

1 FISH, 2 FISH...

Do you really want to know about Maximum Sustainable Yield?

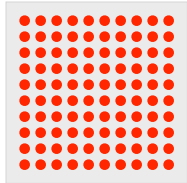


Salmonguy Design Co.

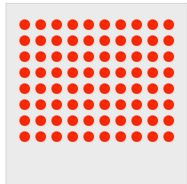
© May 2011
DAVID LOEWEN & ASSOCIATES

1 FISH, 2 FISH

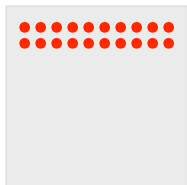
LESSON 1: How ^{not} to manage fish.



a. A particular population or run of salmon is estimated at this size.



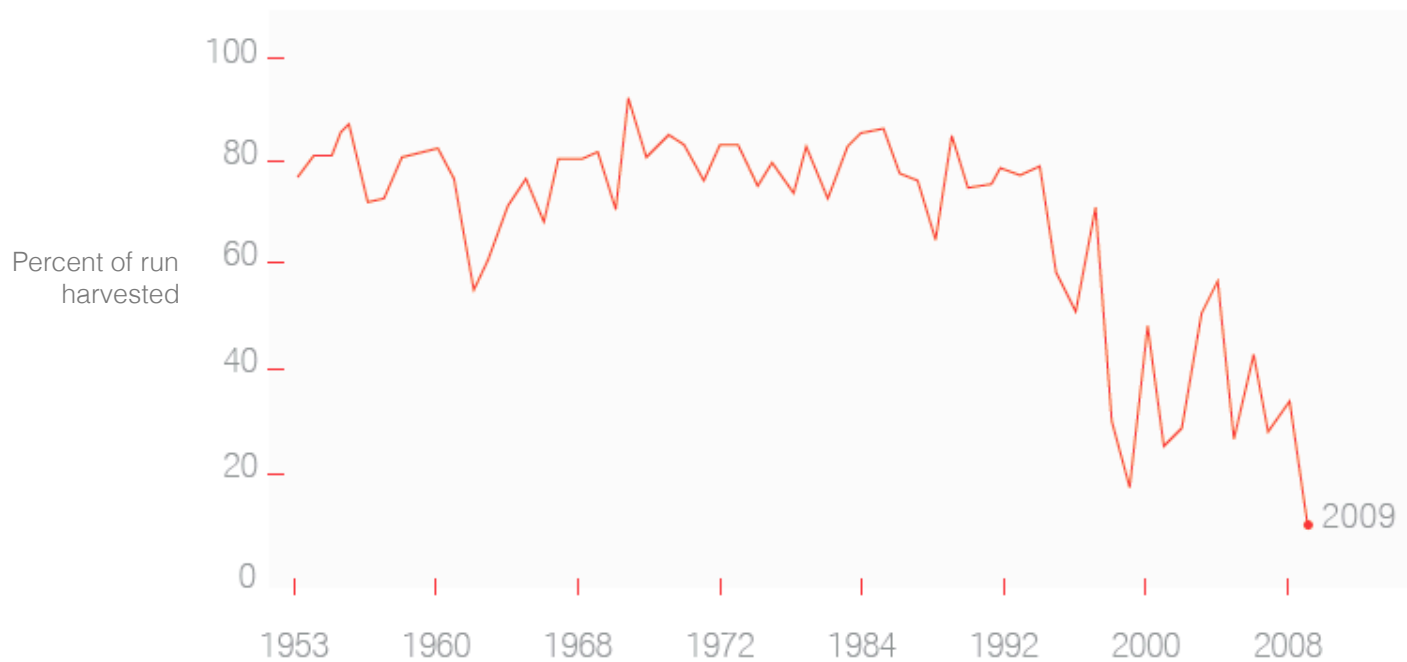
b. Fisheries management science experts say we can safely take 80% of the run (**Maximum Sustainable Yield**).



c. The remaining 20% "*escapes*" the fisheries. This 20% of "*escaped fish*" or "*escapement*" are supposed to feed all the critters in ecosystems that feed on salmon, as well as produce an equal-to or greater-than salmon run the following year.

LESSON 2: MSY at work.

This graph shows estimated % of Fraser River sockeye run harvested over the last fifty years.¹



LESSON 3: Are we MSY-ing something?

The concept of Maximum Sustainable Yield (MSY) for managing fisheries gained popularity in the 1930s. It then increased in popularity in the 1950s with the introduction of “*surplus-production models*.” As an apparently simple and logical management goal, MSY was adopted as the primary fisheries management goal by several international organizations and countries.

Between 1949 and 1955, the U.S. lobbied to have MSY used for all international fisheries management. International MSY (adopted in 1955) gave fleets the right to fish off any coast. Nations that wanted to exclude foreign fishing had to first prove that its fish were overfished.

Through the 1960s and 70s, some researchers challenged the capability of MSY in dealing with real world complexities such as food chain interactions, changing ocean environments, and so on.

LESSON 4: Seems we are...

In 1977, Dr. Larkin a Canadian scientist, challenged the goal of MSY on several grounds:

- It put fish populations at too much risk;
- It did not account for variability in population productivity (loss of river habitat for salmon);
- It did not account for species other than the focus of the fishery (bears, seals, etc.);
- It considered only the benefits, not the costs, of fishing; and
- It was sensitive to political pressure. ²

Soon after some fisheries managers began to use more conservative catch quota recommendations, but the influence of MSY still prevailed. Even while the scientific community was beginning to question the model it was incorporated into the 1982 United Nations Convention for the Law of the Sea, thus ensuring its integration into national and international fisheries acts and laws.

According to Walters and Maguire (renowned fisheries scientists), an “institutional juggernaut had been set in motion”, climaxing in the early 1990s with the collapse of North Atlantic cod. ³

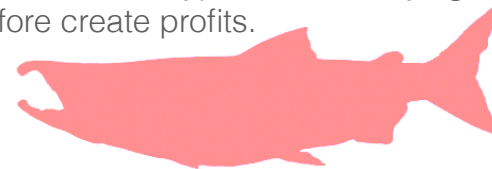
MSY is still part of the Fisheries and Oceans Canada *Wild Salmon Policy*.

LESSON 5: MSY means business

MSY is based on these assumptions:

TAKE THE SURPLUS

- 1** Natural populations have a “surplus” that can be harvested as long as enough population is left to reproduce for the next harvest.
- 2** If a natural population is too small then there is no surplus and we should not kill (harvest).
- 3** If humans do not harvest from a population then the population will spiral out of control and eventually decline because of overpopulation—so it is better to harvest or cull. In salmon management this is called “*over-escapement*” meaning (in theory) that too many adult salmon are in a stream and will dig up each others eggs resulting in chaos, death and low productivity.
- 4** By using MSY, say the fish scientists, we are creating an optimal sized population that will reproduce perfectly (following our rules and assumptions). This is related to the concept of “*carrying capacity*.” Fish scientists assume they can quantify the “carrying capacity” of every stream and the ocean where salmon migrate through and thus we can take the surplus over and above this hypothetical carrying capacity—and therefore create profits.



LESSON 6: A bigger assumption...

MSY assumes that the productivity of rivers and oceans remain constant over time thus ensuring a static foundation to calculate MSY.



LESSON 7: It is $M_e S_s Y$

We have no way of accurately predicting natural animal populations—we can't even predict our own brain patterns.

Environments and species interact with each other in so many ways that we can never know all factors affecting one group of animals. That's why there is a discipline called chaos theory—ever heard of the proverbial butterfly flapping its wings...



But, even chaos theory cannot explain why we expect 20% of a salmon population to survive perpetually for over a century—let alone in the face of habitat damage, climate change, and other increasing demands.



The ocean is not a static environment. The North Pacific is not like a pasture where goat herds produce the same “*yield*” year after year.

Rivers are not static. Logging, urbanization, mining, and other human development is affecting salmon habitat.

And, what about all the eagles, bears, wolves, orcas and other critters that depend on annual salmon returns... over 137 different species according to some estimates. ⁴

LESSON 8: Houston we have a...

In 2000, Gresh et al. analyzed cannery records, spawner records, and harvest records up and down the Pacific coast to estimate historic salmon returns and catch to western North America over the last one hundred years or so. They concluded that over-fishing (e.g. dictated by MSY), habitat loss, and poor marine survival have contributed to the decline of salmon returns to many streams during the last century. ⁵

In the U.S. Pacific Northwest (WA, OR, ID, and CA) they estimated historic total mass of returning salmon at 160 - 226 million kg.

In the current environment, approximately 12 - 14 million kg are returning.

A loss of 90-95% of total mass and nutrients for critters and ecosystems.

In B.C. stream they estimated a loss of approximately 80 - 85% of total returning mass and nutrients.

“This nutrient deficit may be one indication of ecosystem failure that has contributed to the downward spiral of salmonid abundance and diversity in general, further diminishing the possibility of salmon population recovery to self-sustaining levels.”

Yet... MSY continues to dictate fishing plans. For example, read Canada's Department of Fisheries & Oceans fishing plans for this year and the goal is to “rebuild Chinook populations to maximum sustainable yield (MSY) levels...”

MSY is a Recipe for Wild Salmon Extinction



CREDITS

ONE FISH, TWO FISH — MAXIMUM SUSTAINABLE YIELD

Acknowledgements:
JONES-DAVIES AND DAVIES

References:

1. "Adapting to Change: Managing Fraser sockeye in the face of declining productivity and increasing uncertainty." Statement from Think Tank of Scientists. (2009) www.sfu.ca/cs/science/resources/1273690566.pdf
2. Larkin, P.A. (1977). "An epitaph for the concept of maximum sustainable yield" *Transactions of the American Fisheries Society*, 106: 1–11.
3. Walters, C. & J. Maguire (1996) "Lessons for stock assessment from the northern cod collapse". *Reviews in Fish Biology and Fisheries*, 6:125–137
4. Cederholm, C.J., M. D. Kunze, T. Murota, & A. Sibatani (2000). "Pacific Salmon Carcasses: Essential Contributions of Nutrients and Energy for Aquatic and Terrestrial Ecosystems". *Fisheries* 24:6-15.
5. Gresh, T., J. Lichatowich, & P. Schoonmaker. (2000). "An estimation of historic and current levels of salmon production in the northeast Pacific ecosystem: Evidence of a nutrient deficit in the freshwater system of the Pacific Northwest". *Fisheries*, 25:15–21.

© Copyright 2011 David Loewen & Associates

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.

That means you're free to copy, distribute, and transmit it for non-commercial purposes, provided you say where you got it. In fact, please share it with anyone.

Or, send them to www.salmonguy.org to get their own copy.

And please consider making a contribution to support more of these types of contributions: \$5, \$10, \$20... you name it -- it all assists.