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Salish Sea Ecosystem Conference

2016 Salish Sea Ecosystem Conference (Vancouver, BC)

Jan 1st, 12:00 AM - 12:00 AM

### Reducing Uncertainties in Managing in British Columbia Waters: Applying an Adaptive Management Mindset on the South, Central and North Coasts

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Olson, Erica; Murray, Carol; and Tamburello, Natascia, "Reducing Uncertainties in Managing in British Columbia Waters: Applying an Adaptive Management Mindset on the South, Central and North Coasts" (2016). *Salish Sea Ecosystem Conference*. 43.

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# Reducing Uncertainties in Managing British Columbia Waters:

Applying an Adaptive Management Mindset

Erica Olson Carol Murray Natascia Tamburello Marc Nelitz Alex Hall



Terrace Prince Rupert

Ketchikan

Smithers BRITISH Houston COLUMBIA

Hazelton

Kitimat

Prince George

Graham Island

Masset

Haida Gwaii

Kamloops

Kelowna

National Par

Large uncertainties due to:

- Limited data
- Imperfect understanding
- Complex interactions

Google

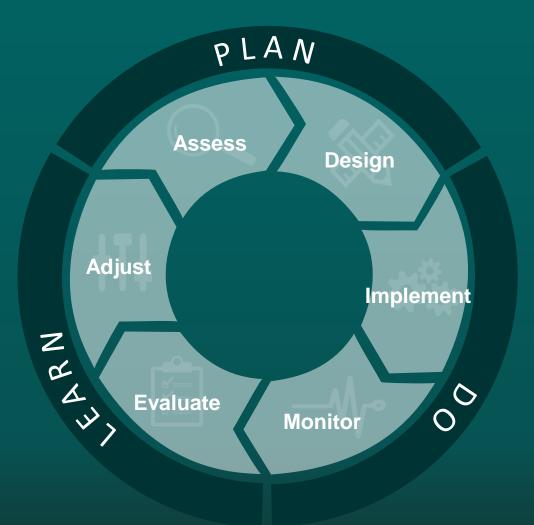
Vancouver Island

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# Adaptive Management (AM) Cycle



3

## People with an AM Mindset...

Embrace <u>uncertainty</u> and focus on those that have the most influence on <u>decision making</u>

Are clear about their fundamental management objectives Encourage diverse and <u>collaborative</u> <u>processes</u> for resolving uncertainties

> Commit to <u>monitoring,</u> <u>learning, and</u> <u>adjusting</u> their actions

Use '<u>systems thinking</u>' as a way to analyze complex social-ecological systems Adopt <u>scientifically rigorous</u> <u>approaches</u> for developing and testing hypoth<u>eses</u>

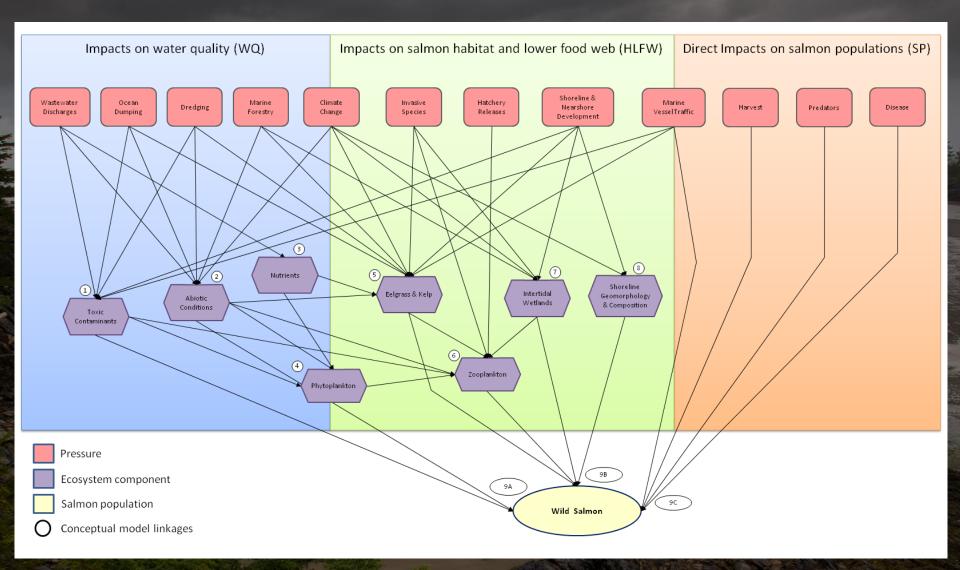
## Applied to the North Coast Skeena Estuary

## BC Cases: North Coast Skeena Estuary

Uncertainty & Decision Making Current status of habitat & How pressures may affect habitat

Clear Objectives Minimize impacts on salmon habitat Collaborative Processes Technical Advisory Committee

**'Systems Thinking'** Skeena estuary conceptual model



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Monitoring, Learning, & Adjusting Indicators and benchmarks Existing data

### **'Systems Thinking'** Skeena estuary conceptual model

Impact	Indicator	Indicator Type	Measurement Unit	Dataset	Benchmarks			Citation for	]
Category					Good	Fair	Poor	Benchmark	
WQ	Wastewater Discharge Sites	Ρ	# of discharge permits	BC MoE – Wastewater Discharges	Absent	t –	Present	n/a – (TAC consulted	
	Disposal at Sea Sites	Ρ	# of disposal at sea sites	EC – Disposal at Seat Sites	Absent	t -	Present	n/a - (TAC consulted)	
	Dredging Extent	Ρ	area dredged	data unavailable for this project or does not exist	No specific benchmarks			n/a	an and an
	Log Boom Sites	Ρ	# of log storage/handling permits	Tantalus Crown Tenures – Log Storage & Handling	Absent Present		n/a - (TAC consulted)	Col	
	Water Column Chemical Contaminants – Arsenic	EC	arsenic concentration (mg/L)	PR Harbour Water Quality Sampling	<0.0125 >0.0125		CCME 1996		
	Water Column Chemical Contaminants – Mercury	EC	mercury concentration (mg/L)	PR Harbour Water Quality Sampling	<0.0000	16	>0.000016	CCME 1996	
	Water Column Chemical Contaminants – Naphthalene	EC	naphthalene concentration (µg/L)	PR Harbour Water Quality Sampling	<0.0014 >		>0.0014	CCME 1996	
	Water Column Bacterial Contaminants – Enterococci	EC	enterococci concentration (CFU/100mL)	PR Harbour Water Quality Sampling	<4	4-11	>11	BC MOE 2001	
	Water Column Bacterial Contaminants – Fecal Coliform	EC	fecal coliform concentration (CFU/100mL)	PR Harbour Water Quality Sampling	<14	14-43	>43	BC MOE 2001	
	Sediment Chemical Contaminants	EC	concentration of key sediment contaminants	data unavailable for this project or does not exist	n/a		n/a	No.	
	Turbidity or Total Suspended Sediments (TSS)	EC	total suspended sediment concentration (mg/L)	PR Harbour Water Quality Sampling	<25	25-80	>80	DFO 2000	
	Dissolved Oxygen (DO)	EC	dissolved oxygen concentration (mg/L)	PR Harbour Water Quality Sampling	>5	2-5	<2	US EPA 2012	

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 DF0 2000
 US EPA 2012
 US EPA 2012
 Learning, & Adjusting
 Indicators and benchmarks Existing data

# Minimize impacts on salmon habitat

## 'Systems Thinking'

Skeena estuary conceptual model

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**'Systems Thinking'** Skeena estuary conceptual model **Scientifically Rigorous Approaches** 

Data quality assessment Monitoring recommendations

	Dataset	Relevance Score	Scientific Quality Score	
	Wastewater Discharges	***	***	
	Disposal at Sea Sites	***	***	S
	Log Storage & Handling	***	***	
Jncerta	PRH Water Quality Sampling	**	**	
<b>)ecisio</b>	Shoreline Development	**	***	
urrent	Marine Vessel Traffic	**	***	
low pre	Intertidal Wetlands	**	***	
abitat	BCMCA – Chlorophyll a	**	***	
abitat	BC Shorezone Bioband	**	***	
	Brstad CASI - Eelgrass	*	***	-
	Chatham Sound Study - Eelgrass	***	***	
lear	BCMCA - Eelgrass	***	***	-
a consideration	WWF - Eelgrass	**	***	E.
Objecti	PRH Foreshore Habitat Classification	**	***	
/linimiz	GeoBC - Kelp	**	***	
abitat	Zooplankton	*	**	
	Riparian Vegetation	**	***	
C. C.M.	Harbour Seal Haulouts	**	***	1

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Monitoring, Learning, & Adjusting Indicators and benchmarks Existing data

### **'Systems Thinking'** Skeena estuary conceptual model

Scientifically Rigorous Approaches Data quality assessment Monitoring recommendations

### Data Gaps

#### No data

Uncerta

Decisior

Current s

How pre

habitat

Clear

Objectiv

Minimize

habitat

- Dredging Extent
- Algal Bloom Number or Extent
   Invasive Species Distribution or Abundance
- Predatory Fish Abundance

Smolt growth

#### Unavailable data

- UVSediment Chemical Contaminants
- Hatchery Salmon AbundanceRecreational Harvest

#### High quality

- Wastewater Discharge SitesLog Boom Sites
- Shoreline & Nearshore Development Extent
- Commercial Harvest

#### Limitations

- Disposal at Sea Sites
- Turbidity / TSS, P, N, SST, DO
- Water Column Chemical Contaminants
- Chlorophyll a
- Intertidal Wetlands
- Intact Riparian Vegetation Extent
- Marine Vessel Traffic
- Native Eelgrass Extent
- Native Macroalgae Extent
- Zooplankton Density or Diversity
- Disease & Pathogen Prevalence
- Marine Mammal Distribution or Abundance
- Predatory Seabird Distribution or Abundance
- Adult Salmon Abundance
- Smolt Survival
- Smolt Density
- Smolt Residence Time

## tuary

### Collaborative Processes Technical Advisory Committee

## Monitoring, Learning, & Adjusting Indicators and benchmarks Existing data

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### **Scientifically Rigorous Approaches**

Data quality assessment Monitoring recommendations

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asper National Par

# AM mindset is broadly applicable

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# Take Away Messages

- AM mindset broadly applicable
- AM mindset different from other paradigms
  - Focus on uncertainties & decisions
  - Experimental design
- AM mindset is beneficial
  - Learning faster
  - Reducing uncertainties
  - Adapting to changing conditions



# Thank You!

## Erica Olson eolson@essa.com



www.skeenasalmonprogram.ca

**ESSA** 

## **Ten benefits**

Clarifying critical uncertainties

Strengthening relevance

and reporting Providing greater management certainty



Evaluating effectiveness of management actions

Reducing conflicts

Adjust

etenienz

NAAT

Adaptive Management

PLAN

Implement

Inappropriate context

ALL SITUATIONS

Situations benefiting from AM mindset

Identifying alternative management actions

Infeasible

Improving efficiency of monitoring Understanding cause-effect in complex systems

Hastening the learning loop

Empowering stakeholder and decision makers