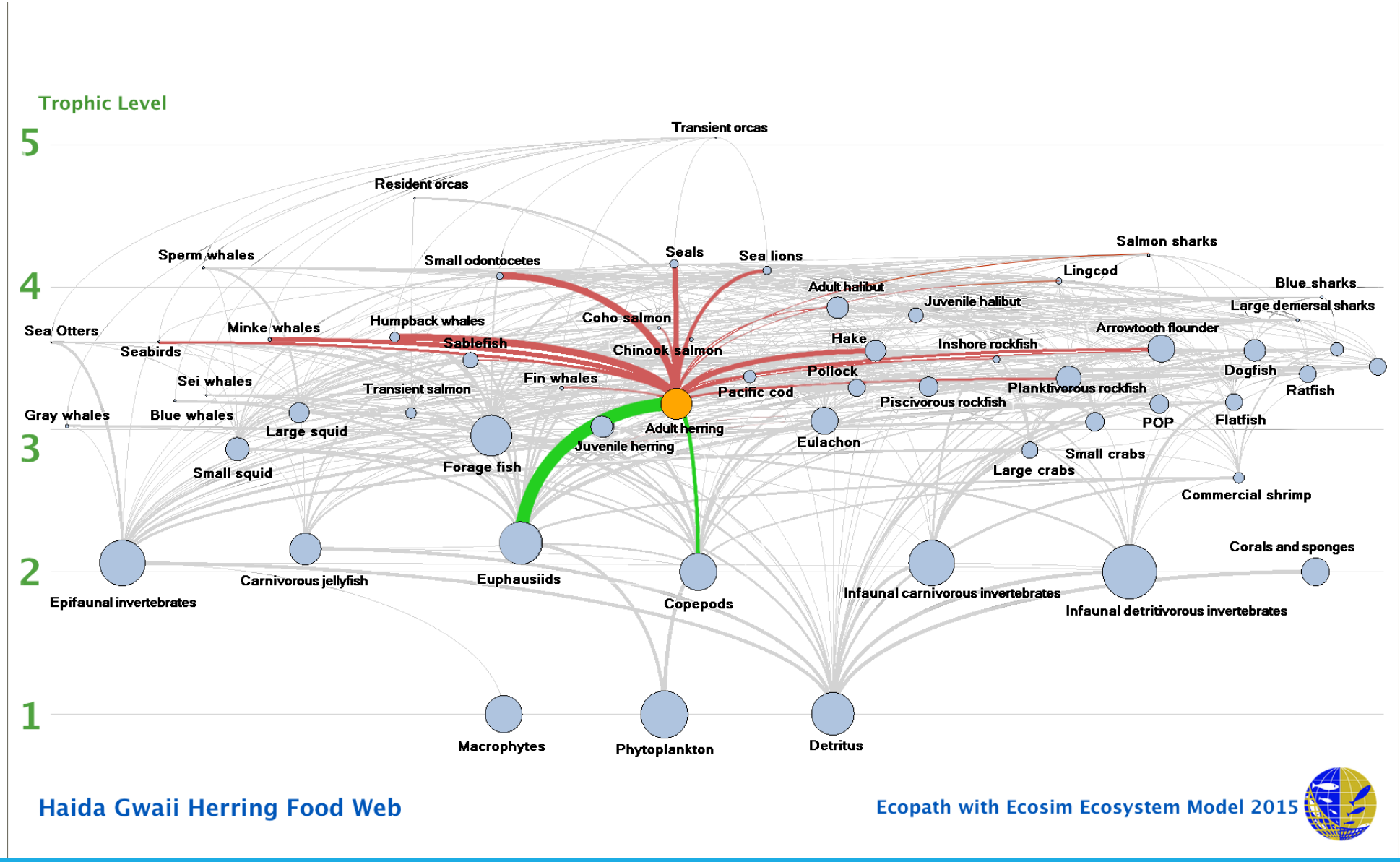
Purse seining for roe herring (I. McAllister)

Herring fisheries in British Columbia



From 2014 Stock Assessment (Cleary and Taylor) for Base Case and Historical Management Procedure.

Herring in the BC marine ecosystem



Pitcher 2015

First Nations and herring

SOK: “soul food,” with deep cultural importance

- Changes in herring abundance, spatial distribution have resulted in loss of traditional SOK food for many FNs

Important source of revenue

- SOK and roe fisheries highly lucrative in past
- Recent decrease in Japanese demand, increase in supply have hurt price

From Greba (2015)

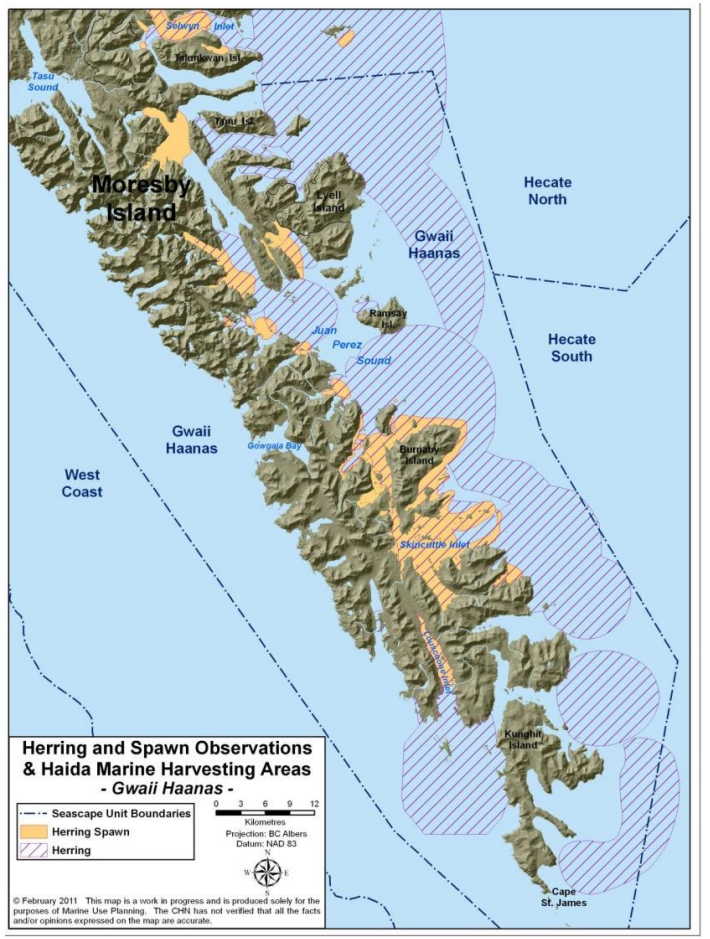
Haida Gwaii
(neé Queen Charlotte Islands)

Accessed from: http://placeofwonder.com/

Traditional ecological knowledge (TEK)

Oral histories of First Nations inform extensive knowledge of past herring abundances, spatial patterns

Has led to disagreements with DFO over recent and current herring stock statuses



From Jones (2015)

The recent herring conflict

Recent decisions by Canadian Minister of Fisheries to open roe fishery despite scientific uncertainty met strong resistance from First Nations

- In 2014, fishing industry agreed informally to avoid traditional FN fishing areas
- In 2015, the Haida Nation won a court injunction against commercial fishery opening in Haida Gwaii waters
- In 2015, members of the Heiltsuk Nation achieved closure of commercial fishery after occupying DFO Vancouver office

How to create a more ethical system?

Legal action and civil disobedience are not long-term solutions to disputes between stakeholders and management

A more appropriate system would:

- Address disagreement over facts
- Acknowledge differing values of stakeholder groups
- Set management goals for herring harvest via dialogue, rather than dictat

Where to begin?

Identify differences in stakeholders':

- Knowledge/perception of herring stocks & marine ecosystems
- Principles/virtues (deontic, held values)
- Preferences for management goals (consequentialist, applied values)

Cultural consensus theory (CCT)

Developed by Romney et al. (1986)

Formalized in the General Condorcet Model (GCM):

- Statistically reveals group's implicit "answer key" to questionnaire
  - Indicates whether consensus exists
  - Identifies agreed-upon answers to items
- Reveals each respondent's degree of assent with group
- Corrects for guessing

Issues with the GCM

What if there are multiple subgroups within the sample, each with its own answer key?

What if some questionnaire items are more difficult than others?

How to correct for guessing bias in individuals (i.e., unequal likelihoods of guessing answer choices)?

How to accommodate “I don’t know” responses to questionnaire items?

Recent improvements to CCT models

Anders & Batchelder (2012): the Multi-Cultural GCM (MC-GCM)

- Identifies presence of multiple subgroups with unique consensus patterns
- Accounts for possible variability in question difficulty

Oravecz et al. (2014): the Extended Condorcet Model (ECM)

- Accommodates “I don’t know” responses to true/false questions
- Accounts for possible respondent guessing biases

Further improvements to CCT models?

Potential to combine ECM and MC-GCM models for greater usefulness?

Could MC-GCM be further generalized to accommodate multinomial, ordinal answer choices?

(I'll touch on this again soon)

My research agenda

1) Propose criteria for an ethical fishery governance regime

2) Develop questionnaire probing respondents' knowledge and values

3) Distribute questionnaire to stakeholders

4) Analyze results using CCT and other statistical methods

5) Identify ways forward to a more ethical fishery governance regime

1) Propose criteria for an ethical fishery governance regime

Intuitively, I suggest the following criteria:

- Equal participation of stakeholder groups in decision-making
- Equitable allotment of benefits to stakeholder groups

1) Propose criteria for an ethical fishery governance regime *(cont'd)*

Justifying these criteria:

- How to decide who is a stakeholder?
  - *Individuals? Groups? Non-humans?*
  - *Who decides?*
- How to decide what is equitable?
  - *What weights should be placed upon which benefits/costs?*
  - *What types of values are included in "benefits" and "costs?"*
- Why is this more ethical than a benevolent but authoritarian mgmt regime?
  - *Can ethical theory support participatory resource governance?*
  - *Can empirical results of other governance regimes?*

2) Develop questionnaire probing respondents' knowledge and values

Questionnaire items will definitely examine:

- Respondents' demographics (age, residence, ethnicity, occupation, etc.)
- What values respondents hold (held values = principles/virtues)
- What values respondents apply to herring and the marine ecosystem (applied values = preferences)

2) Develop questionnaire probing respondents' knowledge and values *(cont'd)*

Questionnaire items may examine:

- Respondents' perceptions of what food web interactions occur between herring and other species
- Respondents' perceptions of such interactions' relative weights
- Respondents' perceptions of human interactions (social & economic) with herring

2) Develop questionnaire probing respondents' knowledge and values *(cont'd)*

Questionnaire items probably won't, but could, examine:

- Respondents' social network attributes
  - Who do respondents feel have the greatest influence on their principles/virtues?
  - From whom do respondents obtain knowledge of herring-ecosystem & herring-human interactions?
  - What is the relationship between the respondent and each named connection?

This data could be compared with results of MC-GCM analyses to explore relationship between social networks and cultural consensus

2) Develop questionnaire probing respondents' knowledge and values *(cont'd)*

Challenges of using CCT:

- Questionnaire response choices must be binary to accommodate GCM & MC-GCM as they are
  - ECM allows third, "don't know," option
- Expansion to accommodate multiple ordinal choices, along with "don't know," will require further generalization of GCM
- Are my algebraic & statistical skills up to the task?

3) Distribute questionnaire to stakeholders

Who to include in sample?

- At minimum, residents of Haida Gwaii and commercial fishers from elsewhere in BC
- Ideally, also include other First Nations groups, scientists
- Potentially also managers, NGO affiliates, BC seafood consumers

Need to balance breadth with depth

- Logistics of identifying and contacting potential respondents may be tricky
- Longer questionnaire unlikely to achieve high response rate
- Broader array of stakeholders = potentially more revealing results

4) Analyze results using CCT and other statistical methods

Exploratory analysis will:

- Identify distinct groups of like-minded respondents (via MC-GCM)
- Look for correlations/lack thereof between self-identified characteristics and group affiliation
  - Are some perceptions, values, preferences universal?
  - Do common-sense group definitions accurately represent consensus?
    - Do all Haida value herring similarly?
    - Do most commercial fishers share the same management preferences?

5) Identify ways forward to a more ethical fishery governance regime

Given proposed criteria for ethical governance and results of analysis:

- Do results offer better picture of who stakeholder groups are?
- What are the similarities and differences in:
  - Perceptions groups have of herring-ecosystem & herring-human interactions?
  - Values groups hold to be important?
  - Values groups apply to herring management scenarios?
- Do results suggest that disagreements between groups arise from different perceptions, principles, preferences?

My primary concerns with methodology

1) Developing questionnaire

2) Developing generalized GCM model

3) Hypothesis testing

1) Developing questionnaire

Answer choices:

- Binary (True/False, Yes/No), or
- Ordinal (how important on scale of 1 to X)?
- Depends on ability of CCT model to accommodate choices

Phrasing:

- Must balance positive and negative phrasing of items to avoid bias
- Must elucidate response reflective of respondent's true state
- All questions of same type (i.e.: knowledge, principles, preferences) should be equally difficult
  - Though differences can be accounted for in MC-GCM
- Should question types be separated in different sections?

2) Developing generalized GCM model

Is it necessary/desirable to adapt model for ordinal answer choices?

- Seems intuitively less precise to elicit preferences, principles, values using binary choices
- But perhaps accuracy is more important than precision here?

Allowing “don’t know” responses seems quite desirable for questions regarding ethical issues

Effort allocation:

- How best to balance time & effort spent on GCM development vs effective questionnaire?
- (I’m behind schedule already!)

3) Hypothesis testing

Moving beyond exploratory analysis requires formal, testable hypotheses

- How to choose which questions to ask?

Two broad categories of hypotheses I might test:

- A) Conformation of revealed consensuses with self-identified demographic groups
- B) Conformation of respondents' knowledge, principles, preferences with hypothesized cultural models

3) Hypothesis testing

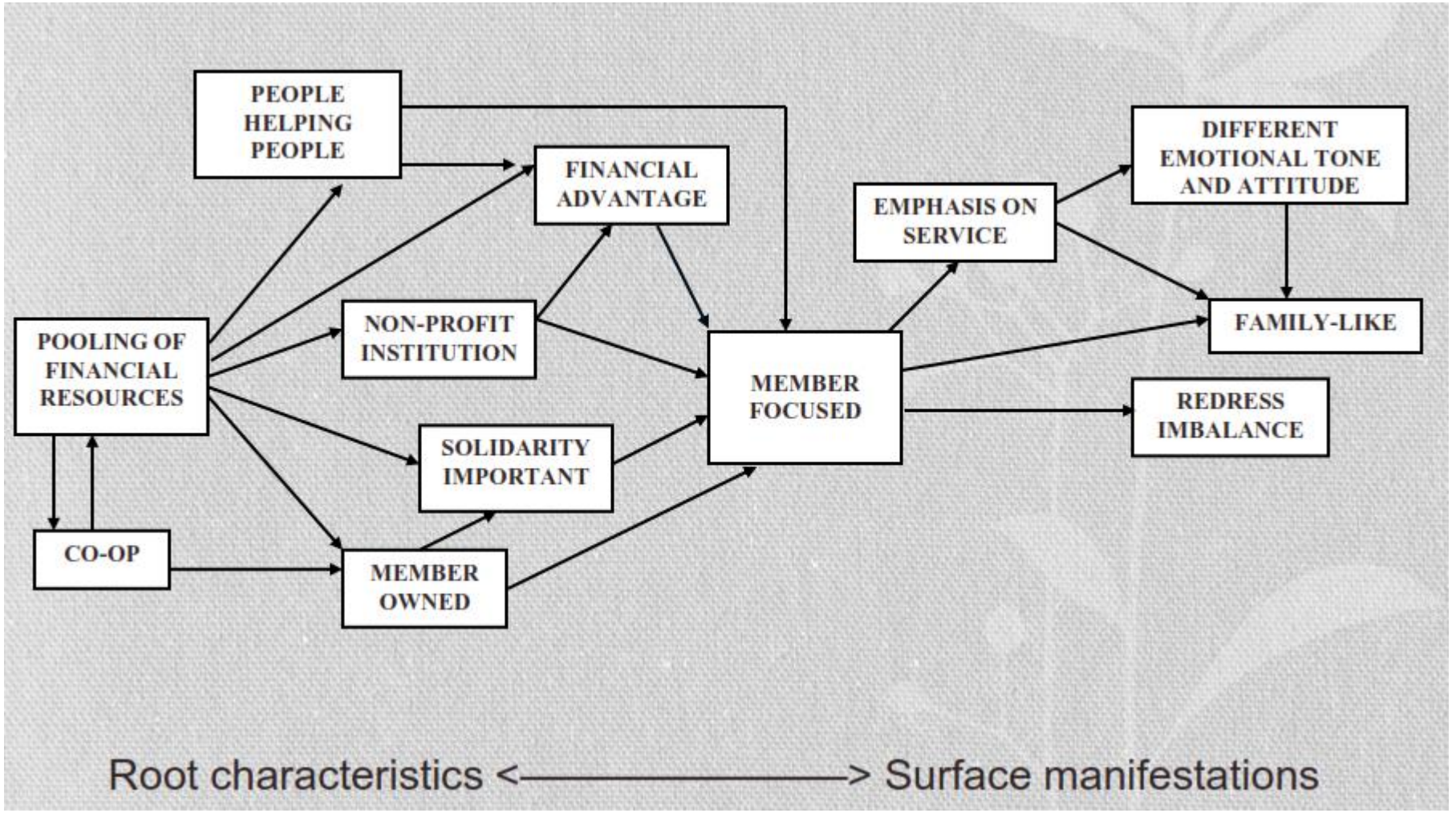
A) Conformation of revealed consensuses with self-identified demographic groups

- Do members of intuitively-defined stakeholder groups (e.g., Haida Gwaii residents, commercial fishers, members of the Haida Nation) hold similar beliefs to groupmates?
  - Testable hypothesis: “Haida Gwaii residents are more likely to agree with one another than with non-HG residents.”
- Do said groups hold beliefs similar to other groups’?
  - Testable hypothesis: “Revealed consensus group A’s response to questionnaire item #12 differs significantly from that of consensus group B.”

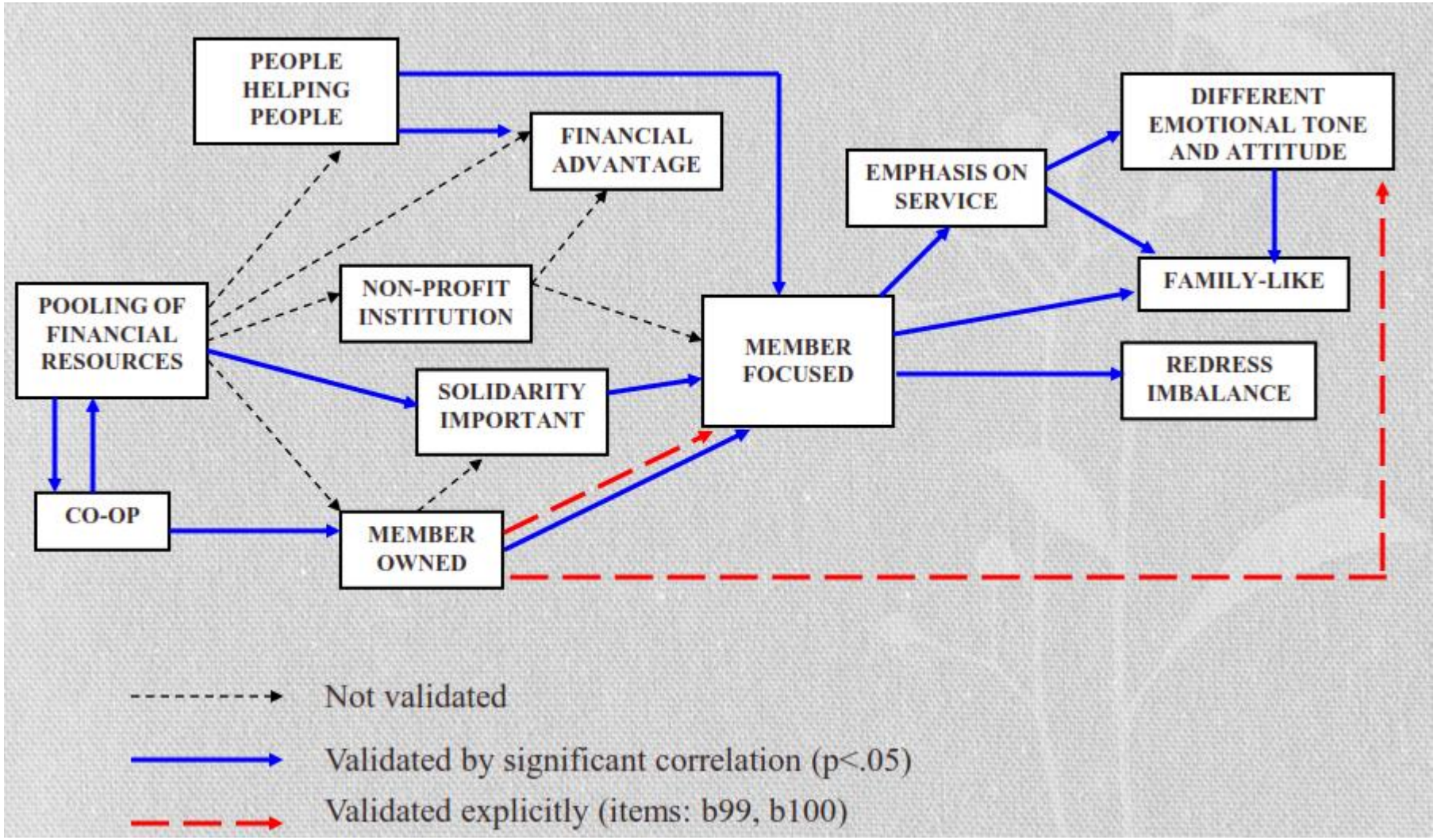
3) Hypothesis testing *(cont'd)*

B) Conformation of respondents' knowledge, principles, preferences with hypothesized cultural models

- Construct hypothetical cultural model of a group's perceptions & principles, and how they relate
  - Methodology borrowed from cognitive anthropology
  - E.g., Gatewood & Lowe 2006, 2008



Cultural model of a US credit union, derived from employee interviews. (Gatewood 2015)



Same cultural model, with linkages tested via CCT. Some beliefs were validated as culturally “correct,” while others were not held consensually (Gatewood 2015).

3) Hypothesis testing *(cont'd)*

B) Conformation of respondents' knowledge, principles, preferences with hypothesized cultural models

- Potential to use qualitative data obtained from Haida Gwaii herring values workshops and follow-up interviews

- What sort of model, though?
  - Herring's role in ecosystem & society (descriptive)
  - Current governance structure of fishery (descriptive)
  - Desired governance structure of fishery (prescriptive)

- And how to explicitly include held values?

Advice from philosophers, please?

Justifying governance system for natural resources

- Contractualism
- Contractarianism
- Something else?

Who is a legitimate stakeholder in an issue of social importance?

Equity- definitions?

- Rawls?
- Arrow?
- Sen?

Thanks!