



An Examination of the Conditions and Considerations for the Sustainability of the Atlantic Groundfisheries (emphasis on cod)

Presentation to the
FRCC Consultations April 19th 2010, Port Aux Basques

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&
Barbara Neis, University Research Professor



We are ...

A 5-year program of innovative, interdisciplinary, community-university research and knowledge mobilization:

- Centered at the Bonne Bay Marine Station in Norris Point.

Involving -

- Researchers from the social and natural sciences and fine arts at Memorial University, Sir Wilfred Grenfell College and elsewhere;
- Numerous stakeholders and community organizations on Newfoundland's west coast.



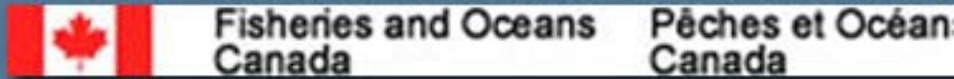
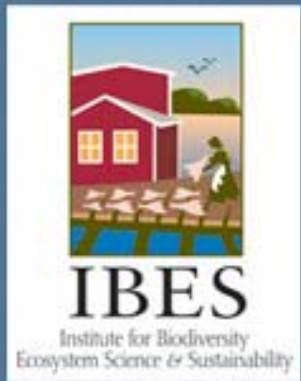


Some of our partners...

1. Red Ochre Regional Board Inc.
2. Fish Food and Allied Workers Union (FFAW)
3. Department of Fisheries and Oceans, Mont Joli, Quebec
4. Department of Fisheries and Oceans, Oceans Branch, Corner Brook
5. Integrated Coastal Zonal Management Board (ICZM)
6. Conservation Corps of Newfoundland and Labrador
7. Intervale Associates

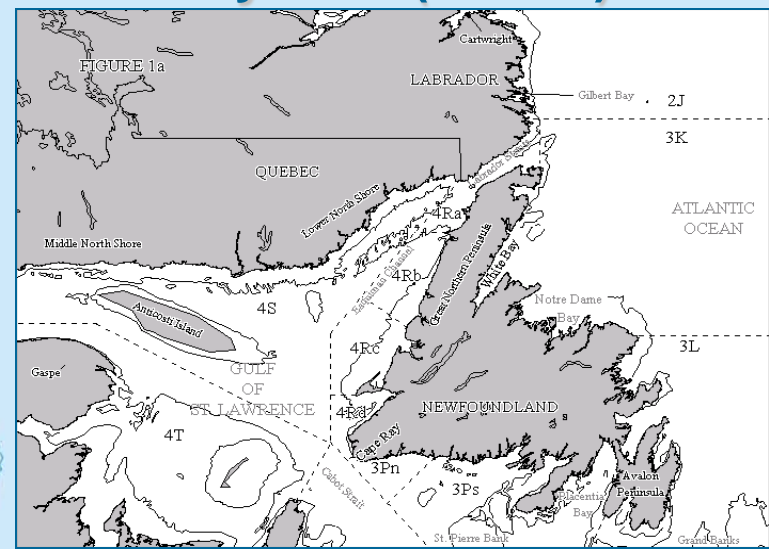


Major Funders





Study Area (4R3Pn)



Murray et al. 2008: Human Ecology



Overall Project Objectives

- Work with communities and organizations along Newfoundland's west coast to create knowledge and programs essential for recovery of fish stocks, fishery communities and the larger region.
- Train researchers in collaborative, community-based research approaches and areas relevant to Newfoundland's west coast.



Groundfishery-related research components

1. Benthic habitat – Deep sea corals
 - Colpron, Edinger and Neis (FFAW partner: J. Spingle, M. Ryan)

2. Juvenile cod habitat and cod migration studies using DST tags
 - Wroblewski, Schneider, Le Bris et al. (DFO Partner: A. Frechette; FFAW Partner: J. Spingle, M. Way)

3. Potential new initiative: Cod reproductive value
 - Schneider, Neis (Intervale Associates Partner: Kathleen Blanchard)

4. Governance Challenges - Pre- and post-collapse cod chain analysis
 - Khan, Chuenpagdee and Neis (DFO Partner: C. Mullins)



1. Deep-sea corals in the N. Gulf of St. Lawrence

Emile Colpron, Evan Edinger and Barb Neis (In Press)

Objectives

- Identify coral species found in the Northern Gulf & map their distribution.

Background

- Recent studies have discussed the potential ecological importance of deep-sea corals for fish (Husebø et al. 2002, Krieger & Wing 2002, Auster 2005, Auster 2007, Edinger et al. 2007b)
- Corals are vulnerable to damage from commercial fishing (Watling & Norse 1998, Edinger et al. 2007a, Fuller et al. 2008).
- Little is known about the types of corals found in the Northern Gulf of St. Lawrence or about their distribution



Deep Sea Corals cont...

Methods

- Comparison of coral observations in:
 - DFO groundfish survey records
 - fisheries observer records
 - transcripts and maps from interviews with 28 west coast Newfoundland fishermen documenting corals observed in their gear

Findings

All 3 data sources document the presence of nephtheid soft corals. Sea pens documented in the deep channels (Anticosti and Esquiman) in DFO trawl surveys and interviews

Large Gorgonians (*Primnoa resedaeformis*, *Keratoisis ornata* and *Acanthogorgia armata*) only documented in fisher interviews.



2. The habitat of age zero (0) -group juvenile Atlantic cod (*Gadus morhua*) in Bonne Bay



J. Bruce, J. Currie, A. Le Bris, D. Methven, D. Schneider
and J. Wroblewski
Department of Biology
Memorial University of Newfoundland (MUN)



0-Group Cod Habitat

- The year class size of a cod stock is set early in life.
- It depends on survival of cod larvae in the plankton and on survival of young cod after settlement.
- Survival of young cod after settlement depends on access to food and shelter.
- The habitat of 0-group cod along western Newfoundland has not been previously scientifically documented.
 - DFO catches older, larger juvenile cod in their bottom trawl surveys in the Gulf



Methods

- Data collected each June, 2002 – 2009 during the fish ecology field course taught at the Bonne Bay Marine Station
- All fish identified and measured for standard length
- Over 13, 000 fish captured and released

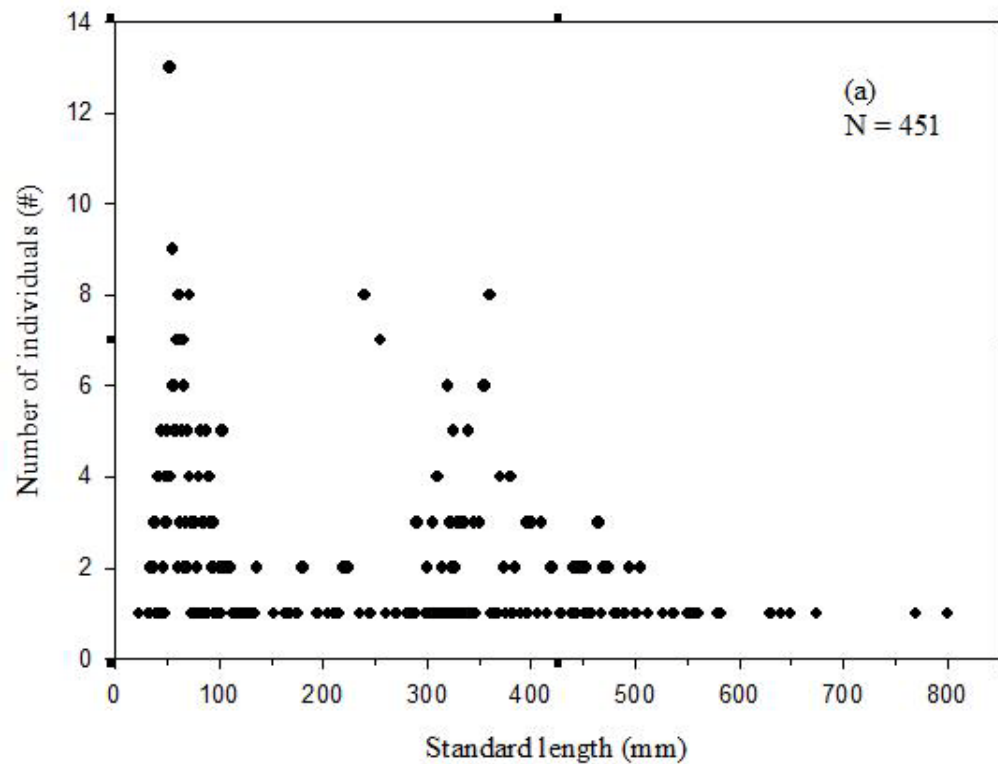
General findings

- Bonne Bay is a nursery ground for fish species that support commercial fisheries and recreational/food fisheries





Size distribution of Atlantic cod (*Gadus morhua*) collected in Bonne Bay 2002-2009



- 0-group present
- Ages 1 & 2 nearly absent
- Ages 3, 4 & 5+ present





Study objective:

To determine whether there is significant variation in 0-group cod abundance among sample sites in Bonne Bay.

Hypothesis:

0-group Atlantic cod are associated with any substrate that provides shelter, not just eel grass habitat.

Methods

Statistical analysis of beach seine Atlantic cod landings in a range of Bonne Bay habitats





Statistical analysis

- Does variation among sites depend on year?
- Does the number of 0-group cod depend on site?
- Does the number of 0-group cod depend on year?

N = number of 0-group juvenile cod per beach seine tow

S = site

Y = year

SY = interaction term

E = residual error

Method: Generalized Linear Model

$$N = \beta_0 + \beta_S S + \beta_Y Y + \beta_{SY} SY + E$$



Interpretation of statistical analysis and overall findings

- The effect of site on 0-group juvenile cod abundance is insignificant.
- The effect of year on abundance is insignificant.
 - No trend in the variation in abundance of 0-group juvenile cod in Bonne Bay over the period 2002-2009.

Thus ...

- 0-group cod occupy a range of habitats in Bonne Bay.
 - Any habitat offering sufficient structure (not only eelgrass) may be inhabited by juvenile cod



Northern Gulf Atlantic cod migratory behavior inferred from Data Storage Tags

Arnault Le Bris (Dept. of Biology, MUN), Alain Fréchet (DFO, Mont-Joli),
Joe Wroblewski (Ocean Sciences Centre, MUN)

FFAW partners: Jason Spingle, Monty Way





- Knowledge of population structure is important for efficient management
- Bay cod stocks may be important in rebuilding the Gulf cod fishery
- Variability in vertical distribution may induce bias in abundance estimations

Objectives:

- Investigate migratory diversity & identify seasonal habitats (residency, offshore vs. inshore, depth, temperature), assess fish availability to July-sentinel survey and August DFO survey

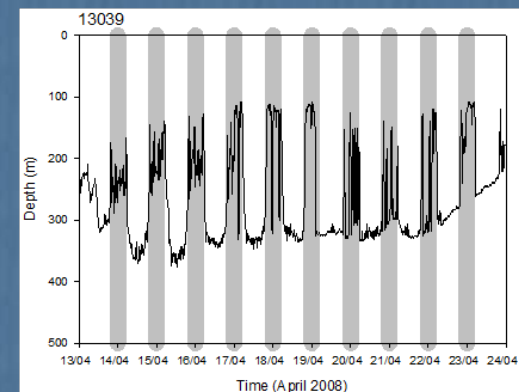
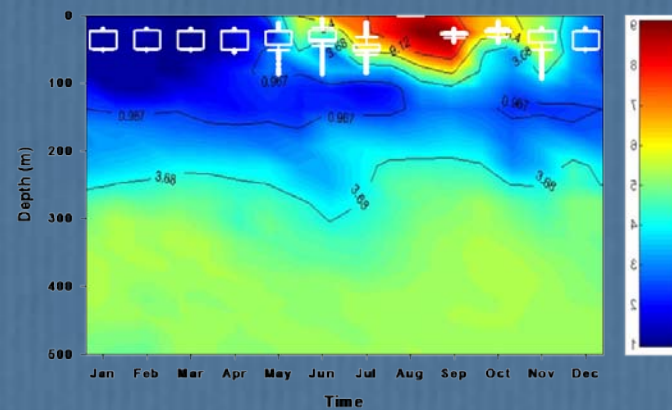
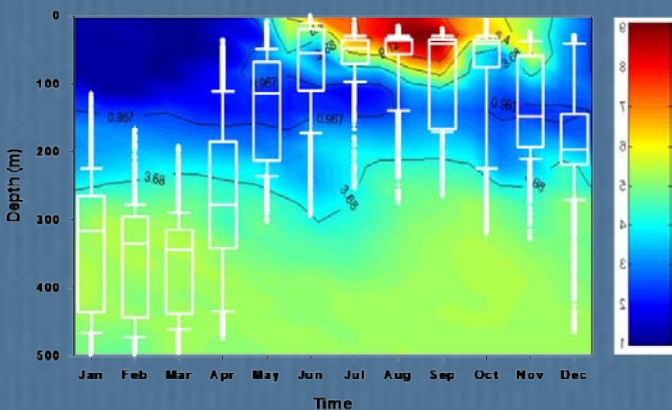
Methods:

- Data Storage Tag = electronic device surgically implanted in cod belly that records time, depth and temperature (242 tags placed to date, more expected this year).
 - Geolocation method matches data from DSTs and data from hydrodynamic models to track fish migration
 - Analyses of depth and temperature profiles to characterize seasonal habitats (overwintering, spawning, and feeding grounds)
 - Analyses of diurnal vertical migration and depth distribution during survey periods



Preliminary results:

- 9 DSTs returned by fishermen to DFO to date
- Two types of migratory behaviours (different overwintering areas):
 - i) 7 fish: overwintered in deep and warm (5-6°C) waters (water characteristics in the Laurentian Channel)
 - ii) 2 fish: overwintered in shallow (<50m) and cold (<0°C) waters (could be inshore residents along the NFLD West Coast, need to be confirmed by geolocation results)
- Increase of swimming activity in the Spring associated with diurnal vertical migration





3. Rebuilding and Cod Reproductive Value*: Should we be doing more to protect large, fecund cod?

Atlantic Cod: All of us can help!

Until the 1960s, the abundance of Atlantic Cod in Newfoundland and Labrador waters was the largest in the world. Today people are working to bring severely depleted cod stocks back to their once bountiful levels.



5 ft. 10 in. Man
3 ft. 2 in. Child

1 ft. 10 in. (.55 metre), age 6, 1 million eggs*

3 ft. 8 in. (1.12 metre), age 16, 25 million eggs*

4 ft. 1 in. (1.25 metre), age 20, 50 million eggs*

Large cod are vital to recovery. A female cod that lives out her productive life span (about 20 years) will have produced 50 million eggs! At age 16 she is only half way there.

What you can do: Support fish harvesters who promote stewardship initiatives and recognize the importance of protecting large fish. In the recreational groundfish fishery, be content with smaller fish. Don't highgrade. Imagine the return of the big ones!

What you can do: Take care of the nurseries. Prevent damage to eelgrass and kelp. Reduce pollution and run-off, discharge of waste, or any activity that makes the water murky.

Eelgrass and kelp beds in coastal waters 6 - 30 ft. deep are nurseries for juvenile cod. They provide protection from predators and abundant food to help young cod grow fast.

Fishing Communities: Our Heritage. Our Future.

Fish harvesters and fisheries scientists are integrating knowledge from harvesters with scientific research to learn more about cod behaviour and migration. A cod tagged in September 2007 was recaptured 331 days later by the same harvester.

What you can do: Learn more about cod and the world's oceans. Ask a harvester and plant worker about their work. Talk with family and friends about the importance of healthy fisheries to coastal communities.

Contributors: David Schneider, with John Bratley, Alain Frechet, Robert Gregory, Jeffrey Hutchings, David Methven, George Rose, Jason Spingle, Joseph Wroblewski, and DFO staff. Egg numbers from a thesis by Cassandra Rideout, based on DFO data from George Lily. Illustration: Cynthia Colosimo. Photos: Kathleen Blanchard, Candace Cochrane, David Côté, Robert Gregory, Pierre LeBlanc, Anne Reich, and Morley Way.

Placemat by:  With support from:      

What do you think?
Send us an email: info@intervale.ca

*Rideout 2007 (NSERC-funded)



Cod reproductive value cont....

- Larger, older cod are more fecund, have larger eggs which have a greater chance of survival and are more successful spawners
- Commercial and recreational fisheries tend to disproportionately remove larger fish
- Analysis of reproductive value of cod stocks (probability of surviving from age 0 to age x and average number of offspring produced by an individual of age x) for northern cod (Rideout 2007) 1983-2003 to explore changes in the capacity of the cod stock to reproduce itself pre and post collapse
- Found that reproductive value (egg numbers) was fairly stable from 1983-1990, then collapsed as most older cod were removed, increased in the 1990s, then a secondary collapse after 2001
- What kinds of policies would protect large, older cod from interception?
- Would they survive if released in recreational/cod fisheries?



4. An analysis of Northern Gulf cod fish production chain: Pre- and post-collapse

A. Khan (Dept. of Geography), R. Chuenpagdee (Dept. of Geography), and B. Neis (Dept. of Sociology)

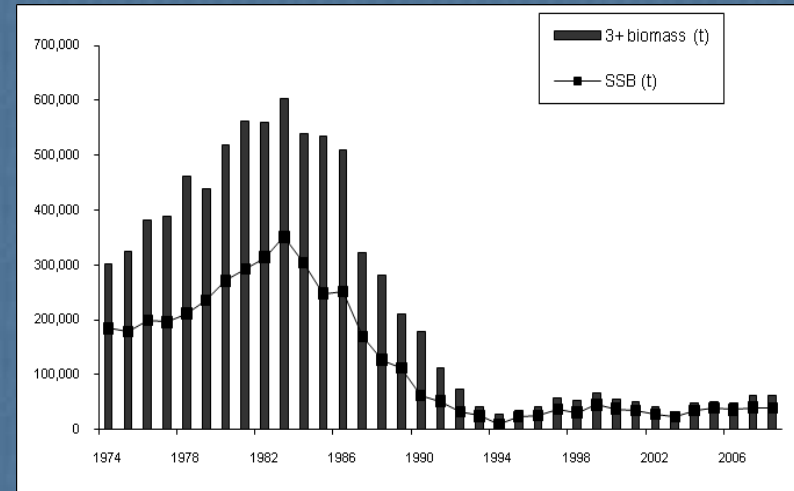
Key research question:

- How have changes in marine ecosystems, socioeconomics and fisheries policies affected the rebuilding of Northern Gulf Cod stocks and related fisheries?

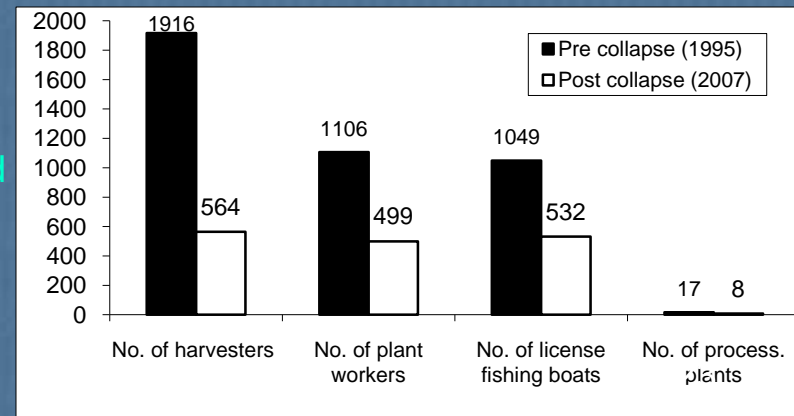


Context

- N. Gulf cod fisheries collapsed in early 1990s
- Moratoria & fisheries restructuring
- Socioeconomic impacts and job losses*
- New and emerging policy changes
- SARA policy process started in 2004
- Proposed Recovery Strategy in 2005
- Industry Renewal Discussion Paper 2006
- Some indications of a dysfunctional recovery & rebuilding process
 - Absence of a recovery plan, implementation strategy & stock rebuilding targets
 - Neglect of markets, livelihood and intergenerational and community concerns in rebuilding strategy
 - Both are essential for long-term sustainability



DFO (2009) Stock assessment



* Great North. Peninsula Fisheries Taskforce Report 2006

*Ommer & Team, 2007: Coast Under Stress Policy Reflections



Conceptual approach

Fish chain approach (Bavinck et al. 2005; Kooiman et al. 2005)

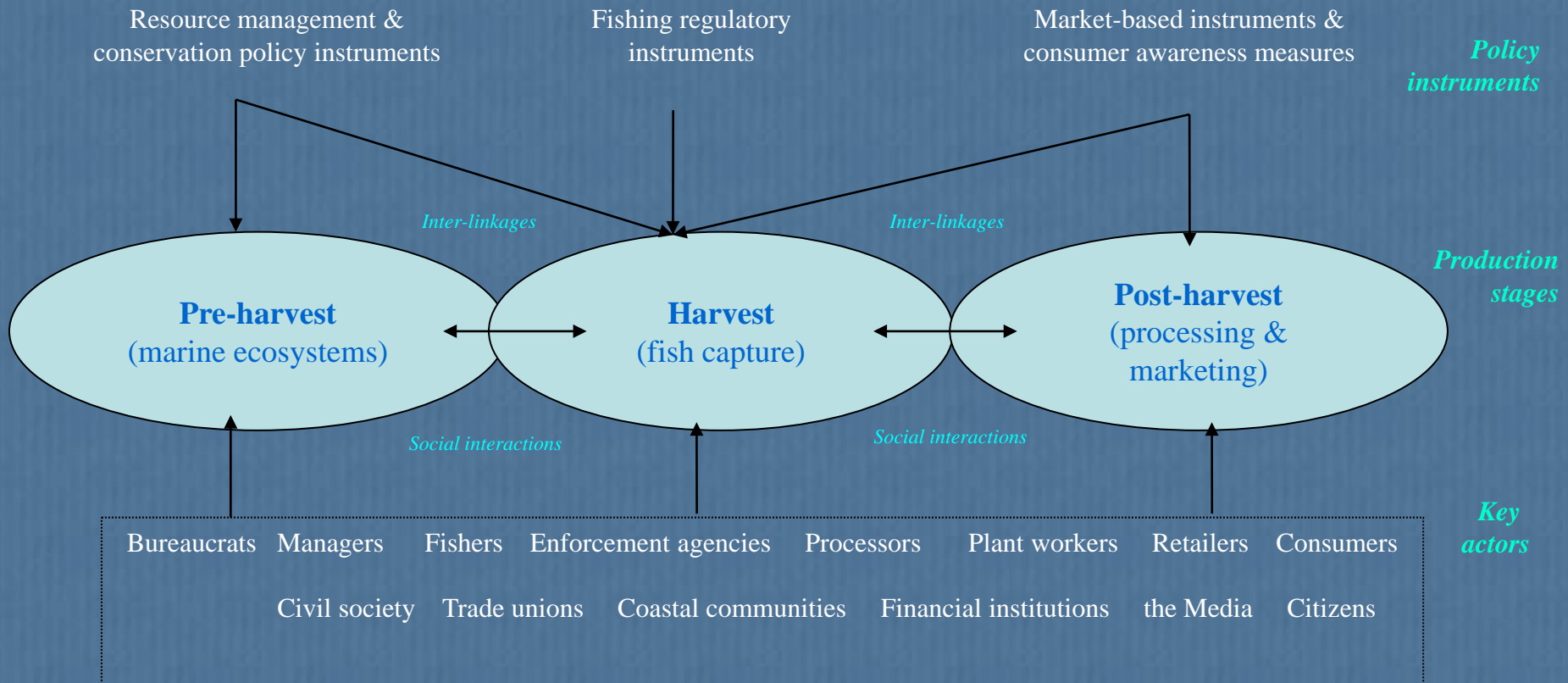


Pre- and post-collapse fish chain comparison

- To identify ecological constraints on cod rebuilding and fishery sustainability
- Document policy changes & institutional arrangements and their consequences for rebuilding and longer term social and economic viability



The fish chain and its interactions





Methodological Approaches

1. Review and synthesis of fisheries collapse and rebuilding (Khan and Neis, 2009)
 - Socioeconomic and sociopolitical factors greatest barrier to rebuilding
2. Assessment of recovery criteria along the fish chain (Khan and Chuenpagdee, 2009)
 - Conservation science, socioeconomics & institutional analysis
3. Preliminary cod chain analysis pre- and post-collapse : primary and secondary document analysis (Khan 2009)
 - Ecological constraints, market drivers, policy changes and impacts, network management concerns, spatial governance challenges & policy scenarios
4. Key informant interviews along the fish chain.



Thematic questions along the fish chain

1. Pre-harvest

- Marine ecosystem status and trends
- Recovery, rebuilding and policy initiatives
- Policy measures in relation to stock health, fishing regulations & conservation goals

2. Harvest

- Interaction between fleets, allocation and landings, crew size and economic returns
- Values and principles for conservation, compliance and stewardship

3. Post-harvest

- Target species, processing requirements, standards, value addition strategies, etc
- Processing plants and community viability and alternative livelihoods
- Markets (local, regional or international) and implications for recovery

4. Governing interactions

- Key stakeholders and organizational structure of the supply chains
- Stakeholder interactions, alliances, unions and approaches for decision-making
- Spatial governance concerns, institutional responses and outcomes for recovery



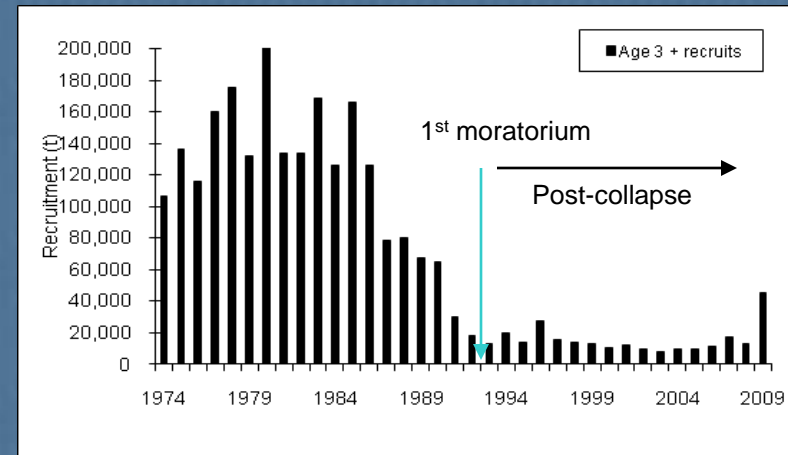


Preliminary findings on cod fish chains: based on FRCC questionnaire

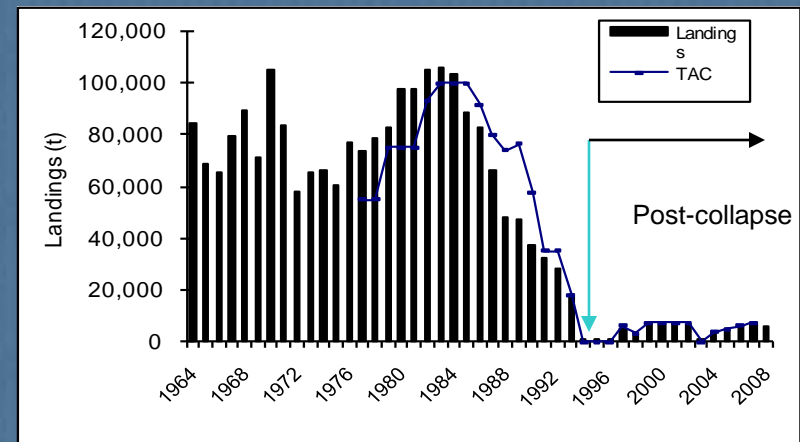


Resource sustainability

- Minimum viable population concept*: Stocks below conservation limit reference points- high mortality (natural and fishing mortality) and low recruitment (DFO, 2009)
- Low cod landings & poor resource base**
- Knowledge gaps in terms of habitats, & stock migration patterns*** (Murray et al. 2008, etc)
- Harvesters' collaboration key in data gathering (CPUE), sentinel fishery, stewardship initiatives, local knowledge & inputs into decision-making.



Trend in recruitment rates age 3+ (DFO, 2009)



Trend in landings and TAC (DFO, 2009)

* Shaffer, 1981: Bioscience

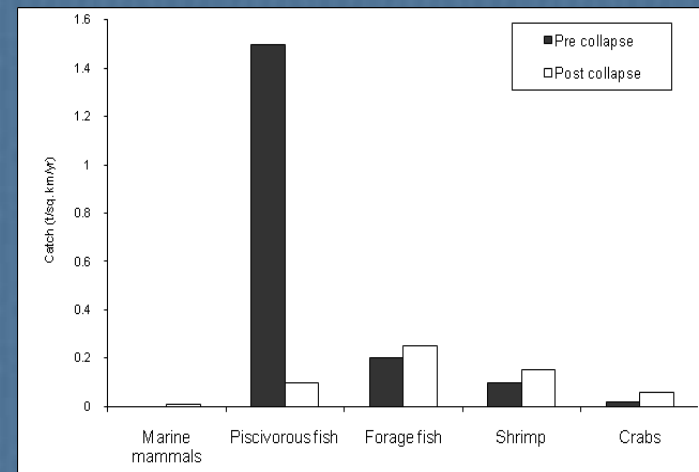
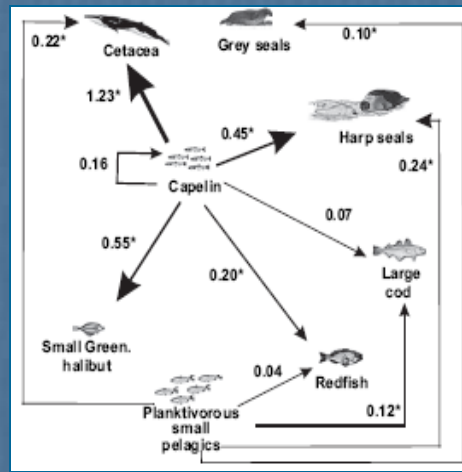
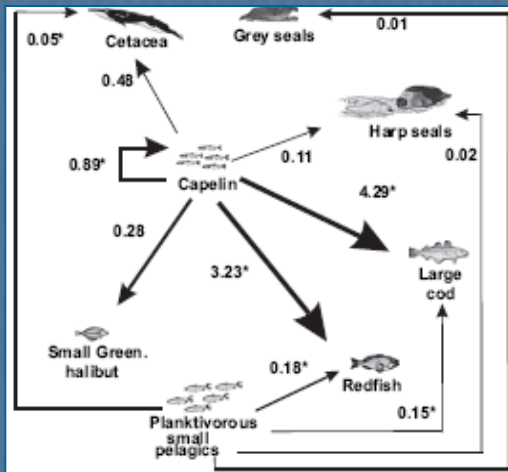
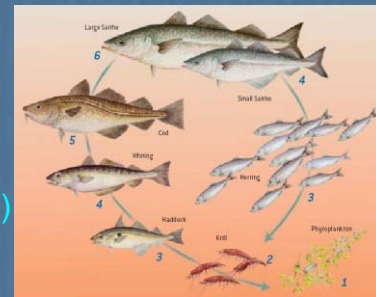
**Rice et al. 2003: ICES Proceedings

*** Methot et al. 2005: J NW Atlantic Fisheries Science



Ecosystems

- On-going by-catch, discard and multispecies concerns
 “Hook and line is the safest way to catch fish and it’s the best quality” fish harvester
- Vulnerable marine ecosystems as shown by decrease in Marine Trophic Index- an index of biodiversity (Morissette et al. 2009)
- Regime shifts from cod/redfish dominated groundfishery to invertebrates and pelagics (Savenkoff et al. 2007; Bundy et al. 2009)



Changes in capelin predation rates in N. Gulf (Savenkoff et al. 2007)

Changes in catch landings (Savenkoff et al. 2007) 30



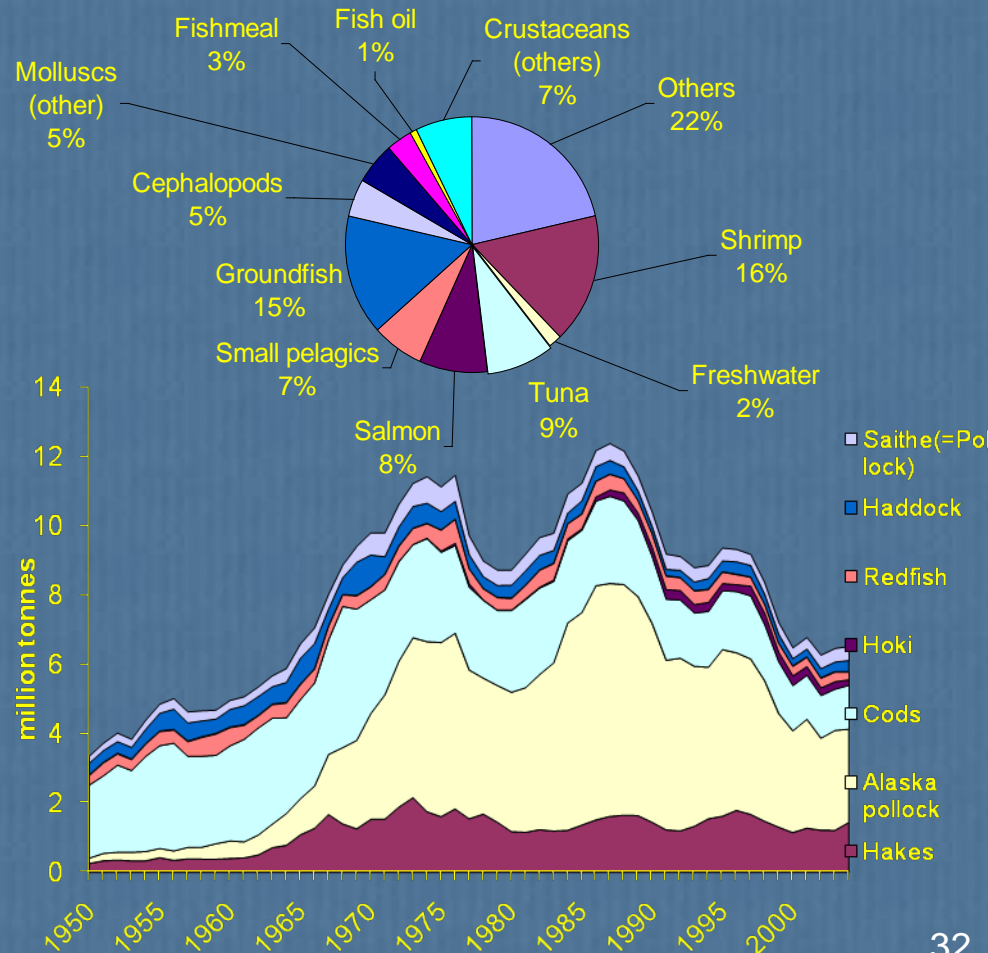
Management issues

- Precautionary Approach is important for harvest decision rules in meeting rebuilding targets (Caddy and Agnew, 2005; Wakeford et al. 2009)
- Co-management key for conservation harvest plans by the FFAW and the sentinel fishery program
- More collaboration and coordination needed across provincial and federal agencies as well as with the fishing industry
- Ongoing transparency, trust and equity concerns
- Gear type affects product type and price but seasonality and migration patterns also determine gear use and access to fish
- Harvester engagement is crucial for effective gear use policy and ecosystem-based management approaches



Economic viability I: Global overview

- Seafood is the most widely traded commodity worldwide (FAO stats)
- Competition between product types and with low cost producers
- Canadian seafood exports mostly to US, China, EU, Japan. Canadian seafood imports also high from both the US and Asian producers
- Intra- provincial and intra-national trade potentially important but under-studied and under-supported



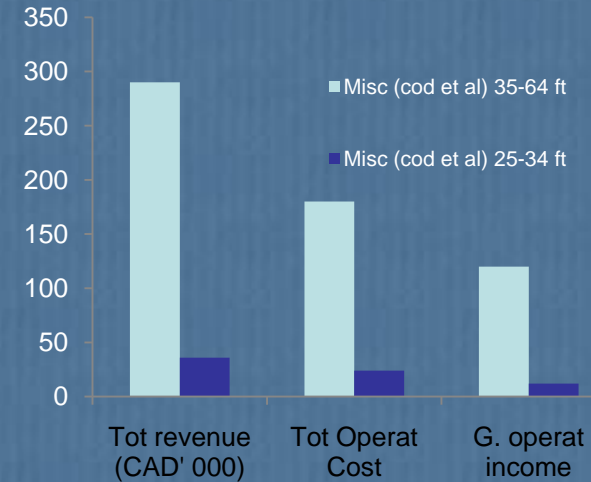
*Data courtesy of H. Josupeit (FAO)



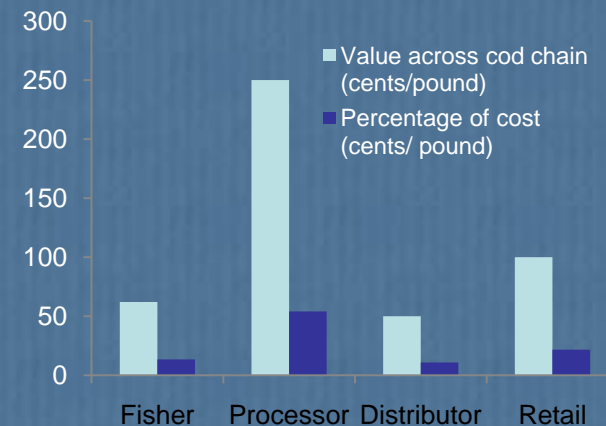
Economic viability II: Profitability

Profitability in the fishing sector { $P > TR > TC$ }

- **Total revenue (TR): price & quantity**
 - Key determinants: Supply of raw materials, price, seasonality, value addition & marketing
 - Insolvency and divestiture concerns (Kirby, 1982, Schrank, 2005)
 - EU tariffs (18%) and traceability concerns (NTBT)
 - EI cushions profit margin for skippers, income of crew creates dependency, regulations constrain marketing options, and further contribute to harvester dependency on processors (Schrank, 2005)



DFO, 2007: Cost and earnings survey

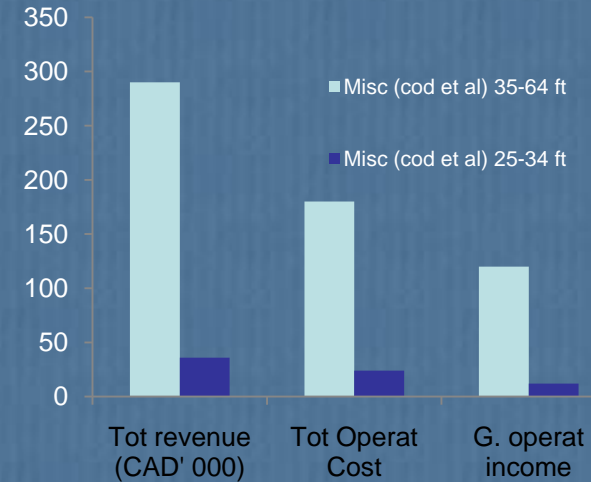




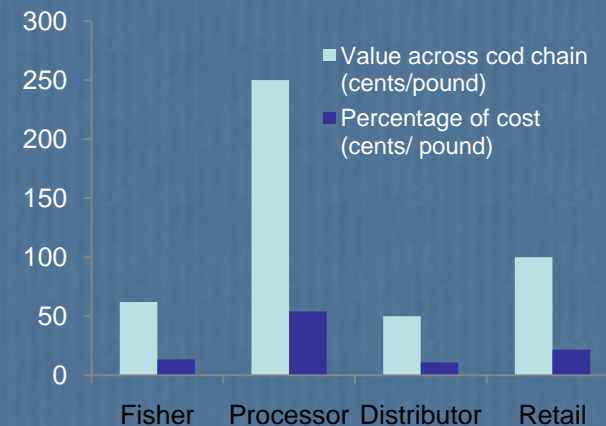
Economic viability II: Profitability

Profitability in the fishing sector { $P > TR > TC$ }

- **Total cost (TC): fixed & variable cost**
 - Labor and fuel accounts for 50% of variable fishing cost
 - No more loan board for fishers, some loan guarantees
 - Trust agreements and bonus payments prevalent*
 - Plant operation cost: fish 64%, labor 32%, materials 4%**
 - Exchange rates, interest rates, debt services, return on asset, total equity, etc, affect profit margins (see 1993 Income and Adjustment Task Force Reports)



DFO, 2007: Cost and earnings survey





Economic viability III: Markets (Khan, 2010a)

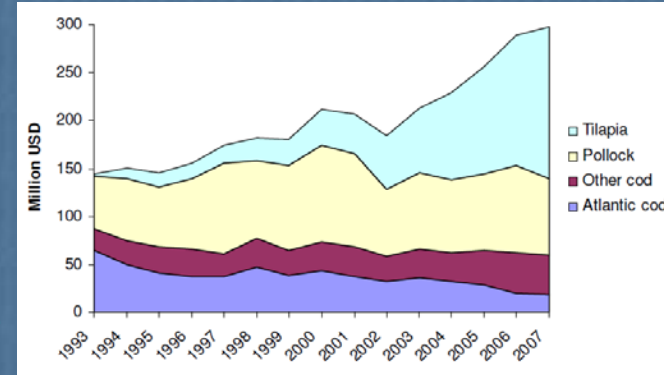
Change in spatial scale of operations

- Shorter operational range of the current cod fish chain
- Low cod landings raise food security concerns
- No major cod marketing plans, branding is an option
- Changes to high value target species & world markets



Product substitution and consumer behaviour

- Pollock and hoki replace block cod from NL
- Cod fillet & cod-by products current main products
- Legendary NL 'Bacalhau' (salt fish) processed in EU
- MSC certification of Pacific cod affects market share
- MSC certification for hook and line fishery in 3Pn?



US groundfish imports (Asche and Smith, 2010)

"..Markets change so many times, so the government should be flexible...." policy analyst

"Over-regulation, increasing fishing cost & low fish prices are my key concerns" fish harvester



Governance: power and equity concerns (Khan, 2010b)

Power to act is key for recovery and rebuilding

- Constitutional and legislative power for a public trust doctrine (see Turnipseed et al. 2009)
- Stakeholders work in networks and alliances for lobbying or bargaining power, as well as in seafood retail, distribution and brokerage (e.g. FFAW, ASP, SPNL)
- Collective action problems* and social dilemmas with implications for cooperation, collaboration and stewardship (e.g. disputes over TACs, fish price, closures, etc)
- Institutional mechanisms key for collective action and 'clumsy solutions'
- Knowledge is power (e.g. R&D), consumer buying power and citizen voting power.

Recovery for whom?

- Recovery is essential for fish stocks to replenish to target reference points
- Rebuilding on the other hand deals with the policy process during stock recovery transition, cost and benefits both in the short and long term, and addressing stakeholder concerns for buy-in, compliance and stewardship
- Rebuilding also deals with intergenerational concerns, re-training and adjustment programs, as well as distributional and procedural policy measures.



Moving forward...

1. Ecosystem approaches for monitoring and planning stock rebuilding
 - Take into account by-catch and use a multispecies approach; climate change, CIL?
2. Establish stronger institutional mechanisms for collective action* to promote partnership, cooperation and stewardship amongst stakeholders
3. Shift focus from stock to fishery rebuilding and an 'oceans to plate' lens
 - Are producer-driven policies of low-value, high volume production still existent in a world governed by buyer-driven fish chains and resource supply?
 - Are enhance marketing capacity, branding, ecolabel certification options?
4. Youth don't see a future in fisheries, don't know much about fisheries
 - Minimal youth, community and local government involvement in fisheries post 1992 – solutions? FFAW/CURRA Schools program; fish school lunch programs...?
5. Fish processing infrastructure – empty, under-utilized, marginalized within communities – alternatives? (Pierre LeBlanc-CURRA researcher)



Alternatives and options?

- Multi-scale, multi-sectoral approach: nested policies and synergy (IM)
 - Greater municipal involvement, REDBs, arrangements and policies to promote local level diversification within fisheries
 - GOSLIM (integrated management-IM approach), fisheries and tourism opportunities, rural planning, fisheries and culture, fisheries and schools, etc
- Regulatory changes that enhance the role of fisheries in local food security, tourism, heritage
- Strategies to protect and enhance incomes of harvesters and plant workers
 - enhance value addition and marketing, create a renewed and educated processing labour force, occupational pluralism, harvester cooperatives for direct marketing?
 - Price setting mechanism, value addition and marketing is a win-win - alternative models (Maine, Alaska, Norway, FPI model, etc)
- A fish trail celebration along the west coast (species, products, heritage)?



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Feedback welcome!

Thesis supervisory committee: Ratana Chuenpagdee, Barb Neis, Bob Hooper & Rashid Sumaila

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