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# Indicators of status and benchmarks for Conservation Units in Canada's Wild Salmon Policy

Carrie Holt, Research Scientist, DFO  
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## Overview

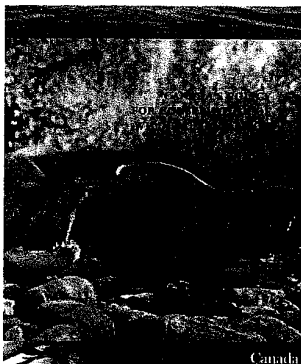
- 1) Wild Salmon Policy: Indicators of status, metrics, and benchmarks
- 2) Developing criteria to assess status
- 3) Monitoring frameworks

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## (1) The Wild Salmon Policy

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The goal is "to restore and maintain healthy and diverse salmon populations and their habitats for the benefit and enjoyment of the people of Canada in perpetuity."

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## (1) The Wild Salmon Policy

### Wild Salmon

Salmon are considered "wild" if they have spent their entire life cycle in the wild and originate from parents that were also produced by natural spawning and continuously lived in the wild.

Salmon that originate directly from hatcheries and managed spawning channels are not considered wild in this policy, and are called "enhanced" salmon.

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## (1) The Wild Salmon Policy

### Wild Salmon

This term is sometimes also applied to salmon that originate from other enhancement activities, such as habitat restoration and lake enrichment, since their rate of production has been augmented. However, the reproduction of these fish has not been altered, and therefore they are deemed "wild" in this policy.

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## (1) The Wild Salmon Policy

### Strategies

- 1) Standardized monitoring of wild salmon status
- 2) Assessment of habitat status
- 3) Inclusion of ecosystem values and monitoring
- 4) Integrated strategic planning
- 5) Annual program delivery
- 6) Performance review

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## (1) The Wild Salmon Policy

### Strategy 1

#### 1) Standardized monitoring of wild salmon status

- Identify Conservation Units, CUs
- Develop criteria to assess CUs and identify benchmarks to represent biological status
- Monitor and assess status of CUs

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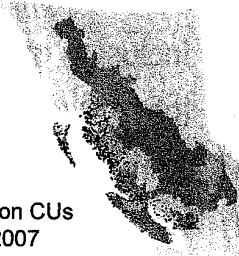
## (1) The Wild Salmon Policy

### Strategy 1

#### 1) Standardized monitoring of wild salmon status

- ✓ Identify Conservation Units, CUs

Odd-year pink salmon CUs  
Holtby and Ciruna 2007



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## (1) The Wild Salmon Policy

### Strategy 1

#### 1) Standardized monitoring of wild salmon status

- Identify Conservation Units, CUs
- Develop criteria to assess CUs and identify benchmarks to represent biological status
- Monitor and assess status of CUs

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## (2) Develop criteria to assess status

Abundance

Trends in  
abundance

Distribution

Fishing  
mortality

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### Abundance

Low abundance greater risks of extirpation due to depensatory mortality, environmental variation, genetic processes, ecological interactions, demographic stochasticity

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### Trends in abundance

Declines may warrant management attention despite abundances not at levels of concern

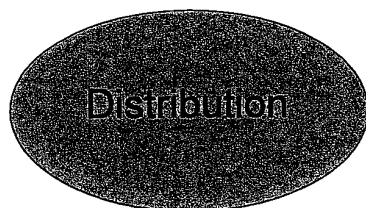
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## (2) Develop criteria to assess status



Distribution may be related to the diversity of habitats and life-history characteristics, and hence responses to changes in environmental conditions

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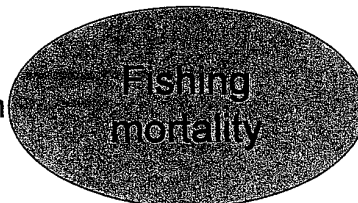


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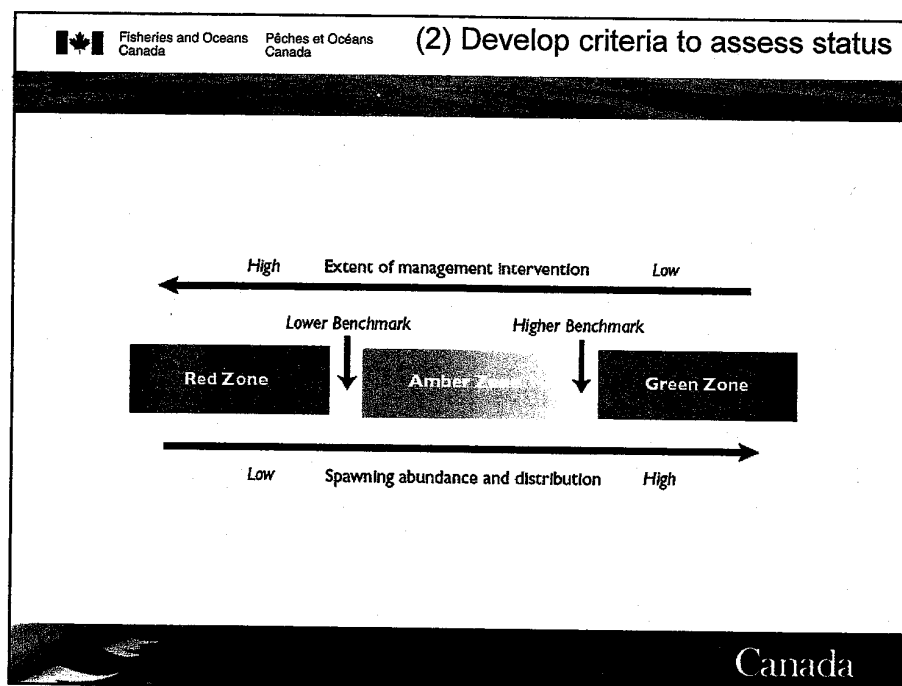
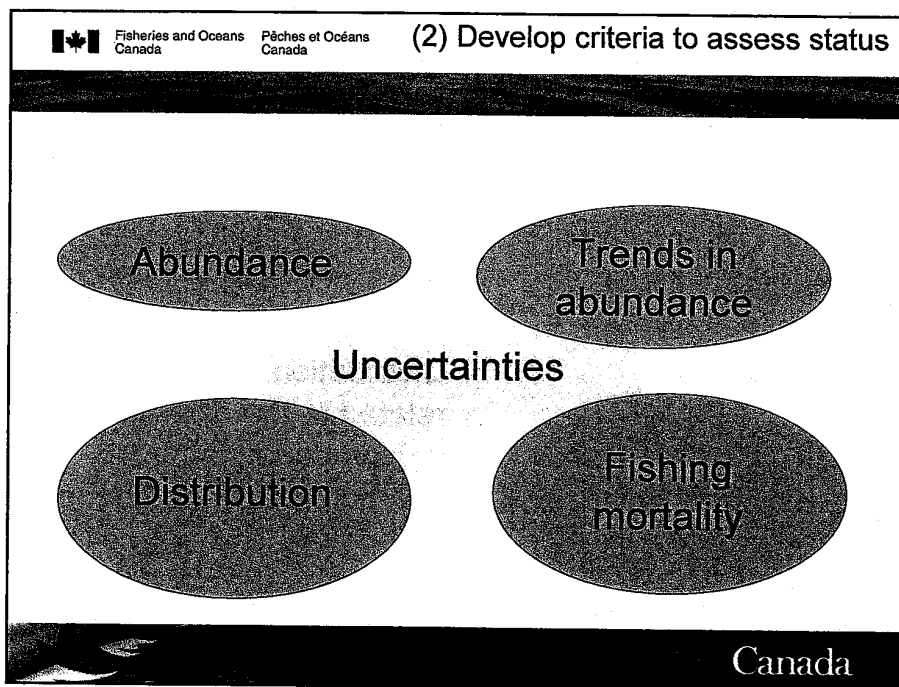
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## (2) Develop criteria to assess status

Fishing mortality relative to stock productivity reflects the ability of a CU to sustain that fishing pressure



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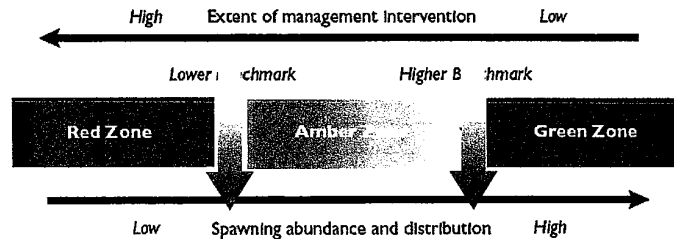




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## (2) Develop criteria to assess status



• "at a level ... high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC "

• "the level expected to provide, on an average annual basis, the maximum annual catch"  
• "there would not be a high probability of losing the CU"

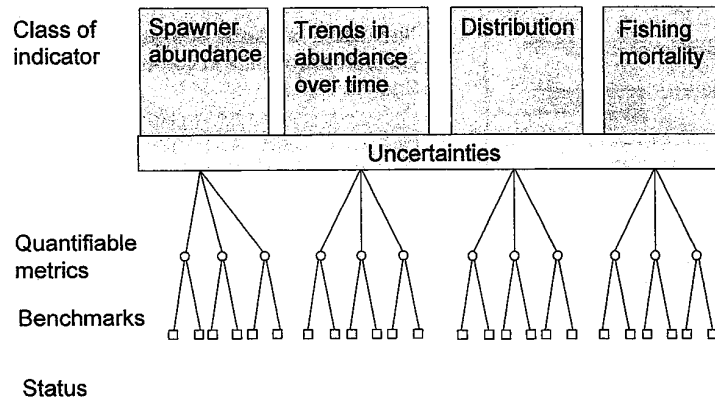
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## (2) Develop criteria to assess status



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## (2) Develop criteria to assess status

### Data availability

Minimum data required	Metrics of status (examples)				
	S relative to SRR	S relative to capacity	Trends in S	Fishing mortality relative to productivity	Distribution of S across spawning groups
Current S	x	x			
Time series of S (absolute)	x				
Time series of S (relative)			x		
Carrying capacity		x			
Time series of recruitment	x				
Current F				x	
Estimate of productivity				x	
Current S by spawning group					x

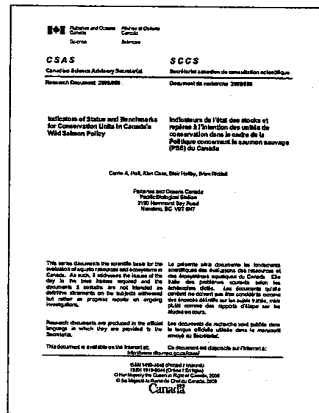
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## (2) Develop criteria to assess status



### "Indicators of Status and Benchmarks for Conservation Units in Canada's Wild Salmon Policy"

Holt, C.A., Cass, A., Holtby, B., and Riddell, B. CSAS Res. Doc. 2009/058.

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### (3) Monitoring

- (i) How can data that is currently collected be used to assess status under WSP?
- (ii) How should monitoring framework be revised in the future to better assess four dimensions of status under WSP?

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### (3) Monitoring

- (i) How can data that is currently collected be used to assess status under WSP?
  - Quality of escapement data vary by survey method:
    - mark-recapture experiments
    - fence counts
    - visual surveys (foot, aerial, tower), ....

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(i) How can data that is currently collected be used to assess status under WSP?

Class of indicator

Spawner abundance

Trends in abundance over time

Distribution

Fishing mortality

Requiring absolute estimates of spawner abundances preferably from mark-recapture or high-quality fence counts

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(i) How can data that is currently collected be used to assess status under WSP?

Class of indicator

Spawner abundance

Trends in abundance over time

Distribution

Fishing mortality

Requiring relative estimates of spawner abundances from mark-recapture, fence counts, or high-quality visual counts (>3 counts per year, well-documented)

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(i) How can data that is currently collected be used to assess status under WSP?

Class of  
indicator

Spawner  
abundance

Trends in  
abundance  
over time

Distribution

Fishing  
mortality

Requiring relative estimates of spawner abundances from mark-recapture, fence counts, or high-quality visual counts (>3 counts per year, well-documented). For metrics that include presence/absence data only, visual surveys with < 3 counts per year may be included.

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(i) How can data that is currently collected be used to assess status under WSP?

Class of  
indicator

Spawner  
abundance

Trends in  
abundance  
over time

Distribution

Fishing  
mortality

Requiring exploitation rate information (absolute estimates of spawner abundances from mark-recapture or fence counts, and catch estimates).

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(i) How can data that is currently collected be used to assess status under WSP?

Class of indicator



↓  
Could use data supplied by  
volunteer-run survey programs

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(ii) How should monitoring framework be revised in the future to better assess four dimensions of status under WSP?

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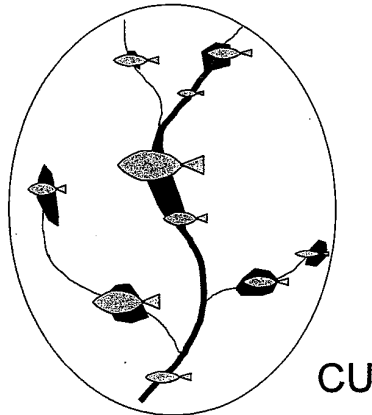
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### (3) Monitoring

## Monitoring designs to measuring changes in distribution

Maintenance of  
biodiversity



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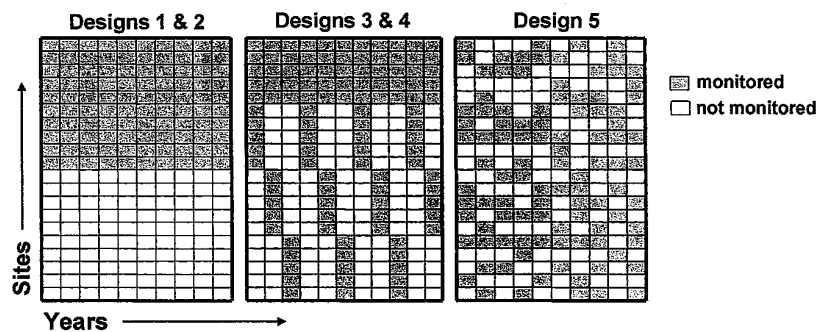


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### (3) Monitoring

## Monitoring designs to measuring changes in distribution



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## Monitoring designs to measuring changes in distribution

Q. Which monitoring design has the highest power to detect changes in distribution?

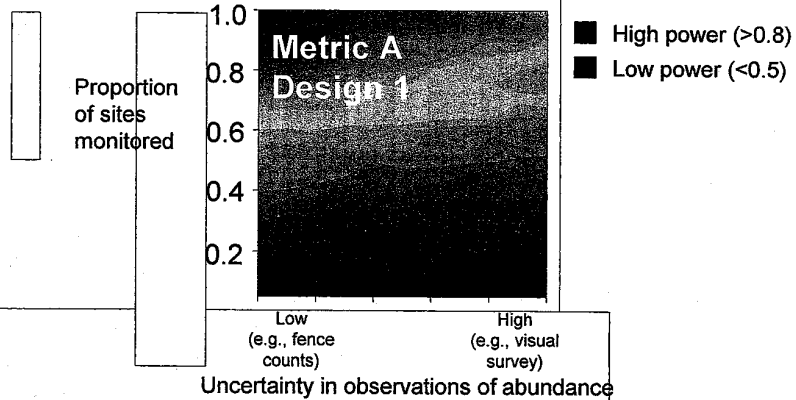
*Simulation modelling approach to answer this question*

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## Monitoring designs to measuring changes in distribution

Sample results

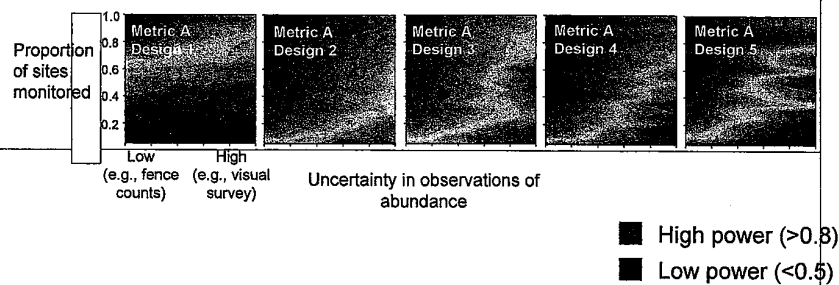


Stephanie Peacock





### Monitoring designs to measuring changes in distribution



Stephanie Peacock



### Summary

1. A multi-dimensional approach for status assessment has been developed for the Wild Salmon Policy to capture information on abundances, trends, distribution, and fishing mortality.
2. Data required to estimate status will vary by metric.
3. There may be a role for volunteer-run programs that use visual surveys of abundance, especially for metrics of trends and distribution.

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## People involved

### Science Branch (developing methodology)

Blair Holtby  
Al Cass  
Michael Folkes  
Jim Irvine  
Kim Hyatt  
Arlene Tompkins  
Mark Saunders  
Carrie Holt

### Policy Branch (implementation)

Lisa Wilson  
...and many others

### Habitat Branch (developing methodology/ implementation)

Dwight McCullough  
Heather Stalberg  
Melody Farrell

### Area stock assessment (implementation)

Wulf Luedke  
Diana Dobson  
Timber Whitehouse  
Steve Cox-Rogers  
Sandy Johnston  
Dave Peacock  
Brent Hargreaves  
... and many others

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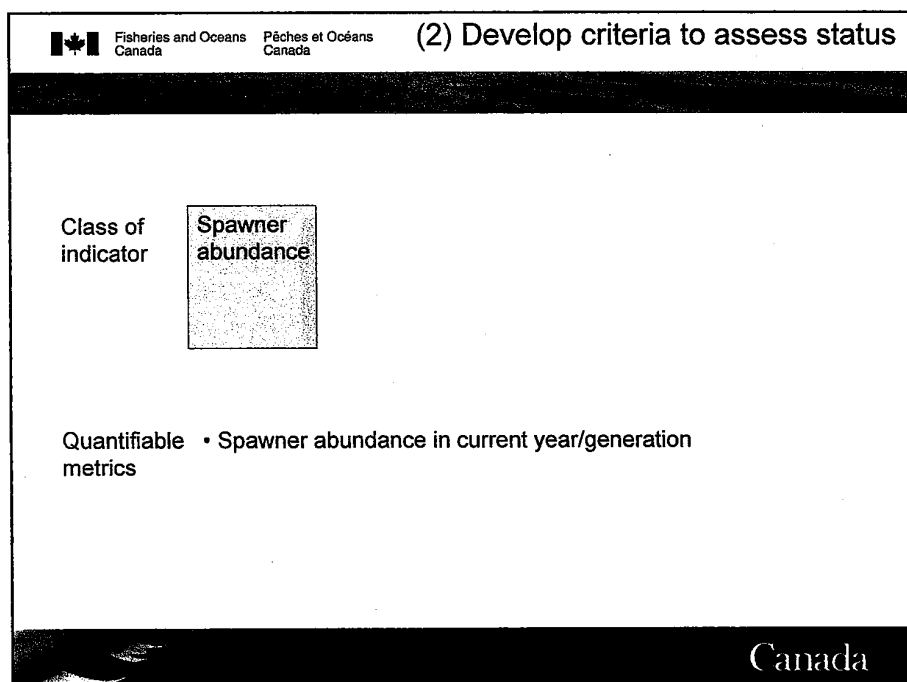
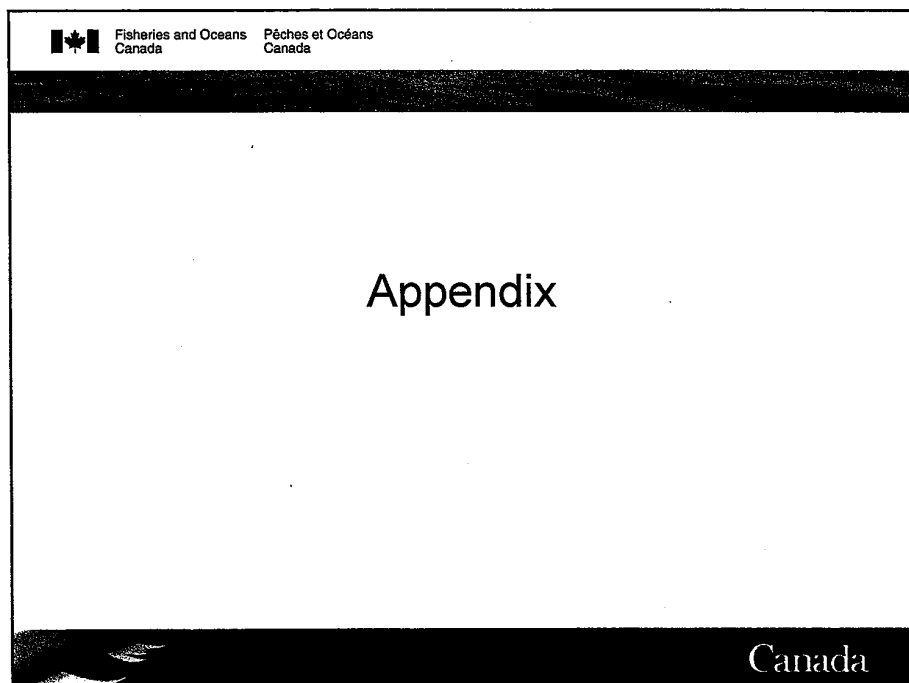


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Thank you

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## (2) Develop criteria to assess status

Class of  
indicator

Trends in  
abundance  
over time

Quantifiable  
metrics

- Slope in the linear change in spawner abundances over 3 generations or 10 years (~COSEWIC criterion for listing)
- Probability that slope of change is  $\leq$  COSEWIC declines
- Ratio of mean  $S$  of current generation to historical mean

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## (2) Develop criteria to assess status


Class of  
indicator

Distribution

Quantifiable  
metrics

- Number of spawning groups with abundances  $>100$  fish
- Minimum number of spawning groups that comprise 80% of total abundance
- Area under a curve of cumulative abundances
- Spatial location and habitat use of spawners/juveniles
- Spatial extent of spawning habitat
- Change in these metrics over previous 3 generations or 10 years

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(2) Develop criteria to assess status

Class of indicator

Fishing mortality

Quantifiable metrics

- Fishing mortality in most current year/generation

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