

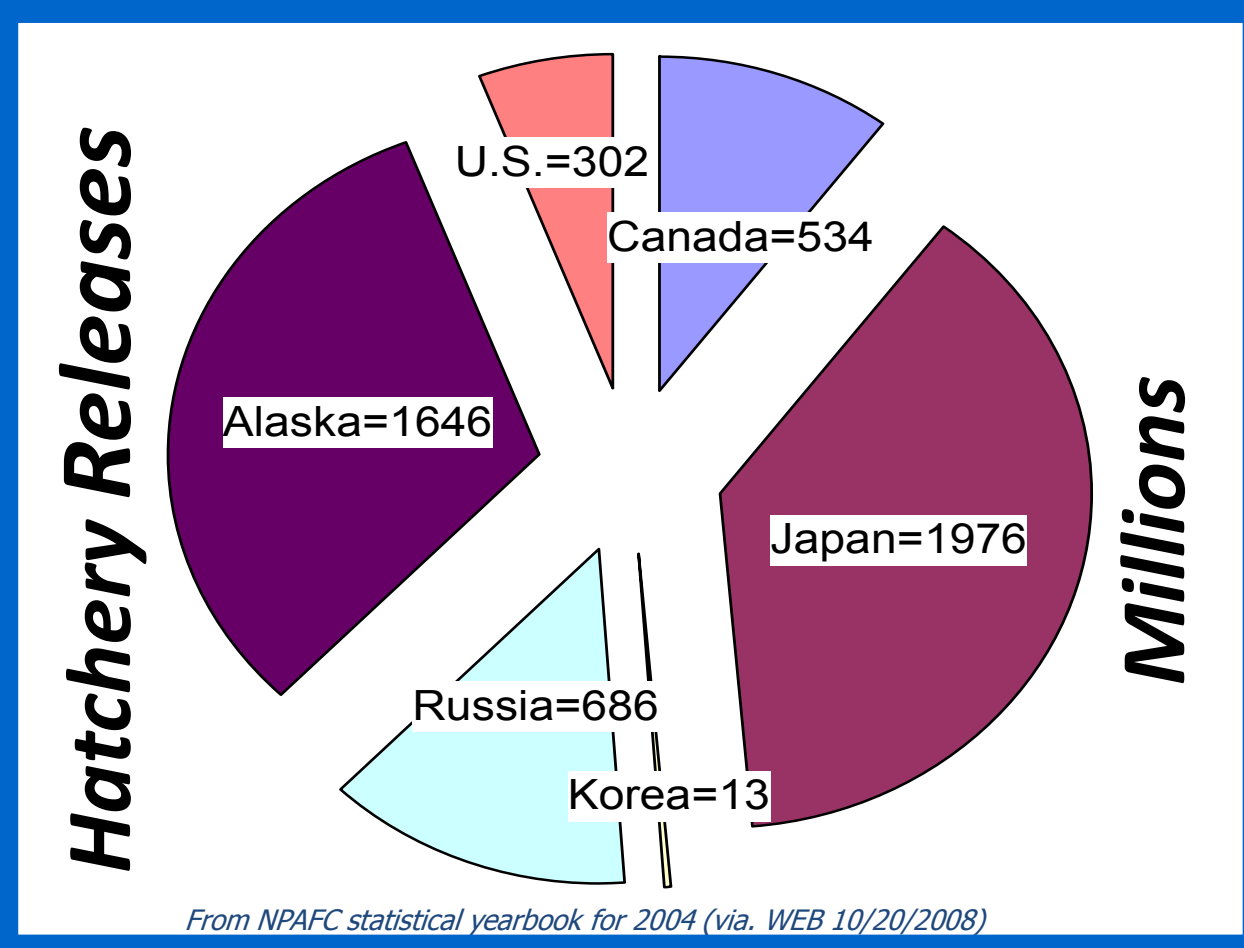
# Hatchery Salmon and Ecosystem Productivity



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\* Disclaimer - the information presented is my own and does not represent positions or policies of my employer.



**ABSTRACT:** The put-and-take business of “ocean ranching” of hatchery salmon extracts nutrients from the ocean and lowers the carrying capacity for all biota. A sizeable proportion of wild salmon runs spawn and die in thousands of watersheds which helps maintain the natural marine-terrestrial-marine nutrient cycle. In contrast, nearly all salmon returning to hatcheries and remote release sites are caught (and should be) and their tons of marine-derived nutrients are removed from the nutrient cycle. Thus, not only are wild fish and shellfish facing direct competition from five billion-plus hatchery salmon now released into the North Pacific each year but the ocean’s productivity is declining from the nutrient mining inherent with these industrial-scale ocean ranching hatchery programs. Of all the anthropogenic and climate change challenges we face, at least we have complete control over this one.

## Hatchery Salmon and Ecosystem Productivity

- Fish production is ultimately dependent on carrying capacity
- It is not the naturally “low” egg-to-fry survival
- It is not the number of fry/smolt released from hatcheries
- The carrying capacity is limited—variable but limited
- You can fill the carrying capacity with wild fish and/or hatchery fish
- But the only way to sustain production and productivity is with wild fish
- Which spawn and die in thousands of rivers, lakes, and streams
- Maintaining the natural marine-terrestrial-marine nutrient cycle
- Important for maintaining ecosystem productivity for all biota

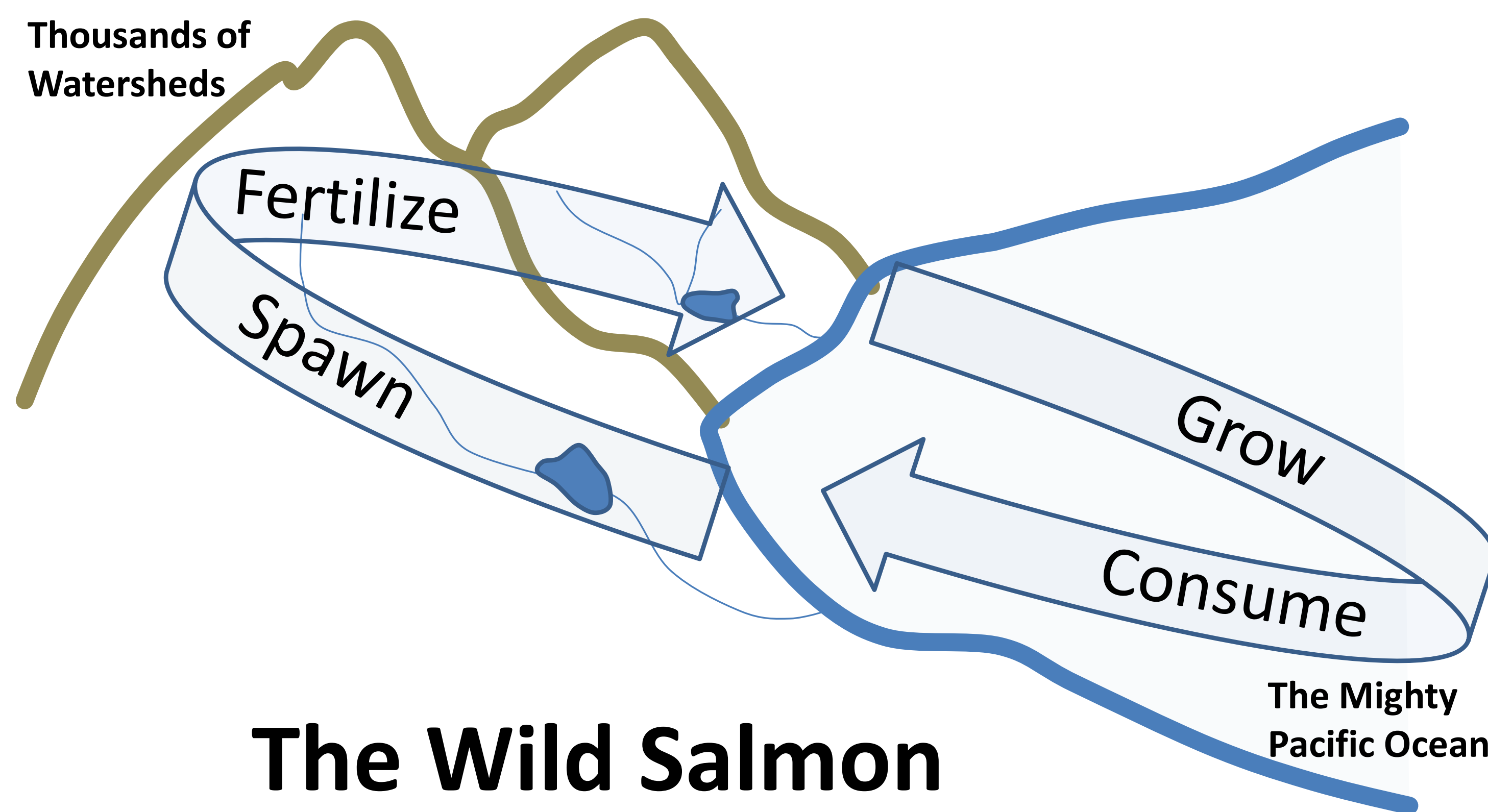
### No Open Niche for Hatchery Fish

- One (1) ocean
- Carrying capacity limited
- Wild and hatchery fish
  - swim together
  - compete for resources
- Can fill carrying capacity
  - With wild salmon
  - With hatchery salmon
  - Or some combination

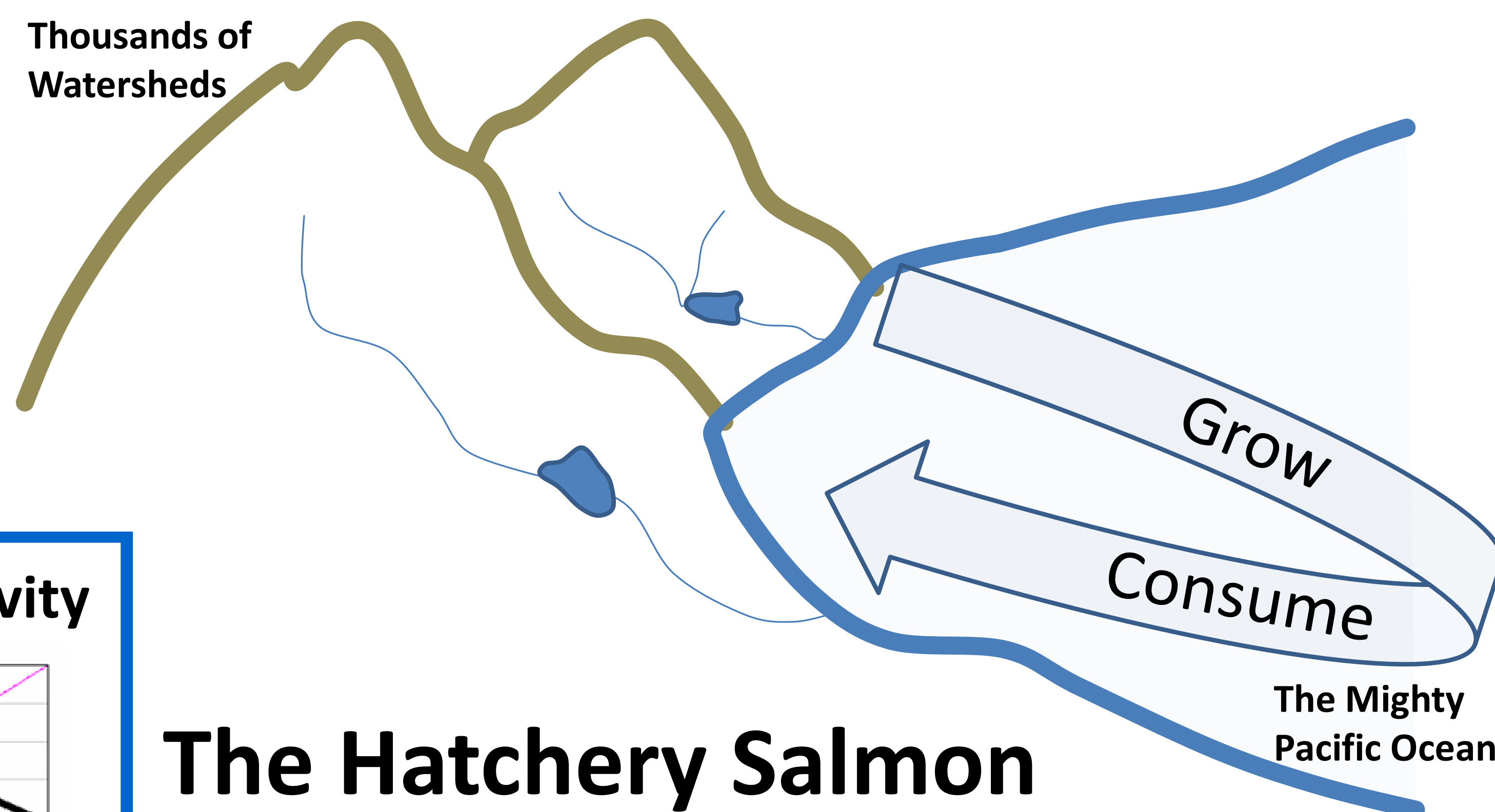
You can't do better than what happens naturally



The Mighty Pacific

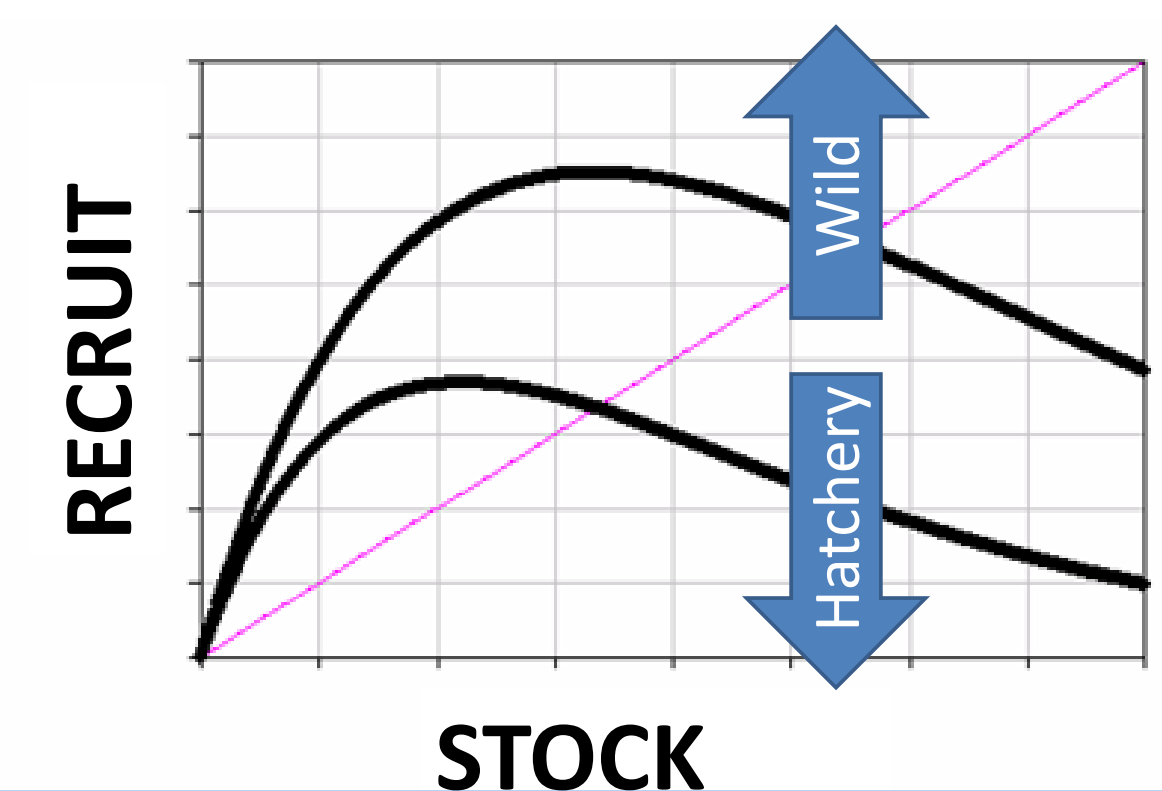


## The Wild Salmon Marine-Terrestrial-Marine Nutrient Cycle



## The Hatchery Salmon Nutrient Mining

### Ecosystem Productivity



## Other Problems with Hatcheries:

An increase in hatchery fish will:

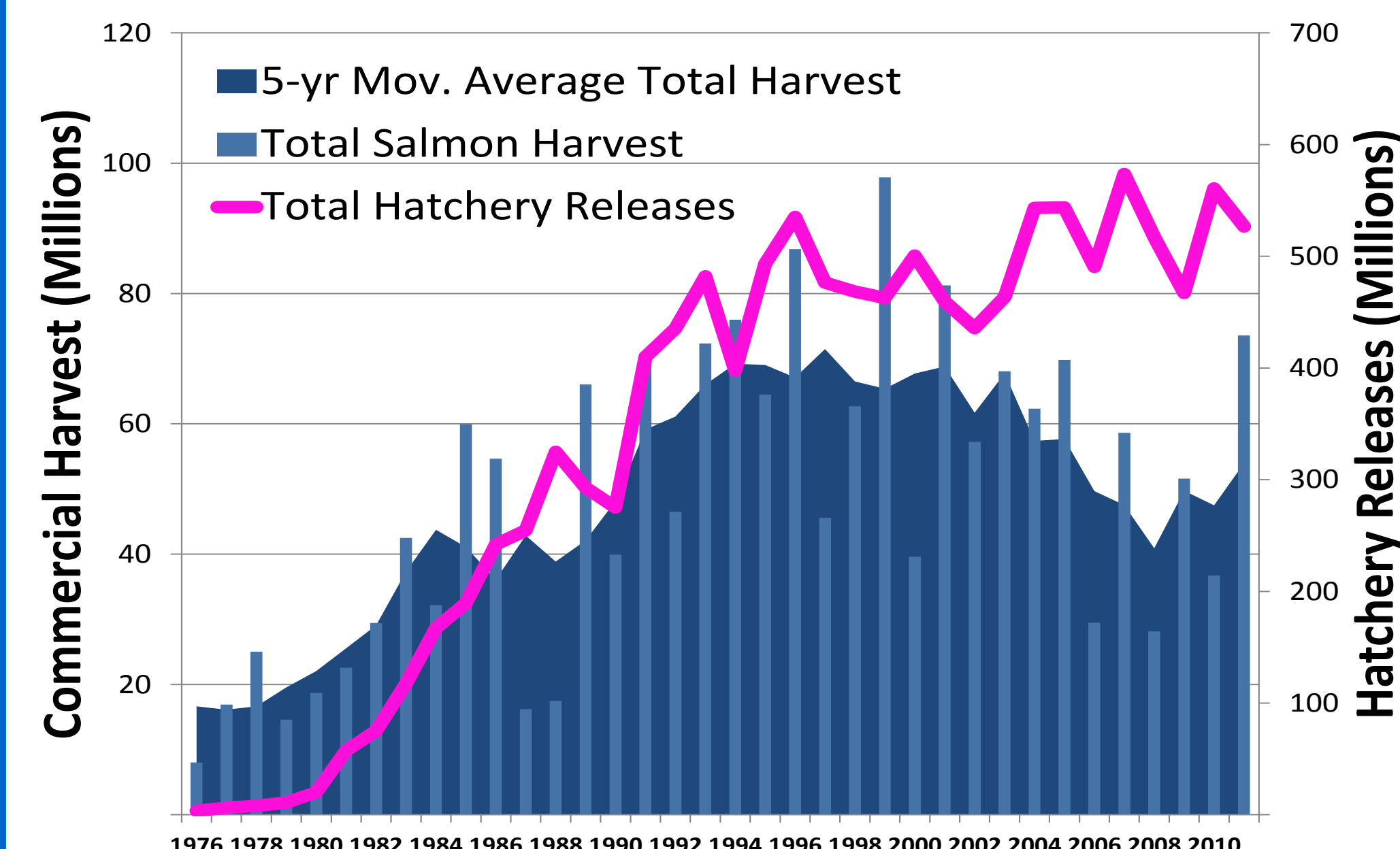
- increase competition
- decrease growth
- increase predation
- decrease survivals
- increase straying
- decrease fitness
- increase harvest pressure (usually)
- decrease management precision



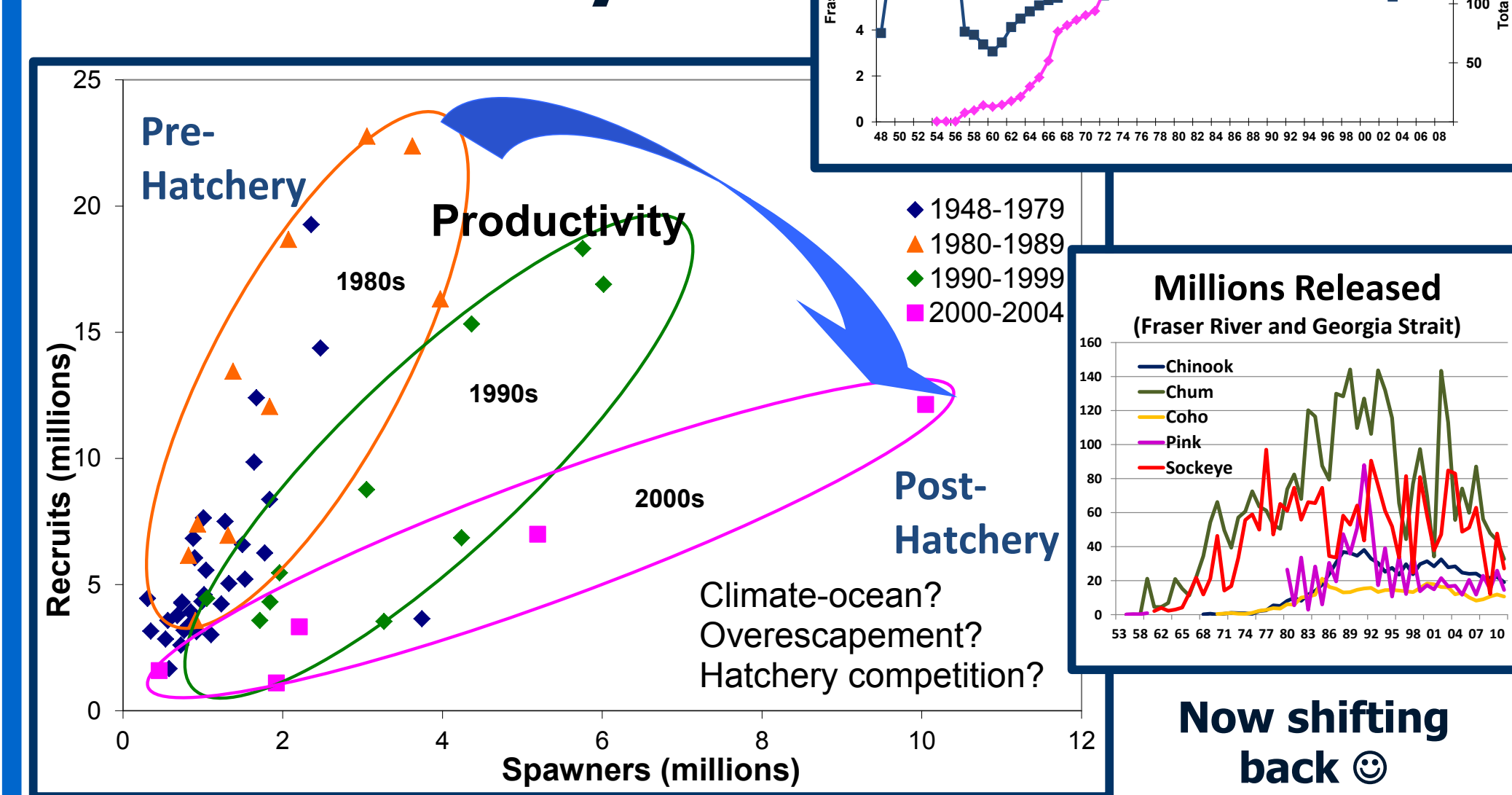
on wild fish

## Where are there production hatchery releases and NOT declining runs of wild fish (salmon, herring, eulachon)?

### Hatchery Releases Up, Harvests Down in Southeast Alaska



### A Hatchery Regime Shift for Fraser Sockeye?



## Hatchery Salmon and Nutrient Mining

- Annual hatchery releases are now over 5 billion salmon
- Hatchery fish now account for 62%, 13%, and 4% of the adult chum, pink, and sockeye salmon in the North Pacific<sup>(a)</sup>
- Most of these hatchery fish are caught—and their 800 million pounds of nutrients are removed annually from the marine-terrestrial-marine nutrient cycle

### Nutrient Mining - unsustainable

- Percent hatchery run<sup>(a)</sup>
  - Japan - chum 100%, sockeye 100%
  - PWS - chum 73%, pink 78%
  - SEAK - chum 55%

### The refrigerator analogy:

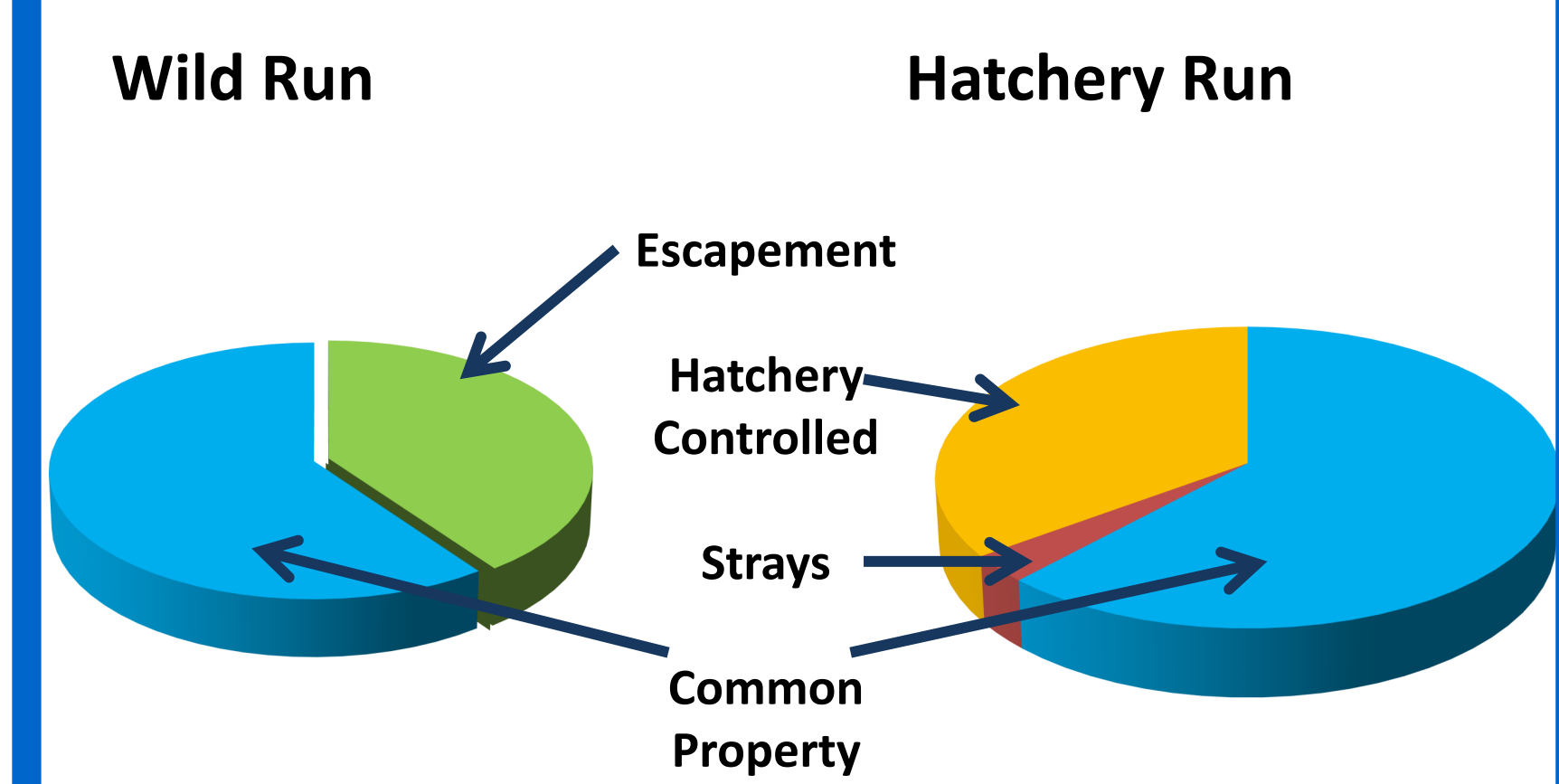
- Keep taking food out
- Without putting food in ...and see how long you're fat and happy

## A Farming Analogy

- At each harvest, nutrients taken up from the soil [ocean] by the growing crop [fish] are exported from the field [ocean] further depleting the productive capacity of the soil [ocean]
- Thus, must fertilize, like wild salmon do

In Alaska, the portion of the hatchery run caught to support the hatchery program is comparable to the proportion of the wild run that is allowed to spawn.

### From Wild Spawners to Hatchery

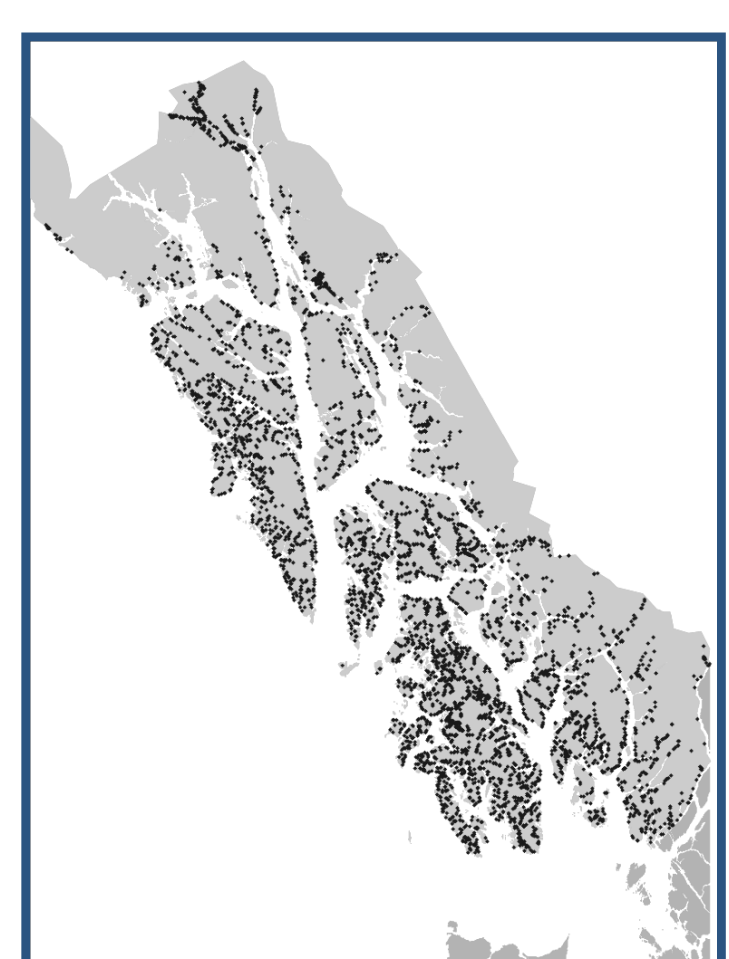


### What if mega hatchery releases continue...

- Reduced ocean productivity
- Reduced fish production
- Reduced biodiversity, fitness
- Increased ecologic risk from
  - Hatchery problems
    - Water supply, disease outbreak
  - Global warming
- Fatter whales, thinner wallets

## Mega Hatchery Bio-de-iversity

- From thousands of wild populations in all the run
- To a handful of release groups in most of the run



	Original Donor Stocks	Hatcheries	Percent Hatchery of Total Run <sup>a</sup>	Wild Systems
SEAK				
Chum	6	13	55%	1,500+
PWS				
Pink	3	4	78%	
Chum	2	3	73%	

<sup>a</sup>Ruggerone et al. 2010

**CONCLUDE:** Fish production is ultimately limited by carrying capacity. The put-and-take business of the “ocean ranching” hatchery programs in Alaska and Asia removes nutrients from the natural marine-terrestrial-marine nutrient cycle which lowers the carrying capacity for all biota.

<sup>(a)</sup> Ruggerone, G. T., R. M. Peterman, B. Dörner, and K. W. Myers. 2010. Magnitude and trends in abundance of hatchery and wild pink salmon, chum salmon, and sockeye salmon in the North Pacific Ocean. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 2:306-328.