Science Context: Data to Decision

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Presentation Overview

1. Role of Science.
2. How Science can support strategic management of the salmon resource, including rebuilding.
3. Current state of SBC Chinook rebuilding
4. Process for moving forward strategically

The role of science is to inform the decision-making context:

1. Assessing the status of salmon stocks and evaluating impacts on salmon populations; including those impacts related to harvest, hatchery, aquaculture, and habitat management and also other factors such as disease, predation, climate change, etc.
2. Helping to evaluate the performance of management actions intended to support sustainable outcomes that extend beyond biological considerations alone. For example, management actions may include harvest, hatchery or habitat measures.
3. Improving the understanding of factors driving production through research, including effects of long-term changes due to climate change and other cumulative impacts.

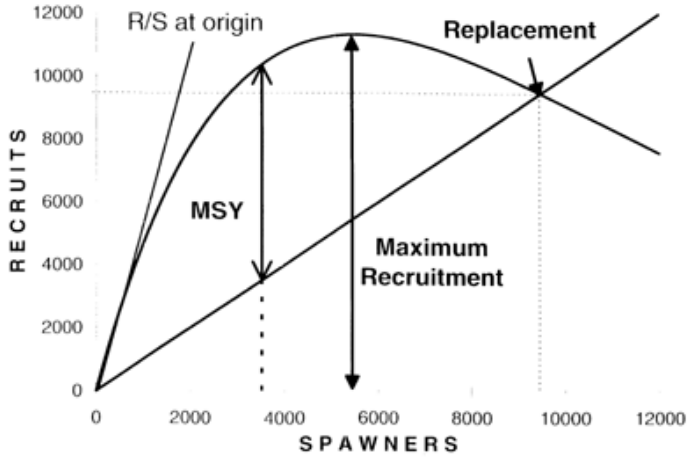
How Science can support 'management', including stock rebuilding

1. Completing stock assessments (i.e. evaluating factors driving production trends, sources of mortality).
2. Recommending management (or rebuilding) strategies.
3. Evaluating management (or rebuilding) strategies against management objectives.
4. Monitoring and evaluating stock status (or, in other words, monitoring the performance of management (or rebuilding) plans).

Stock assessments: understanding factors driving production trends

Specifically:

- Freshwater mortality
- Marine mortality
- Harvest impacts
- Management performance



(Although we don't have 'perfect' information, we use statistical and mathematical models to make predictions and inferences about the response of fish populations to alternative management actions.)

Stock assessments: Understanding factors driving production trends

Life Stage	Example Sources of Mortality / Limiting Factors
Upstream migration (adult)	Limited access, obstructions, water quality, illegal fishing, etc.
Spawning	Habitat quality, disease, predation, etc.
Egg incubation	Sediment, water quality, predation, scour, etc.
Early rearing	Water quality, food availability, competition, disease, lack of habitat, etc.
Estuary rearing	Predation, loss or degradation of habitat, food availability, etc.
Early ocean rearing	Food availability, water quality, competition, predation, etc.
Ocean rearing/migration	Harvest, food availability, water quality, competition, predation, etc.
Terminal migration	Harvest, predation, etc.

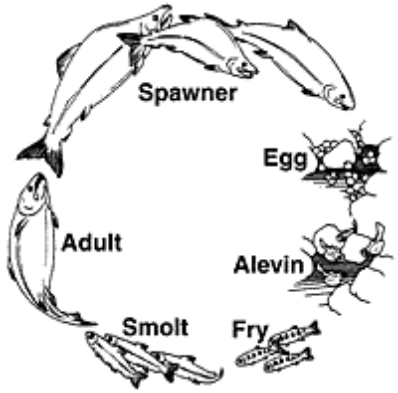
In order to recommend effective rebuilding strategies:

1. **We need to evaluate the relative impacts of various sources of mortality.**
2. **We need to understand the mechanism that results in increased mortality, loss of productivity, etc.**

Noting:

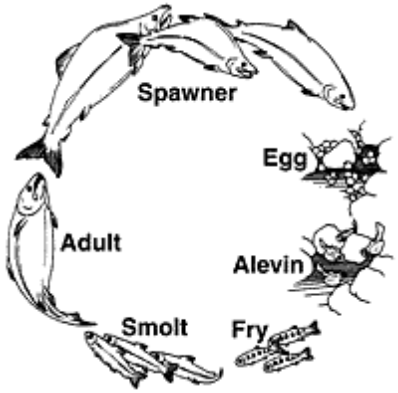
- Listing threats is generally not helpful…
- A variety of methods can be used evaluate these questions (data driven to data limited approaches).

A simplified life history model demonstrates why relative impacts matter:



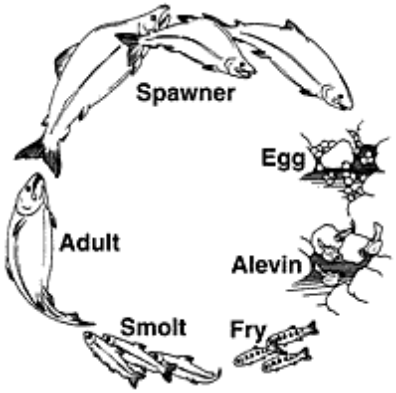
Spawners	500	Fecundity	4800
Eggs	2,400,000	Egg-to-Fry-Mortality	*90%*
Fry	240,000	Fry-to-Smolt Mortality	*90%*
Smolts	24,000	Smolt-to-Adult Mortality	97%
Adults	840	Ocean Harvest	30%
Terminal Return	588	Terminal Harvest	15%
Spawners	500		

Reducing harvest by half results in about a 30% increase in the population size:



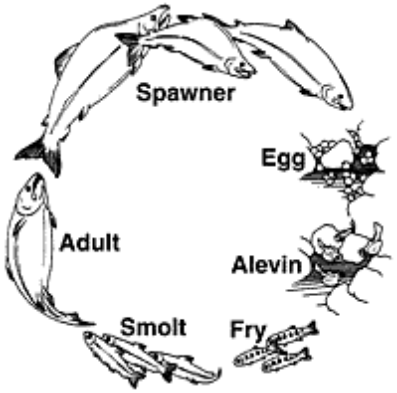
Spawners	500	Fecundity	4800
Eggs	2,400,000	Egg-to-Fry-Mortality	*90%*
Fry	240,000	Fry-to-Smolt Mortality	*90%*
Smolts	24,000	Smolt-to-Adult Mortality	97%
Adults	840	Ocean Harvest	15%
Terminal Return	714	Terminal Harvest	8%
Spawners	660		

However reducing fry to smolt mortality by 5% almost doubles the population size:



Spawners	500	Fecundity	4800
Eggs	2,400,000	Egg-to-Fry-Mortality	*90%*
Fry	240,000	Fry-to-Smolt Mortality	*85%*
Smolts	36,000	Smolt-to-Adult Mortality	97%
Adults	1,260	Ocean Harvest	15%
Terminal Return	1,071	Terminal Harvest	8%
Spawners	991		

Also note the effect of higher marine survival rate:



Spawners	500	Fecundity	4800
Eggs	2,400,000	Egg-to-Fry-Mortality	*90%*
Fry	240,000	Fry-to-Smolt Mortality	*90%*
Smolts	24,000	Smolt-to-Adult Mortality	93%
Adults	1,680	Ocean Harvest	30%
Terminal Return	1,176	Terminal Harvest	15%
Spawners	1,000		

When recommending strategies for rebuilding 3 key questions:

1. **Which sources of mortality are most influential in driving population trends?**
2. **What are the root causes of the mortality? (e.g. what bio-physical processes are causing the effect?)**
3. **How can these causes be potentially mitigated through management actions related to:**
   - **Harvest strategies?**
   - **Stock enhancement strategies?**
   - **Habitat restoration and management strategies?**
   - **Other strategies (e.g. GHG reduction)?**

When evaluating rebuilding actions against management objectives some relevant questions:

- **What is the likelihood the rebuilding action will be effective?**
- **What is the cost-benefit of the potential recovery action (including opportunity-cost)?**

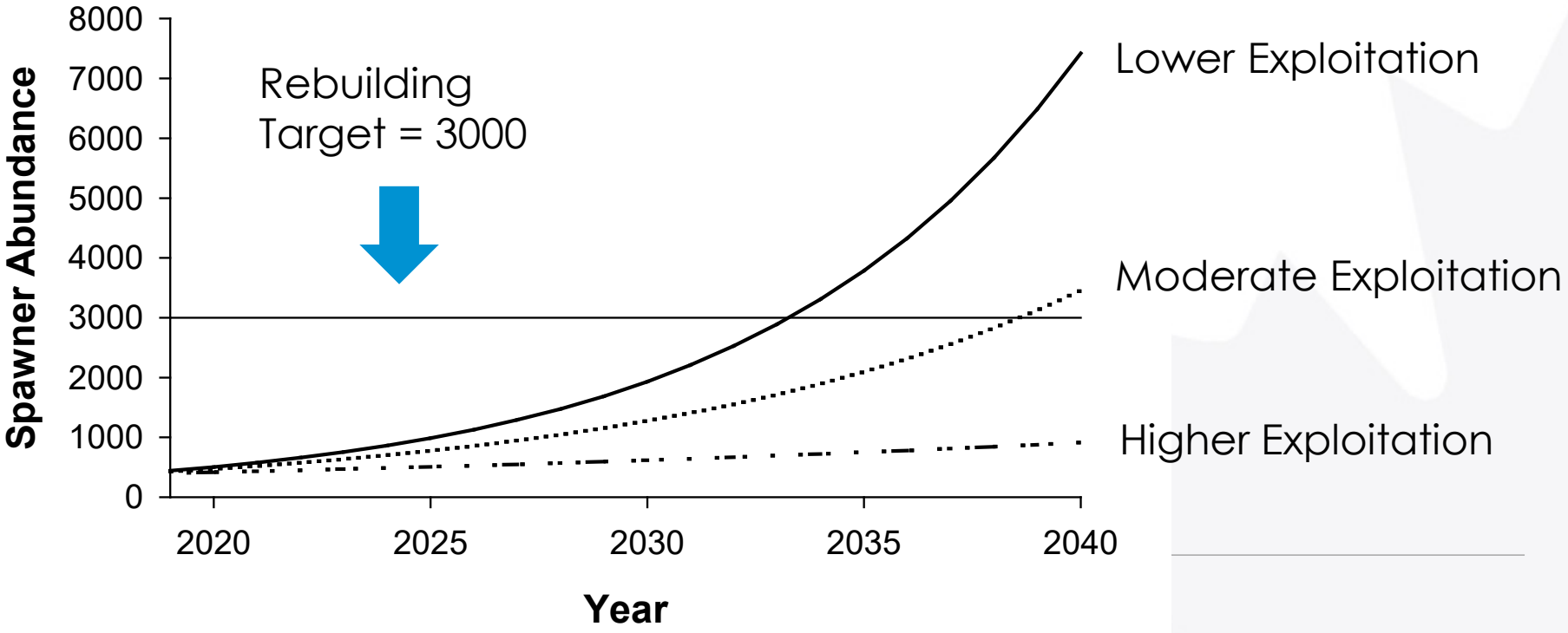
Various methods can be used to help evaluate these questions such as:

- Data driven management strategy evaluation (MSE) type processes, including use of simulation tools. And/or
- More data limited risk-assessment tools, including use of 'structured-decision making' processes.

Harvest Strategy Example: How a rebuilding exploitation rate limit might be set

Rebuilding Strategy: "reduce fishery mortality rates to a level that allows rebuilding within an acceptable timeframe"

Question: What is the effect of various fishery mortality levels on achieving the rebuilding objective?



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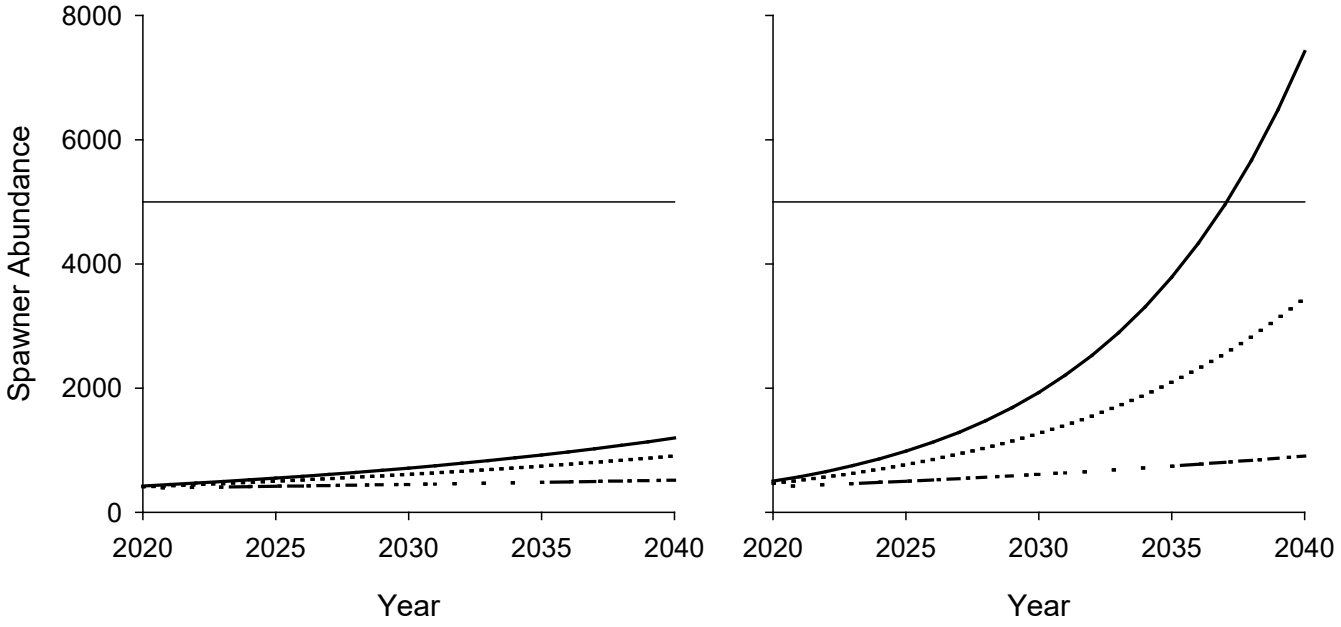
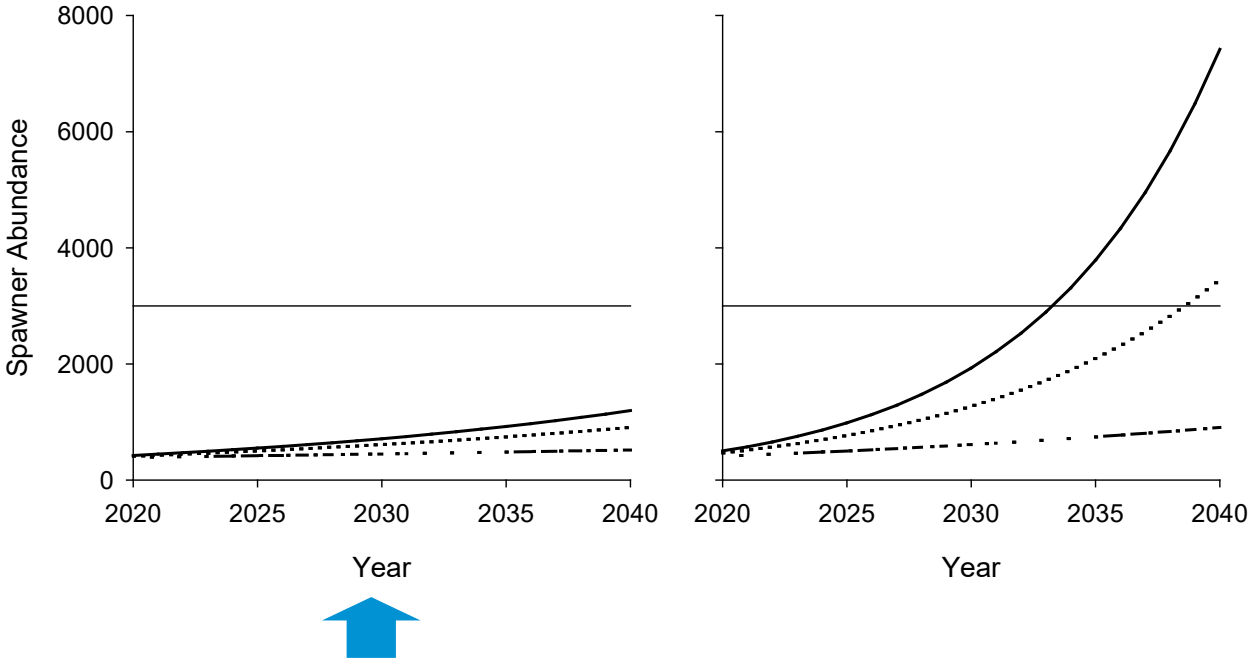


These simulation results would presumably result in different recommendations for rebuilding strategies.

Using this approach to evaluate and set harvest objectives…

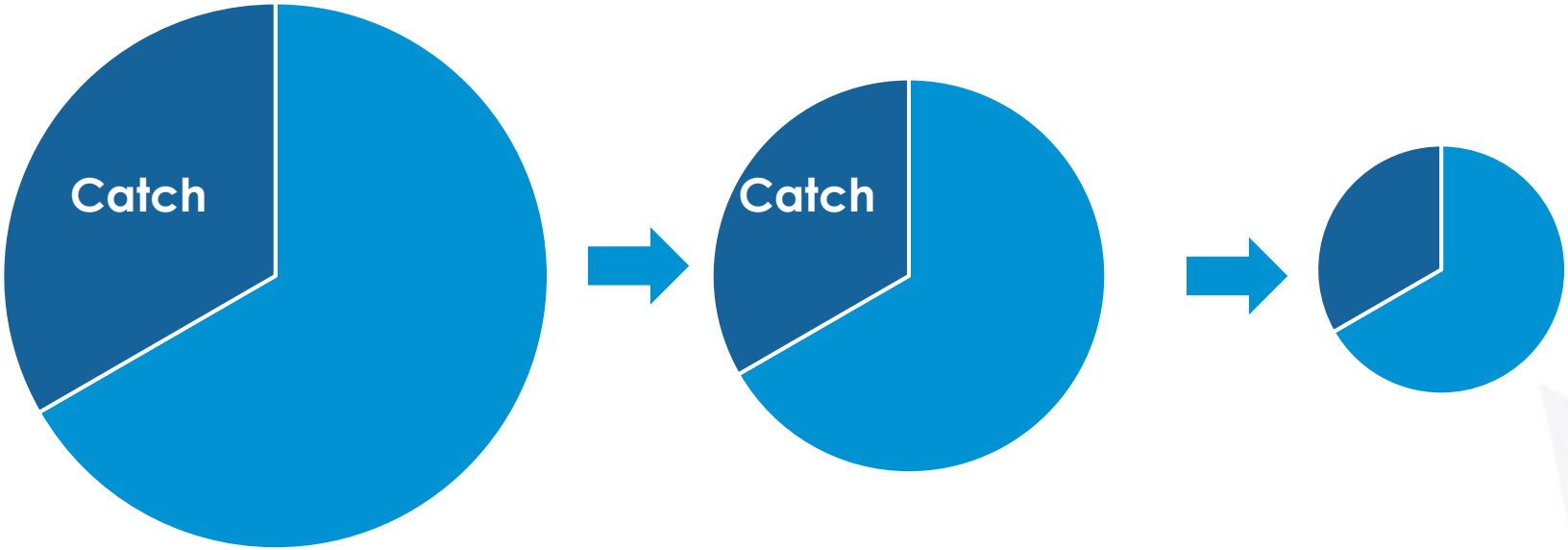


1. An objective is set.

2. The potential effect of alternate harvest scenarios on achieving that effect can be evaluated. (This info. informs cost-benefit analysis against other objectives.)

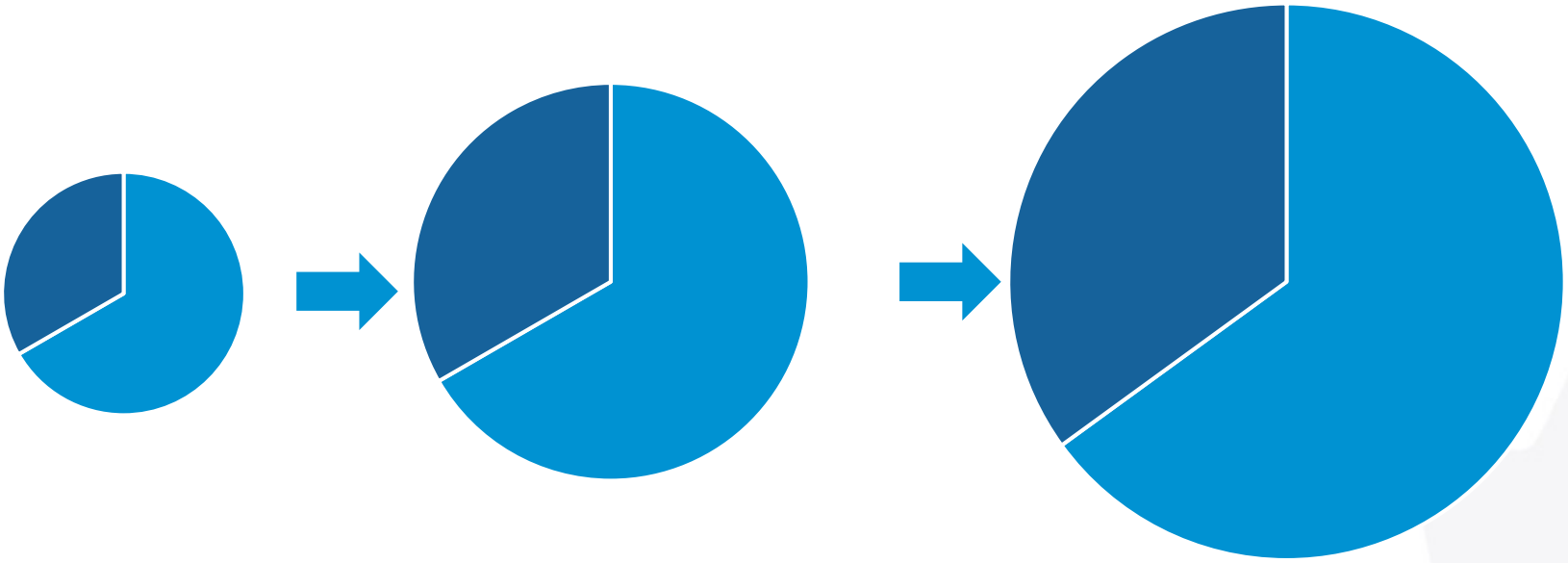
3. With this type of outcome, focus energy on evaluating and implementing rebuilding strategies that are more likely to achieve the objective (e.g. habitat management and restoration?, stock enhancement? Etc.)

In other words…



We’re perhaps spending too much time worrying about a small piece of a shrinking pie…

When we could be strategic



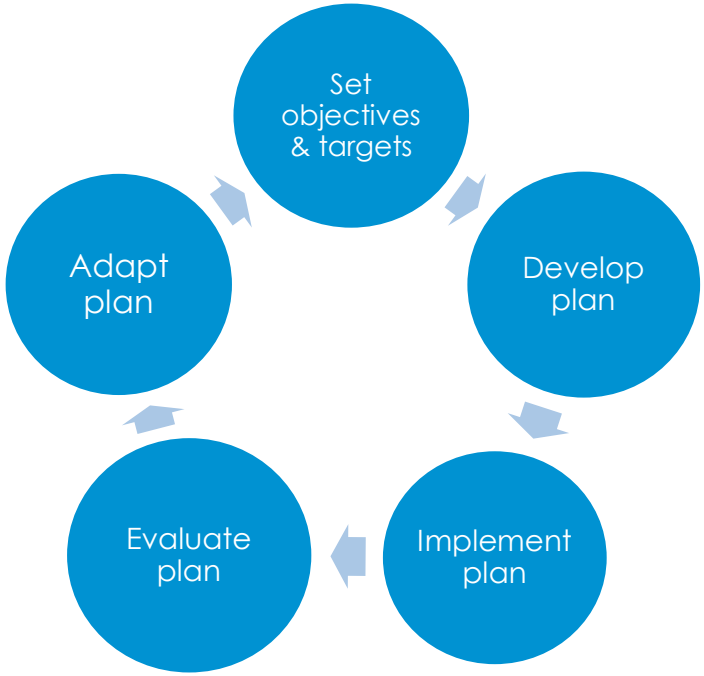
And spend more time about how to make the pie bigger…

SBC Chinook Rebuilding – current status

- Through the SARA process, Recovery Potential Assessments (RPAs) are complete or underway for many SBC chinook 'designated units'.
- However, RPAs are generally not sufficient to develop informed and comprehensive rebuilding plans (i.e. further evaluation is required to recommend and evaluate specific rebuilding actions).
- In many cases, rebuilding objectives are not defined and/or evaluated.
- In many cases, adequate governance systems are not in place to either coordinate rebuilding activities or implement potential rebuilding actions.

Ultimately, monitoring and evaluating status is about management performance

Sustainable management requires a process that includes feedback systems to evaluate and adjust management actions if they do not achieve desired objectives.



Such a process requires clear and measureable objectives and targets as a foundation.

Moving forward strategically will involve developing a comprehensive Rebuilding Plan AND Process:

Components:

1. Developing the process to identify and evaluate rebuilding and other management objectives. (This group?)
2. Completing the evaluation work to identify and recommend rebuilding strategies and evaluate specific actions. (Rebuilding Plan).
3. Developing a governance model to coordinate activities and implement rebuilding strategies and actions. (All levels of gov't)

Development of management (or rebuilding) plans is a shared responsibility: