Against the Odds: Small scale fishers' Climate Change Adaptation through a social ecological resilience lens

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Case Site

- Marilao-Meycauayan-Obando River System
- 52 kilometer long
- 130km^2
- 1.386M people
- Drains to Manila Bay
- “Dirty Thirty” Report of Blacksmith Institute (2007)

Profile of Fisheries

Global and National Level

- 5th highest fish producing country (2010); 3.06% contribution
- 10th in aquaculture produce (2010); 1.24% share

Provincial Level

- **Bulacan**, one of the top milkfish and tilapia producing (2002) provinces
- 15.75% of Region 3 fishery produce (2011); 40,790+ MT
- 41.78% milkfish; 20.86% shrimp; 3.98% tilapia
- **94.04%** are **brackishwater fishponds** out 12, 419.36 has of aquaculture farms
- **13,287 municipal fisherfolk** and 4 licensed commercial fisherfolks

Source: FAO & BFAR R3 (2013)

Methodology

- Key informant interviews and focus group discussions with fishers in MMORS
- 31 fishers (e.g. Barangay Fisheries and Aquatic Resources Management Council)
- Meycauayan, Marilao, Obando (Bulacan); Valenzuela (Metro Manila)
- August-September 2013
- Identified themes based on the literature
- Manual (paper-based) and Nvivo for the interviews
- VenSim for systems model

Resilience as component of adaptive capacity

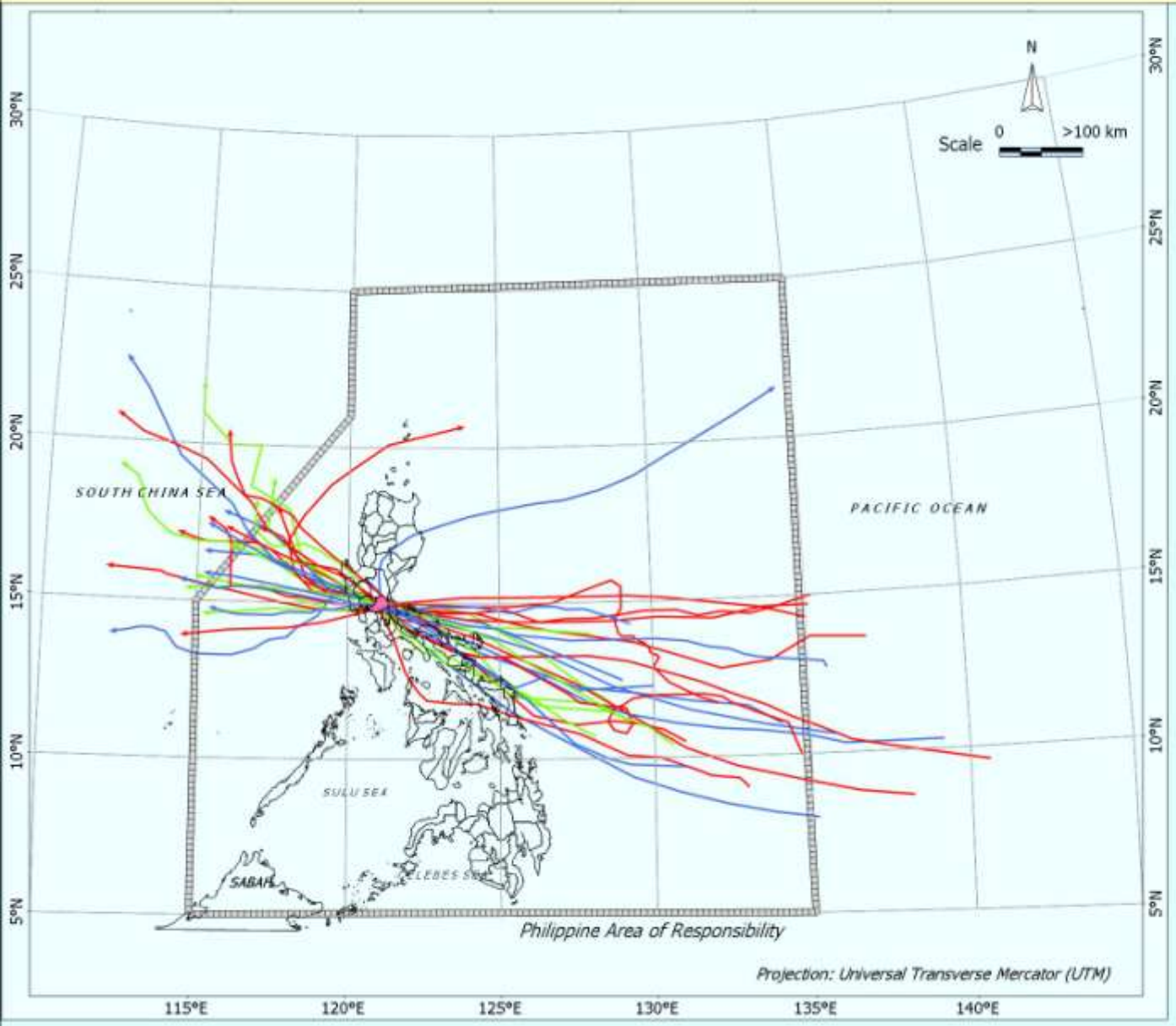
- **Capacity to absorb disturbance** and **re-organize** while undergoing **change** so as to still retain essentially the sa me function, structure, identity, and feedbacks (Walker et al., 2004)
- The key to sustainability is to **enhance the resilience** of social ecological system and **not optimizing isolated** components of a system (Walker and Salt, 2006)

For the MMORS small scale fishers:
Resilient fisheries =
sustained and abundant fishing in MMORS

Climate change adaptation strategies

Climate Change Effects	Impacts to Fisheries	Adaptation Strategies
Change in water temperature	Decrease oxygen level Increase toxicity of pollutants	Early harvest (e.g. based on observation – fishes surfacing ("gataw")
Extreme weather conditions		
Typhoons and tropical cyclones	Destruction of aquaculture facilities (e.g. earth dikes) Loss of fish stock Entry of invasive species Water quality changes	Repair dikes Increase height of earth dikes Use alternative barriers (e.g. nets) Sell to market; use pesticides during pond preparation Use of pumps and water exchange management
Drought	Increase salinity Decrease water level	Early harvest Increase depth of fish pond

Tracks of Tropical cyclones which crossed the Province of Bulacan from 1948 - 2011



Monthly Frequency of Tropical Cyclones

MONTH	NUMBER
JAN	0
FEB	0
MAR	0
APR	0
MAY	1
JUN	5
JUL	5
AUG	2
SEP	3
OCT	7
NOV	5
DEC	0
TOTAL	28

Legend:

Line symbol
- Tropical Depression
- Tropical Storm
- Typhoon
- Super Typhoon

Areas
- Bulacan Province

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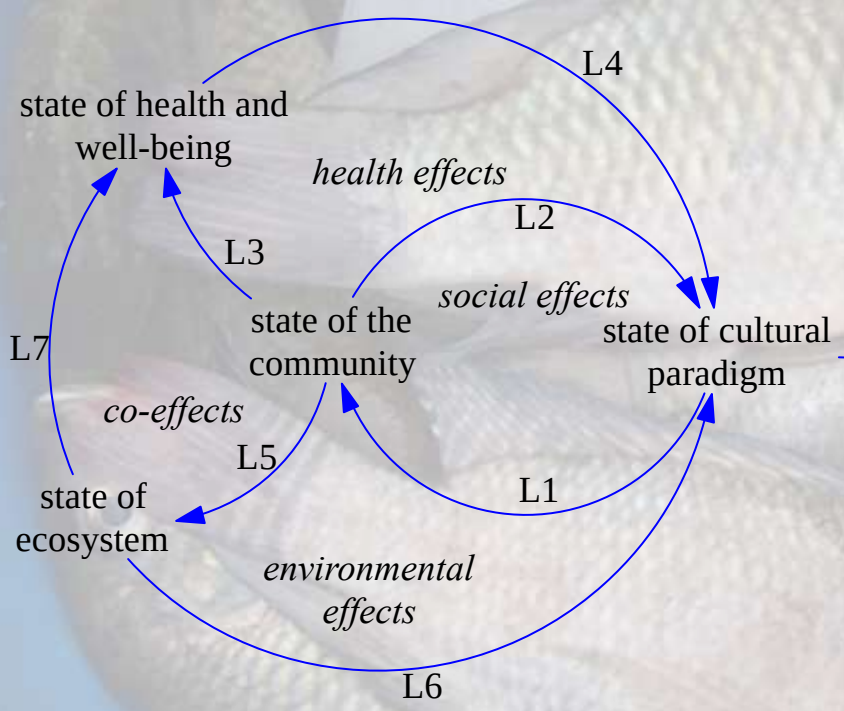
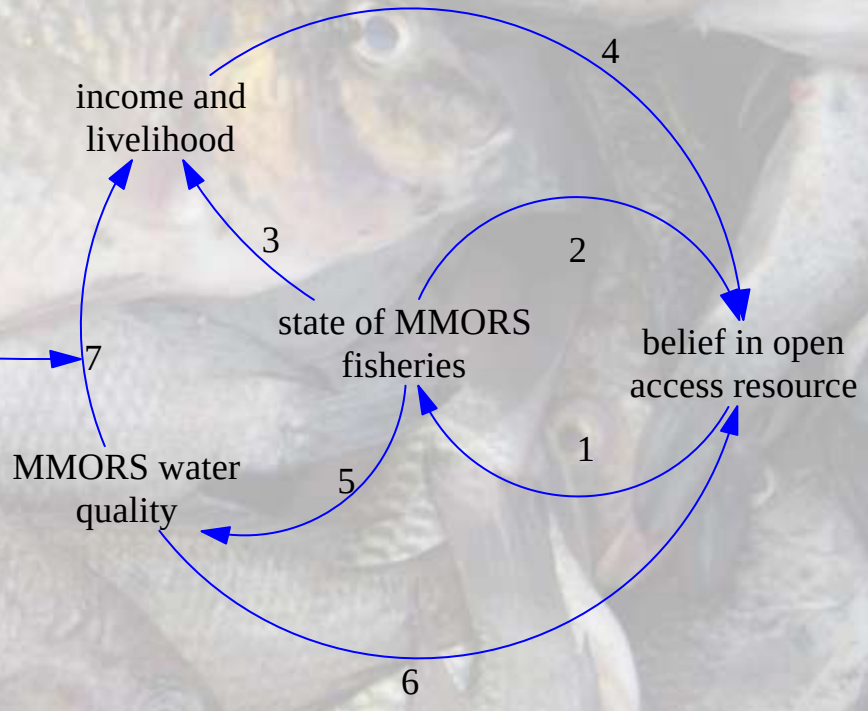
Dynamics of MMORS' small scale fishers' resilience using a systems dynamics template



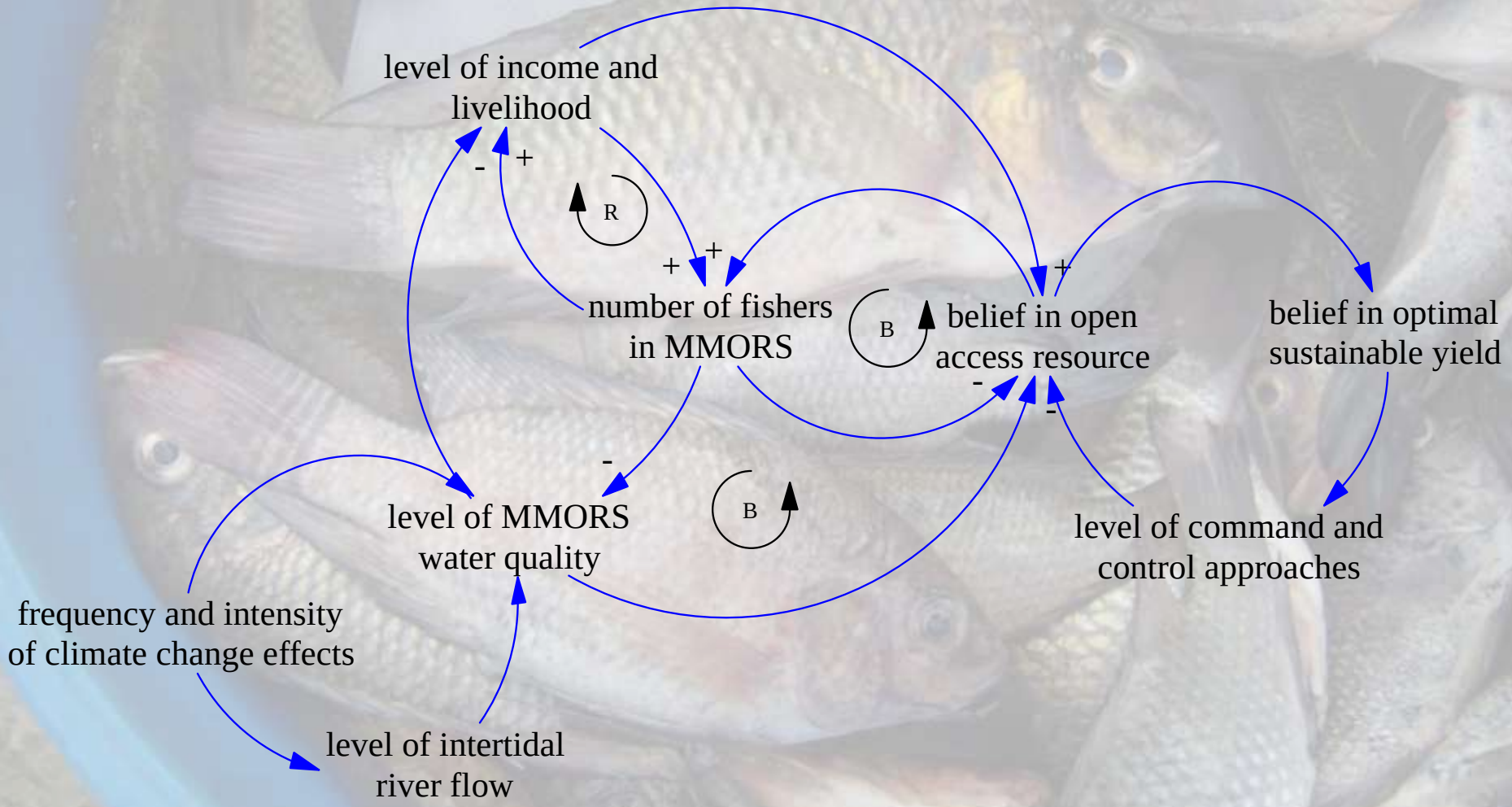
Cultural Adaptation Template
Newell & Dyball, 2014



MMORS Fisheries' **Problem Space**

MMORS Fisheries' System of Interest

Sustained Fishing in MMORS



Indicators of Social Resilience of MMORS' Fishers

Indicators of Social Resilience (Johnson et al., 2014)	Adaptation Strategies of MMORS Fishers
Survival	Fishing as a means of survival; no access to alternative livelihood or capital
Diversification	Some fishers have other sources of livelihood; switch from milkfish to tilapia
Getting by	Sell lesser value fishes; gleaning
Social identity	Fishing as a "way of life" passed on by earlier generation
Optimism	Fishing is a "gamble"; still hopeful of fisheries in the area

Indicators of Social Resilience of MMORS' Fishers

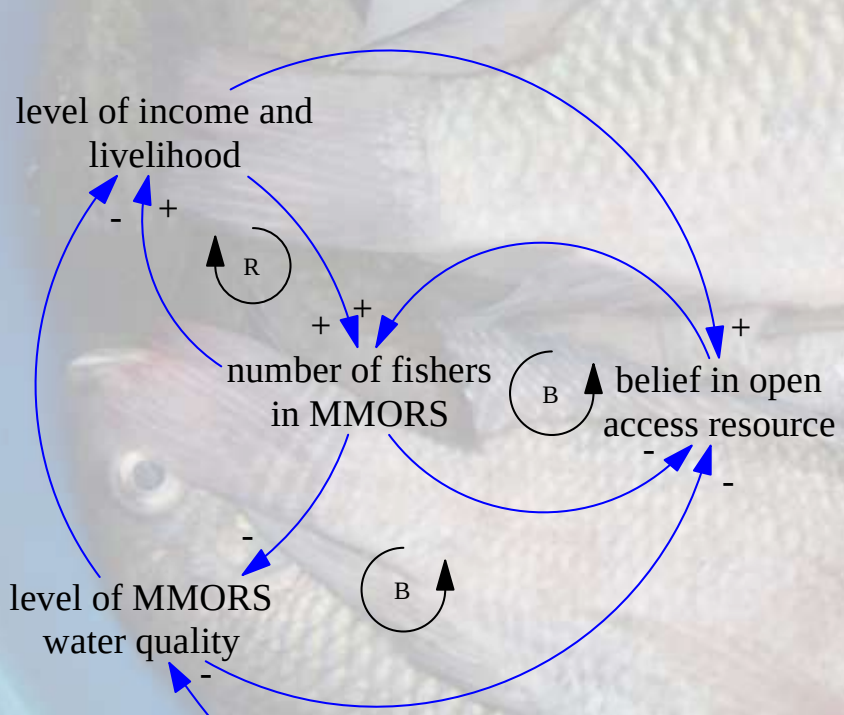
Indicators of Social Resilience (Marshall and Marshall, 2007)	Adaptation Strategies of MMORS Fishers
Perception of risk associated with change	Used to fishing and passed on from generations
perception of ability to plan, learn and organize	Want to learn technologies to help improve fish yield and access to financial resources
Perception of the ability to cope	Those with capital, technology, and know-how continue on; they invest on equipment, improve their fishponds
Level of interest to change	Social identity plays a part; Availability of other opportunities in the area

Categories of adaptation strategies of fishers in MMORS

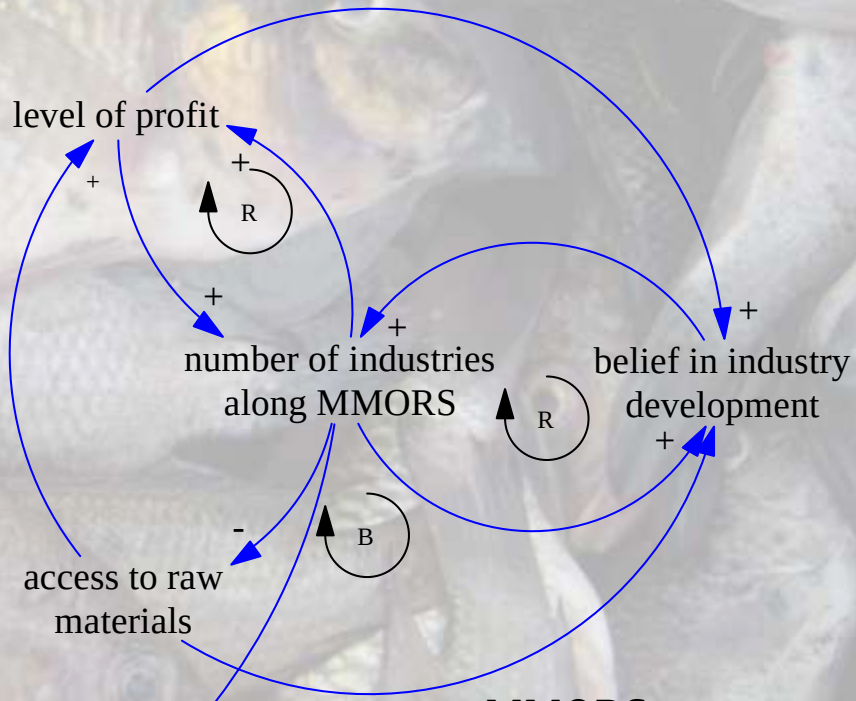
- Technological
- Cultural and social learning
- Economic
- Institutional

Distinct mental models

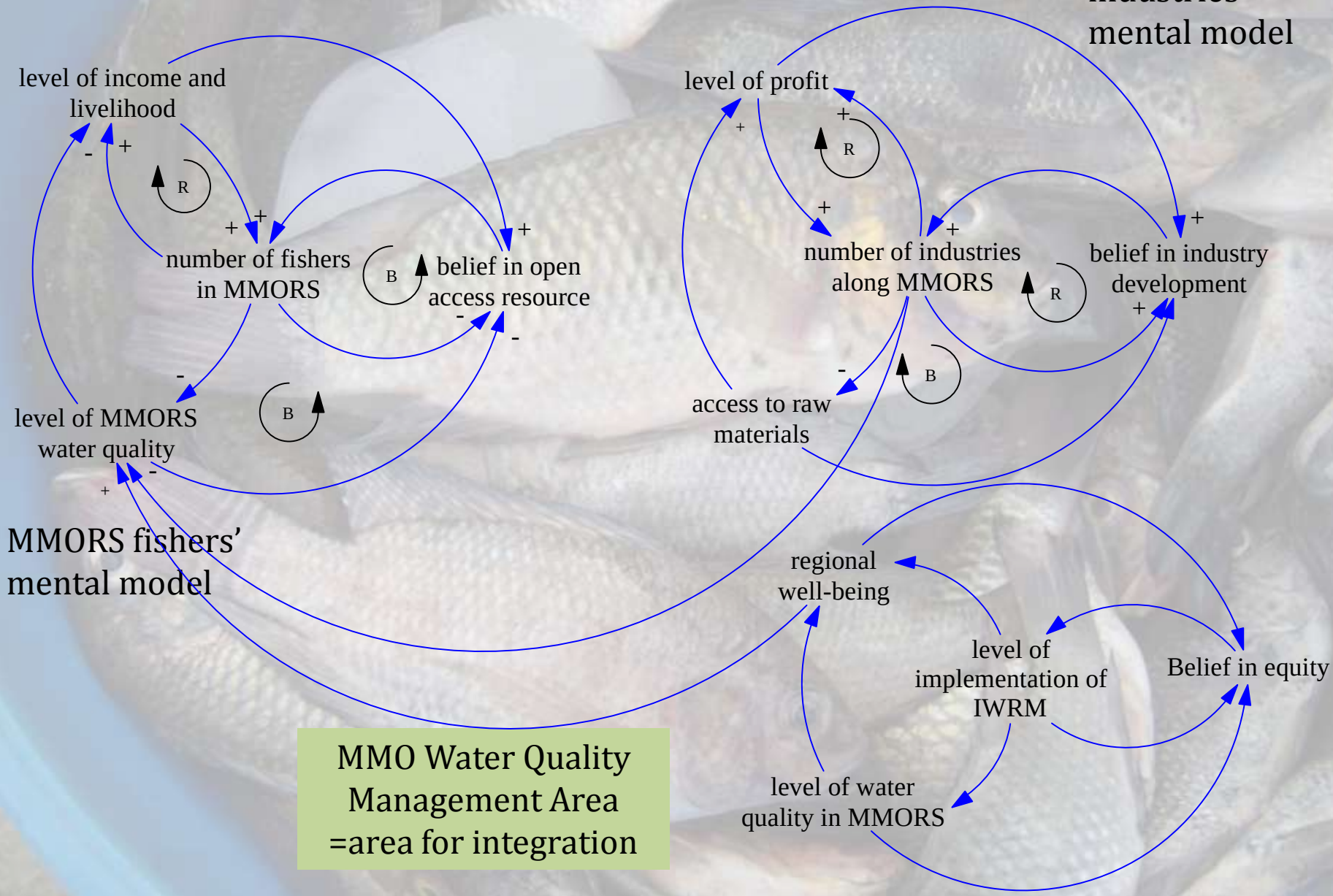
Need to integrate…



MMORS fishers' mental model



MMORS industries' mental model


MMORS industries' mental model
level of income and livelihood
number of fishers in MMORS
belief in open access resource
level of MMORS water quality
MMORS fishers' mental model
level of profit
number of industries along MMORS
belief in industry development
access to raw materials
regional well-being
level of implementation of IWRM
Belief in equity
level of water quality in MMORS
MMO Water Quality Management Area =area for integration

Conclusion

- Social ecological resilience as component of adaptive capacity.
- Climate change affects other system factors which could serve as barriers or drivers to resilience.
- Cultural adaptation templates based on systems dynamics approach could be used to frame and understand the dynamics of climate change adaptation.
- The integrated resource water management council (e.g. WQMA) could be a venue for shared learning and integrated planning and management.

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