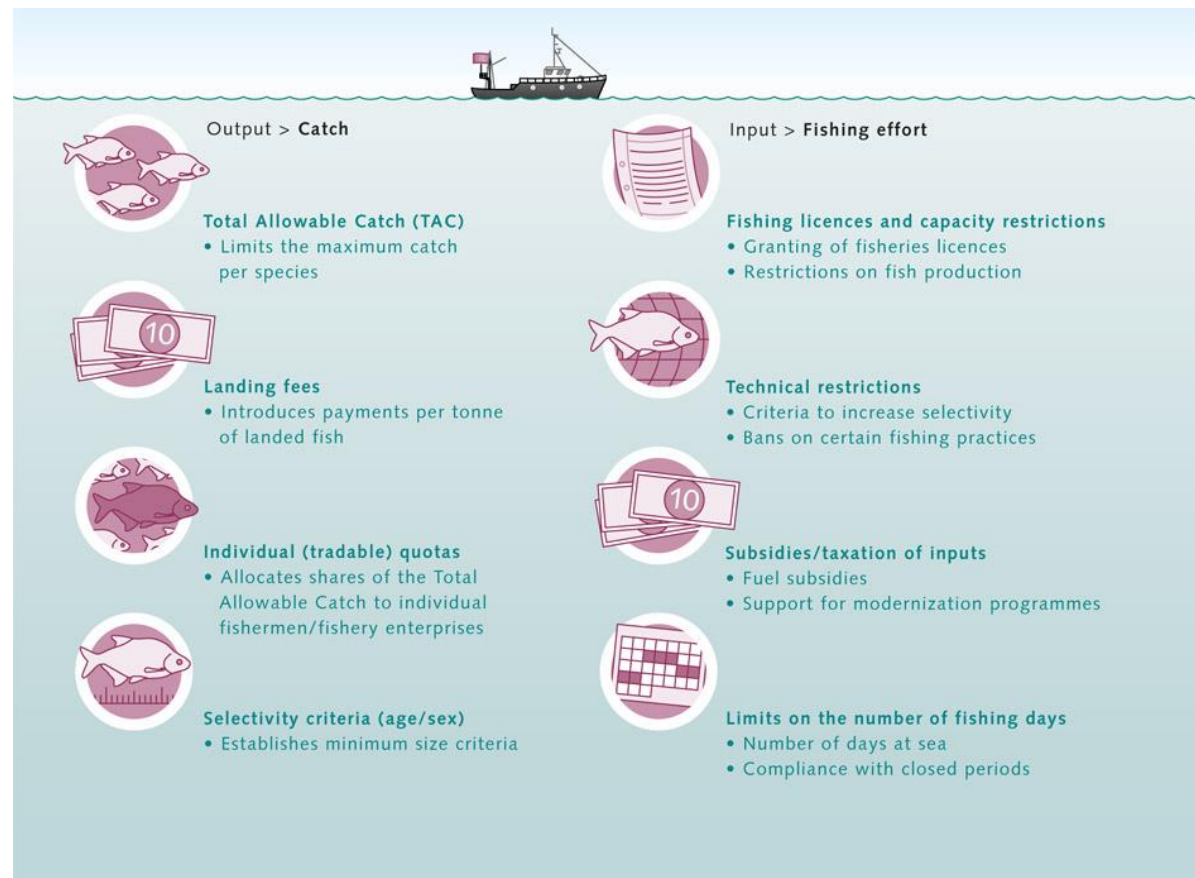
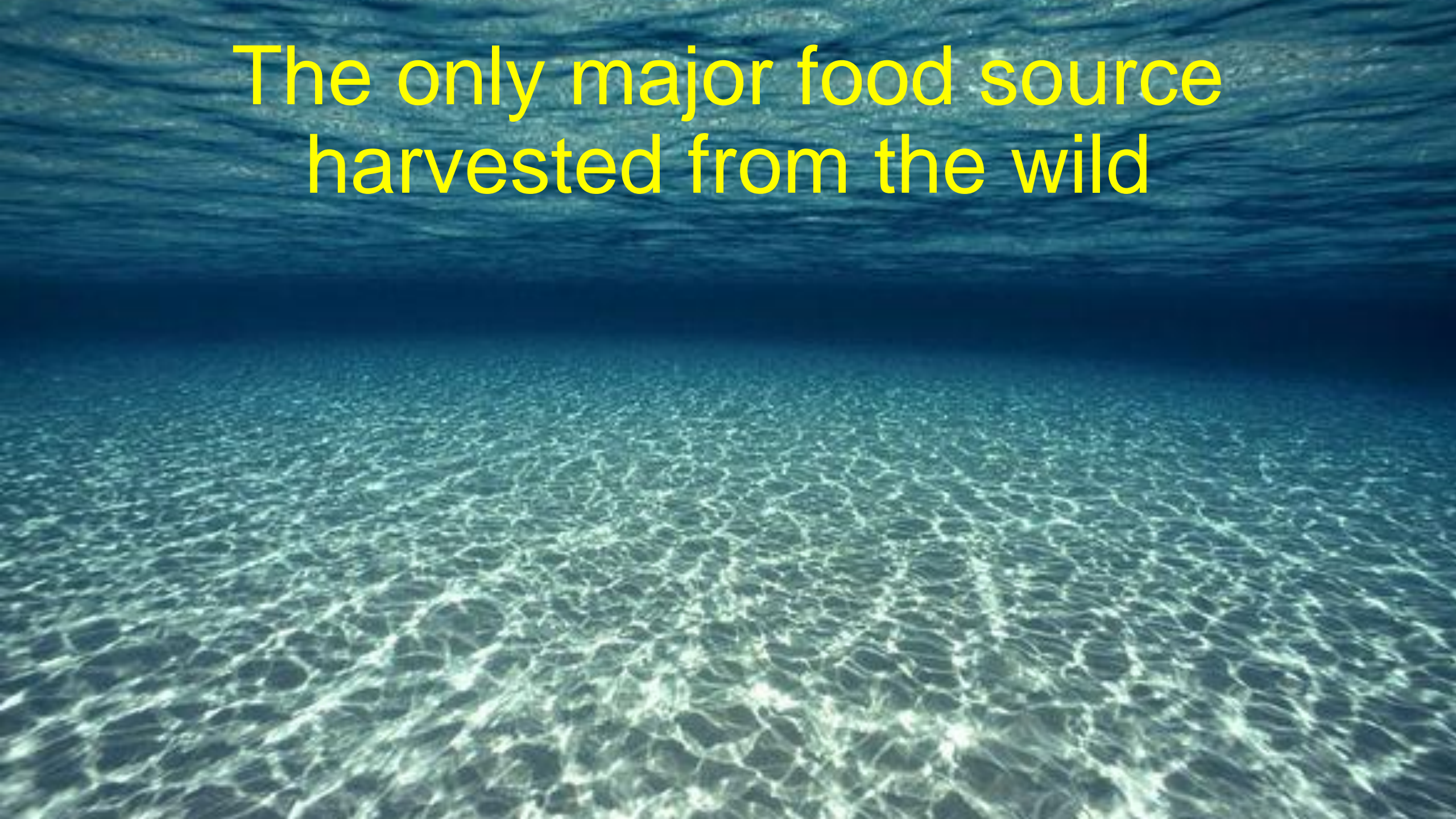


# Aquatic Genetic Resource Management



The only major food source  
harvested from the wild



# FAO- State of world marine resources

## Snapshot of the global situation

*Of the 600 marine fish stocks monitored by FAO:*

- 3% are underexploited
- 20% are moderately exploited
- 52% are fully exploited
- 17% are overexploited
- 7% are depleted
- 1% are recovering from depletion

**> 77% at or beyond sustainable limits**



# Threats to wild fish



Pollution Spill, South Florida



Over-exploitation



Habitat destruction - bottom trawler

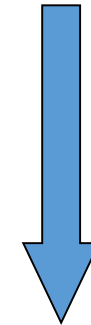


Climate change- melting sea ice

# Response options to such threats

- Physiological acclimation
- Migration
- Adaptation (genetic)

Fast (ecological)



*Rate of  
change*

Slow  
(evolutionary)

Cod in the good old days.....





Fish  
are getting smaller..

1957



*Trophy fish caught on Key  
West charter boats*

1987



2007

# Thousands of Atlantic salmon escape from fish farm into Pacific (The Guardian On-line, August

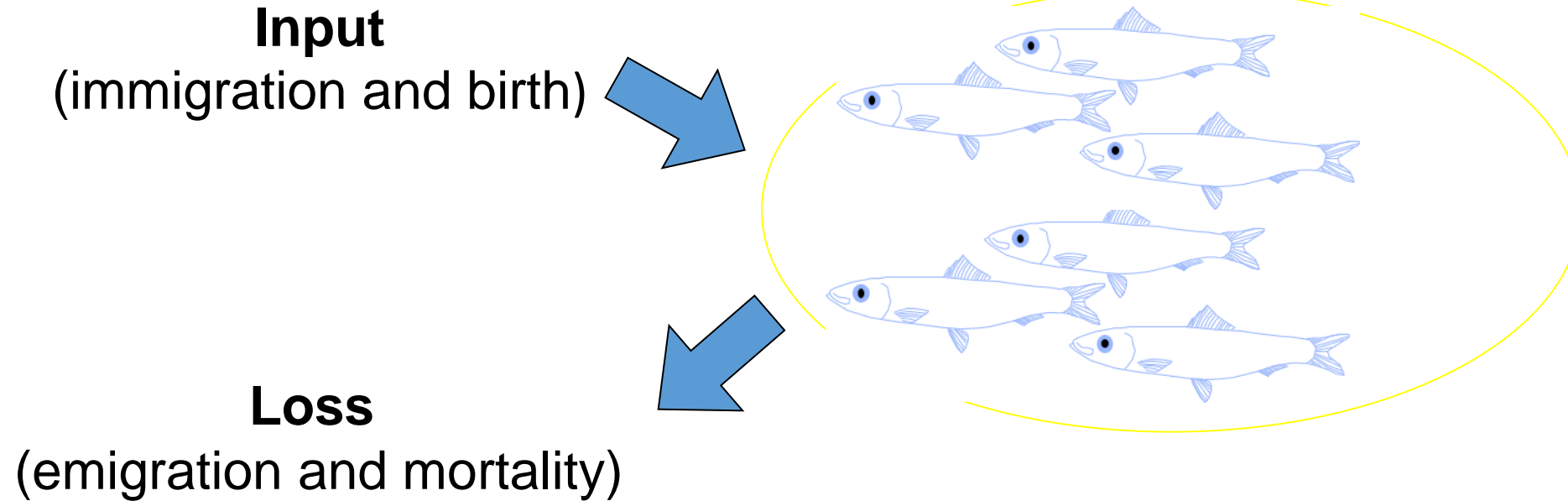
<https://www.theguardian.com/world/2017/aug/24/thousands-of-atlantic-salmon-escape-from-fish-farm-into-pacific>

*A fish farm's net pen failed Saturday afternoon when an anchor pulled loose and metal walkways twisted about. Onlookers said it looked like hurricane debris.*





# Central role of genetics in fisheries biology



**Quantitative change** (abundance)

**Qualitative change** (frequency and composition of genotypes)



**IMPORTANCE OF GENETIC VARIABILITY AND  
LINKS TO ECOLOGICAL TRAITS**

# What are “genetic resources”

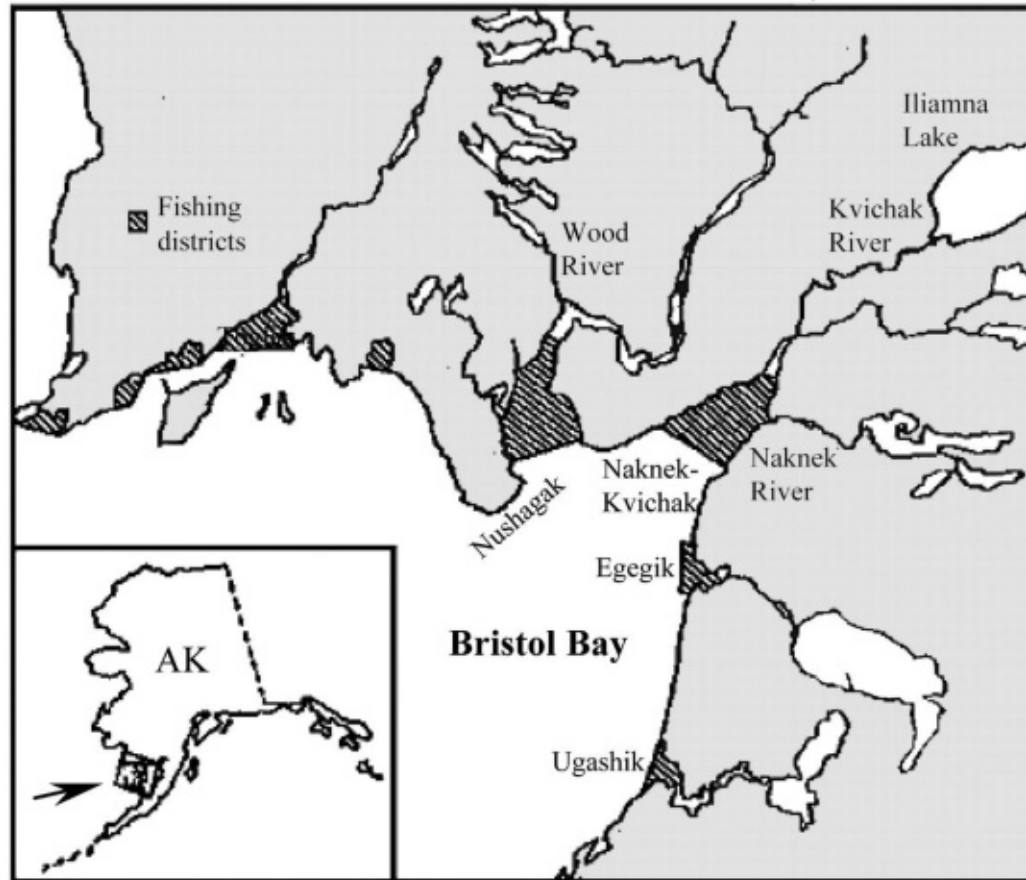
- Extent of allelic diversity at gene loci AND the extent of genetically-based variation (“genotypic variation”) in ecologically-significant traits
- Importance of time-scale and conservation of genetic resources

# Population diversity and biocomplexity: “portfolio effect”

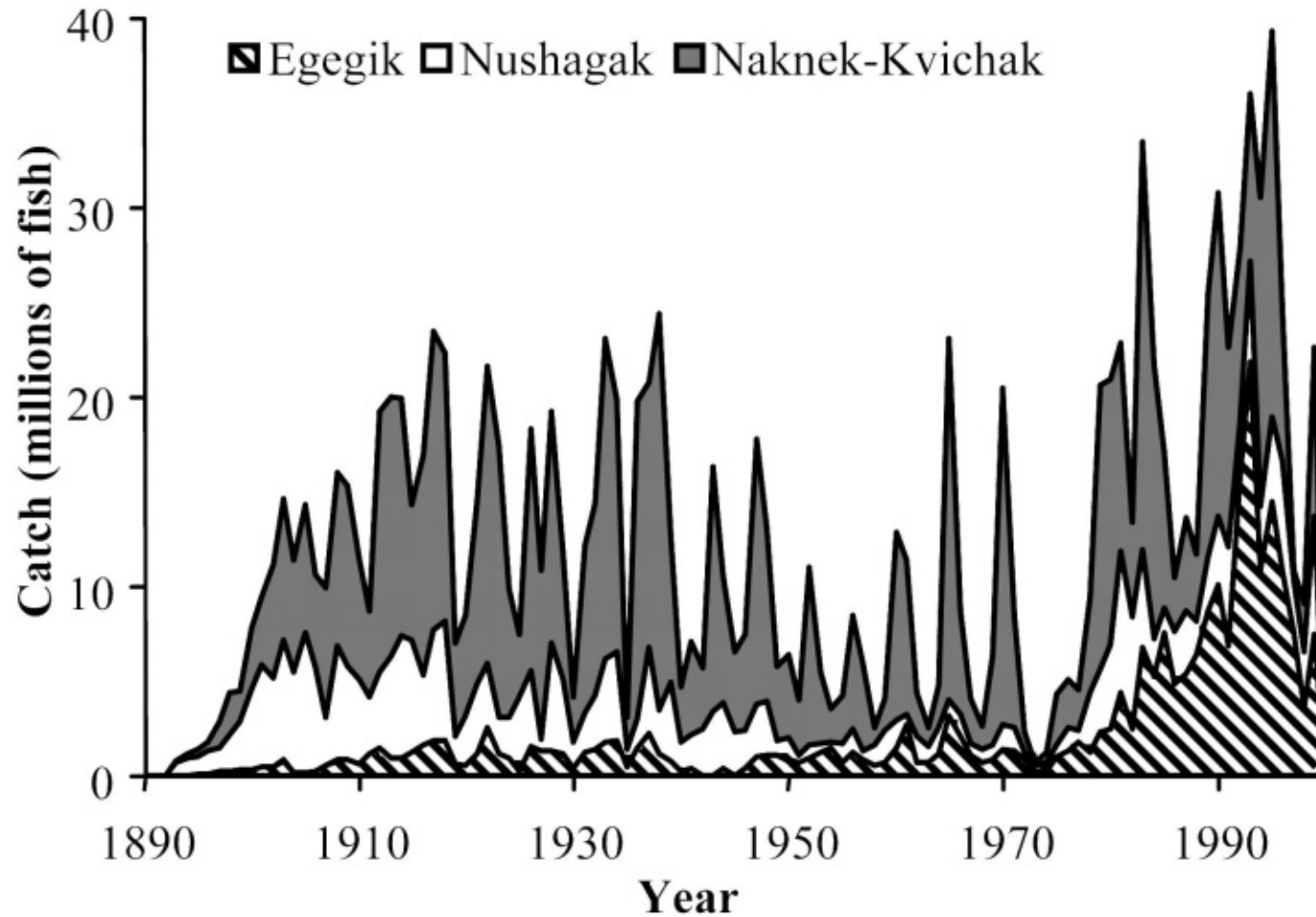
- Individual populations display diverse life history characteristics and local adaptations to spatial and temporal variation – there is a genetic component to these phenotypic differences
- Diverse communities produce more temporally stable ecosystem services because of complimentary or independent dynamics among species **and populations**

# Map of Bristol Bay, Alaska, showing the major lake systems producing sockeye salmon and the associated fishing districts

Hilborn, Ray et al.  
(2003) Proc. Natl.  
Acad. Sci. USA 100,  
6564-6568

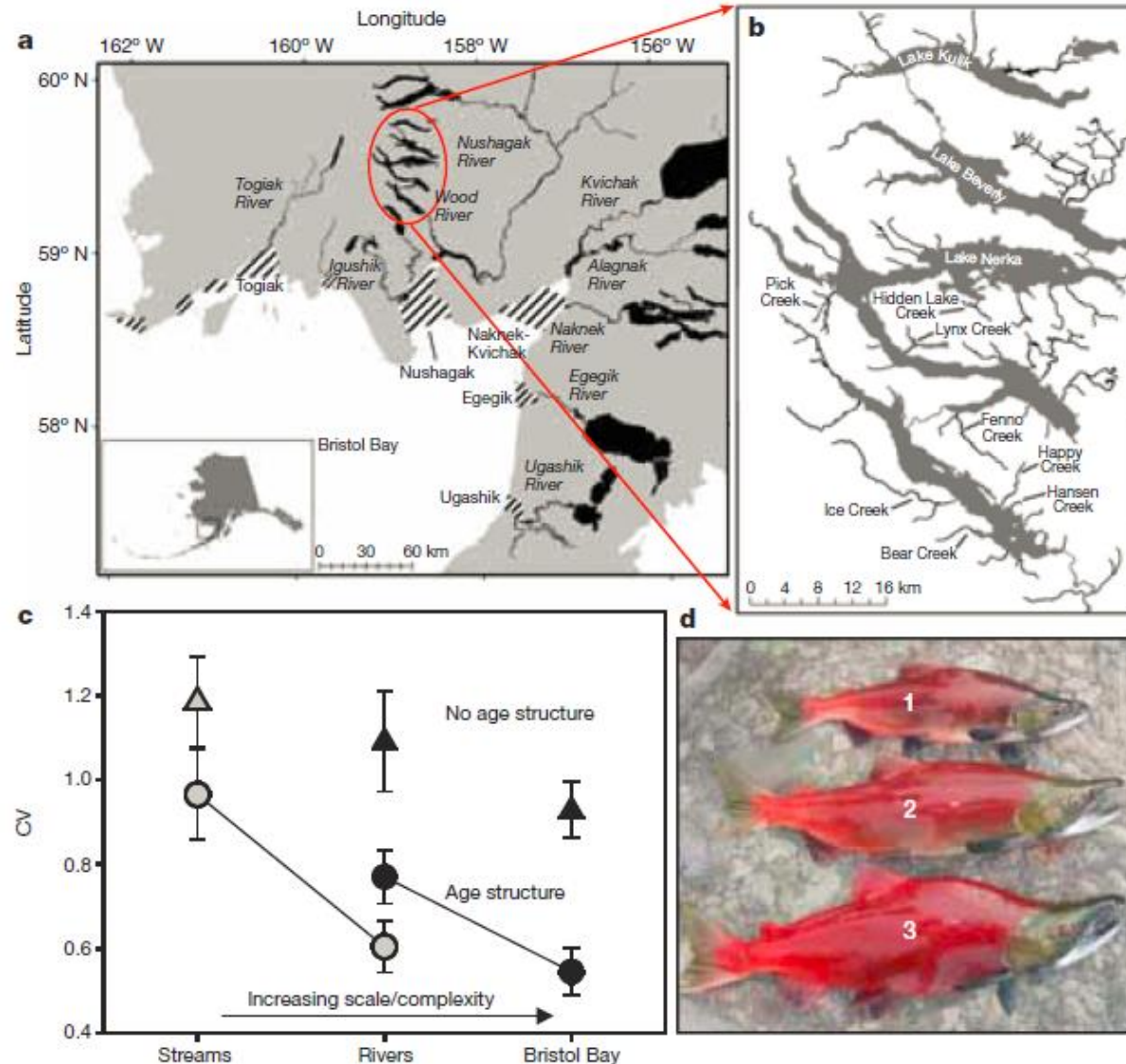


# Distinct stocks dominate different times in the past: *Catch history of the three major fishing areas within Bristol Bay, Alaska*



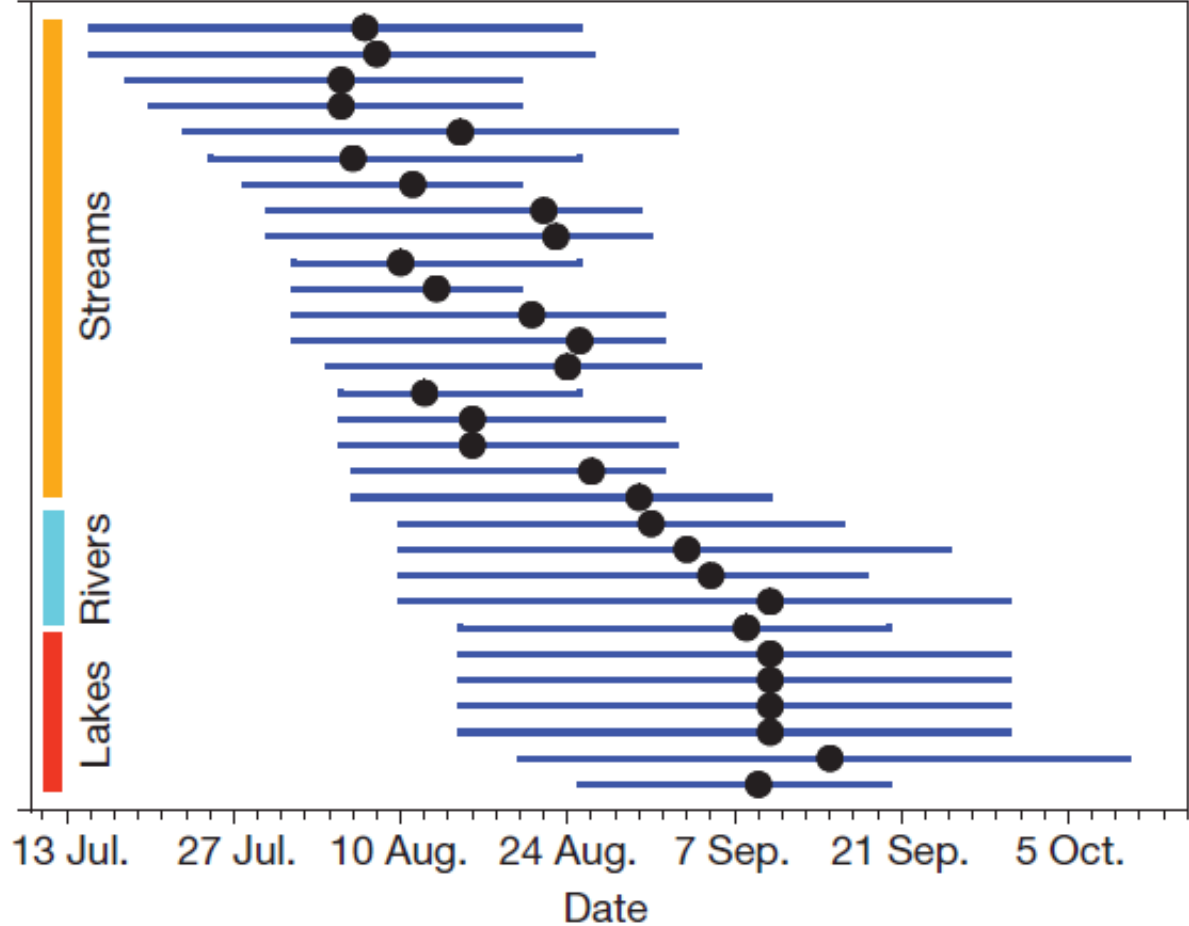
Hilborn, Ray et al. (2003) Proc. Natl. Acad. Sci. USA 100, 6564-6568

# Portfolio effect in sockeye salmon (Schindler *et al.*, 2010)



*Nature*, **465**, 609–612, (03 June 2010), doi:10.1038/nature09060

# Annual run timing to fishing districts and streams



Estimate: 2.2 times fewer salmon returns if a single homogeneous population .....

**Would lead to**  
**10 x more fisheries closures!**