
Aquaculture in Ontario

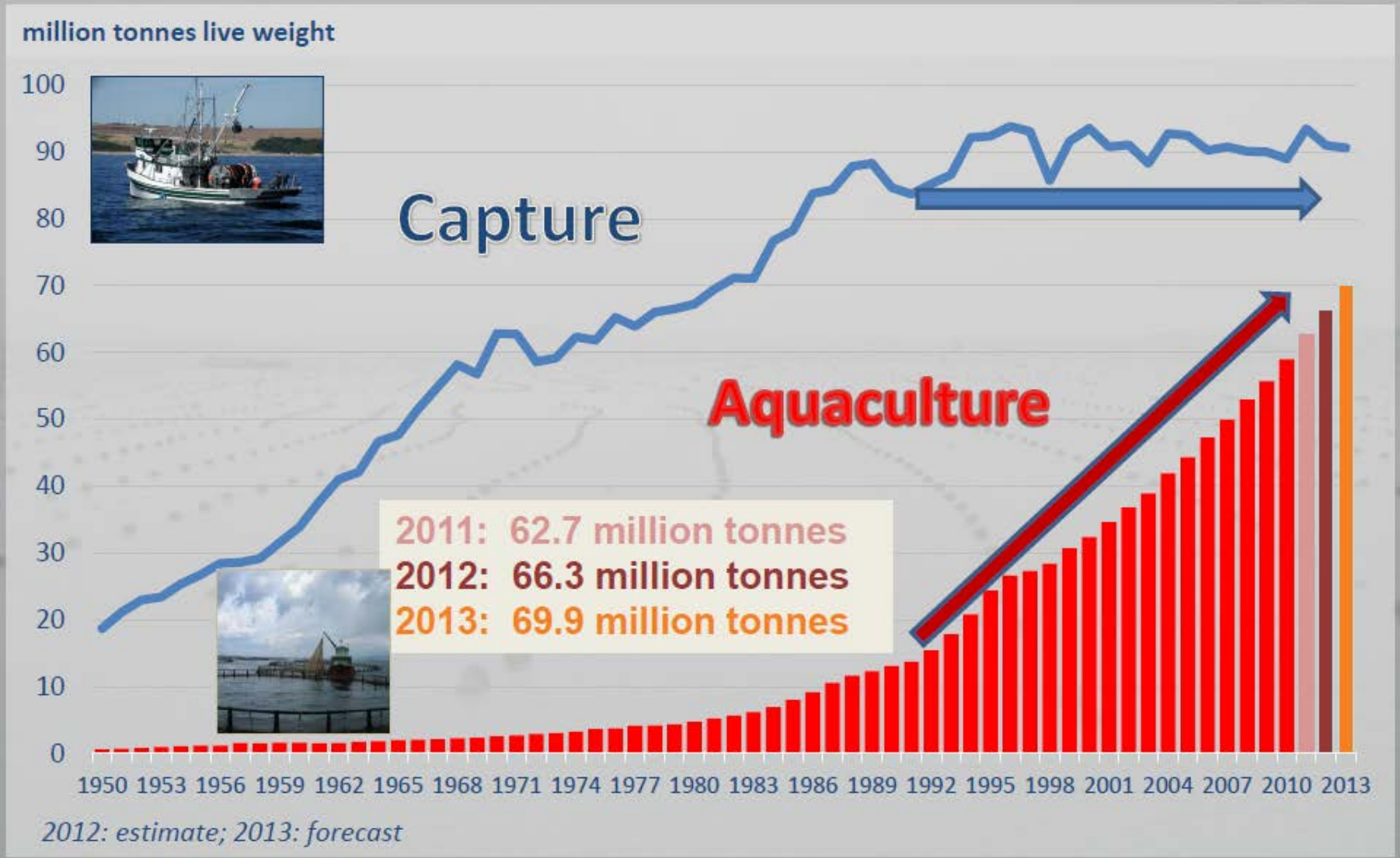





Where Does Our Fish & Seafood Come From?

- Historically – our lakes and oceans
- When we needed more, we just fished
  - Harder,
  - Longer,
  - Deeper
  - or Further Away

Seafood Production



Courtesy R. Subasinghe, FAO 2014

Why Aquaculture?

- Demand for seafood exceeds fisheries capacity
- Represents a sustainable and healthy source of food
- Provides a means to rehabilitate wild populations

- 10 years from now aquaculture will need to increase by 50% to supply the growing demand for seafood. There is no possibility to increase wild capture fisheries worldwide.


fish 42 mT (63% in value)
Courtesy John Bostock


molluscs 14 mT (12 % in value)


crustaceans 6 mT (21% in value)


seaweeds 21 mT (4% in value)
Courtesy Ferenc Lévai






Benefits of Aquaculture

- Economic development in rural and coastal communities
- Year-'round operations
- Capability to produce to meet market demand and consumer needs
- Expanding domestic and international markets
- Enhanced balance of trade (exports)
- Non-extractive, renewable resource industry
  - i.e. sustainable development
- Considerable un-developed potential
- Augments productivity of entire fishery sector





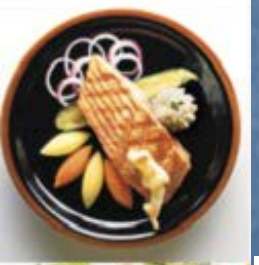

Common Challenges to Aquaculture Development

- Opportunities awareness
- Access to financing
- Training & skills development
- Availability of objective information
- Capacity to develop opportunities
- Infrastructure, transportation costs & economies of scale in often remote locations

Regional Distribution of Aquaculture







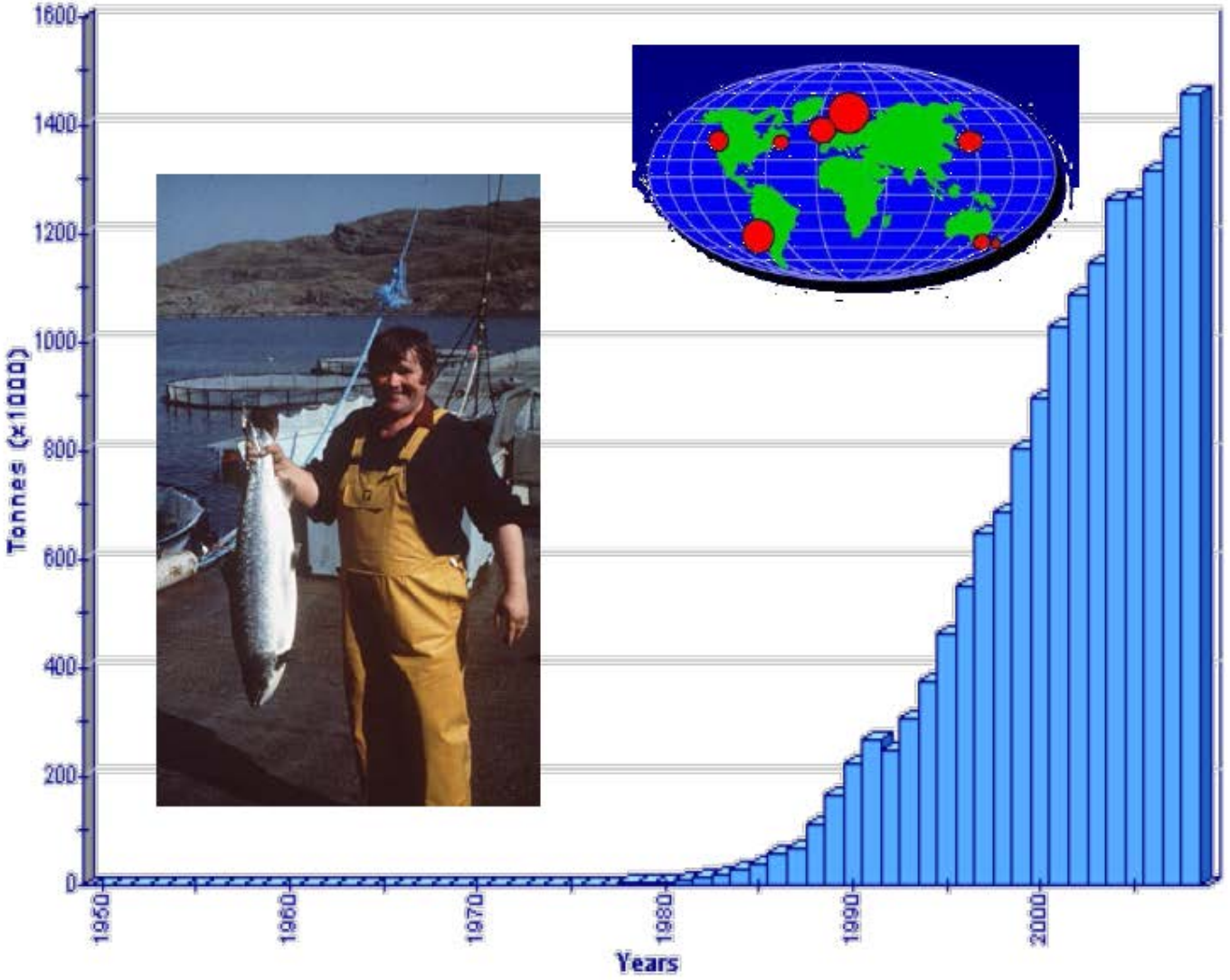

Salmon (72%)

Trout (4%)

Oysters (6%)

Mussels (14%)

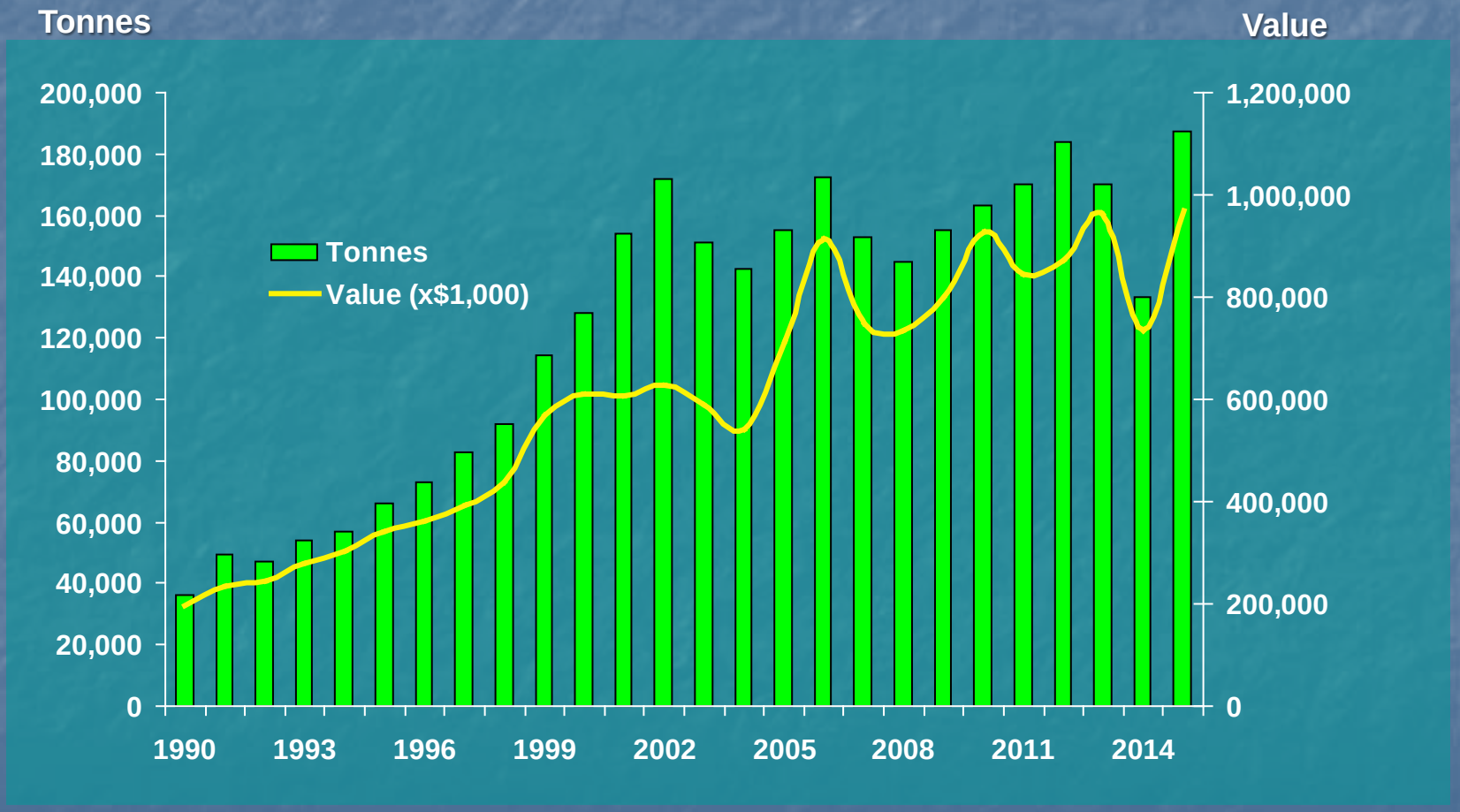
WORLD SALMON PRODUCTION








Canadian Aquaculture (farm-gate)



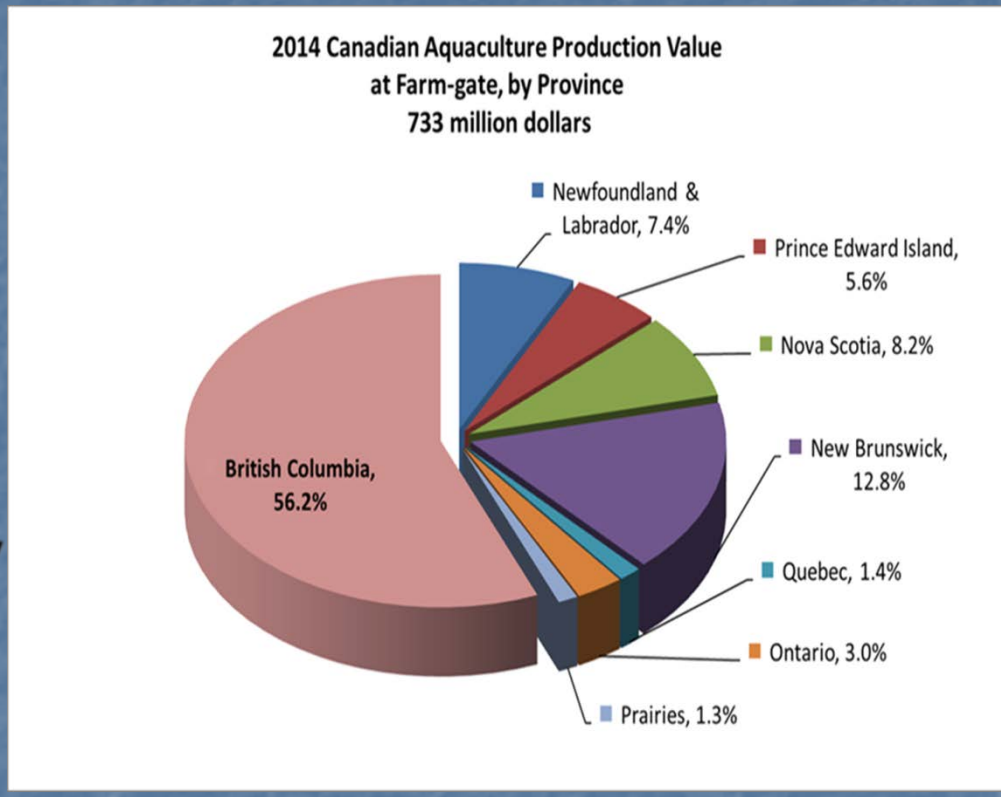
Data taken from Statistics Canada.
Excludes production in Manitoba, Saskatchewan, and Alberta.






Output by Province

- BC leads provinces
  - 54% of total output
  - 95% salmon
- NB is second
  - 25% of total output
  - 98% salmon
- NL & NS also mainly salmon producers
- PEI mainly mussels

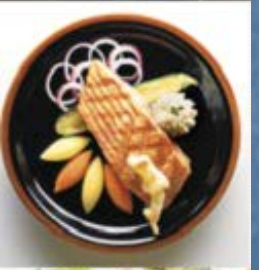


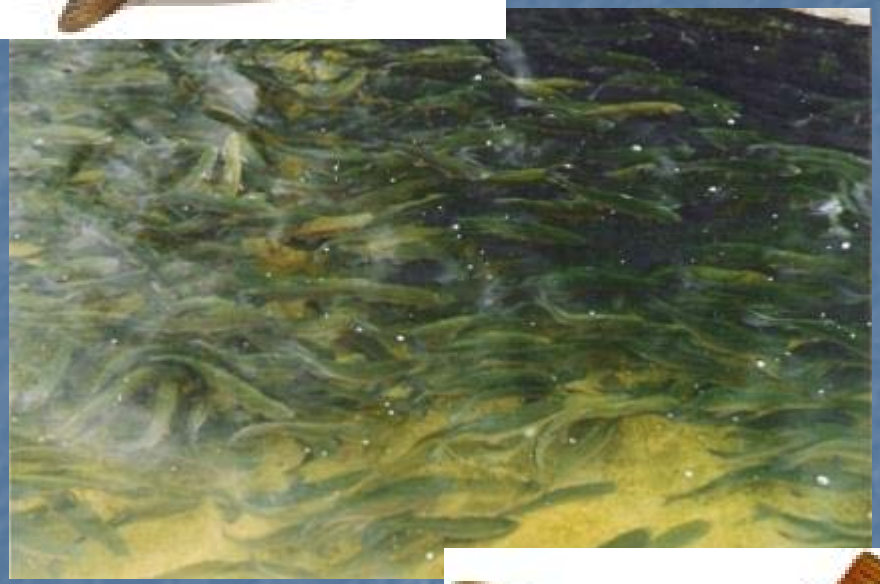
- **ON, QC & Prairies produce mainly trout**

Trout & Charr Aquaculture







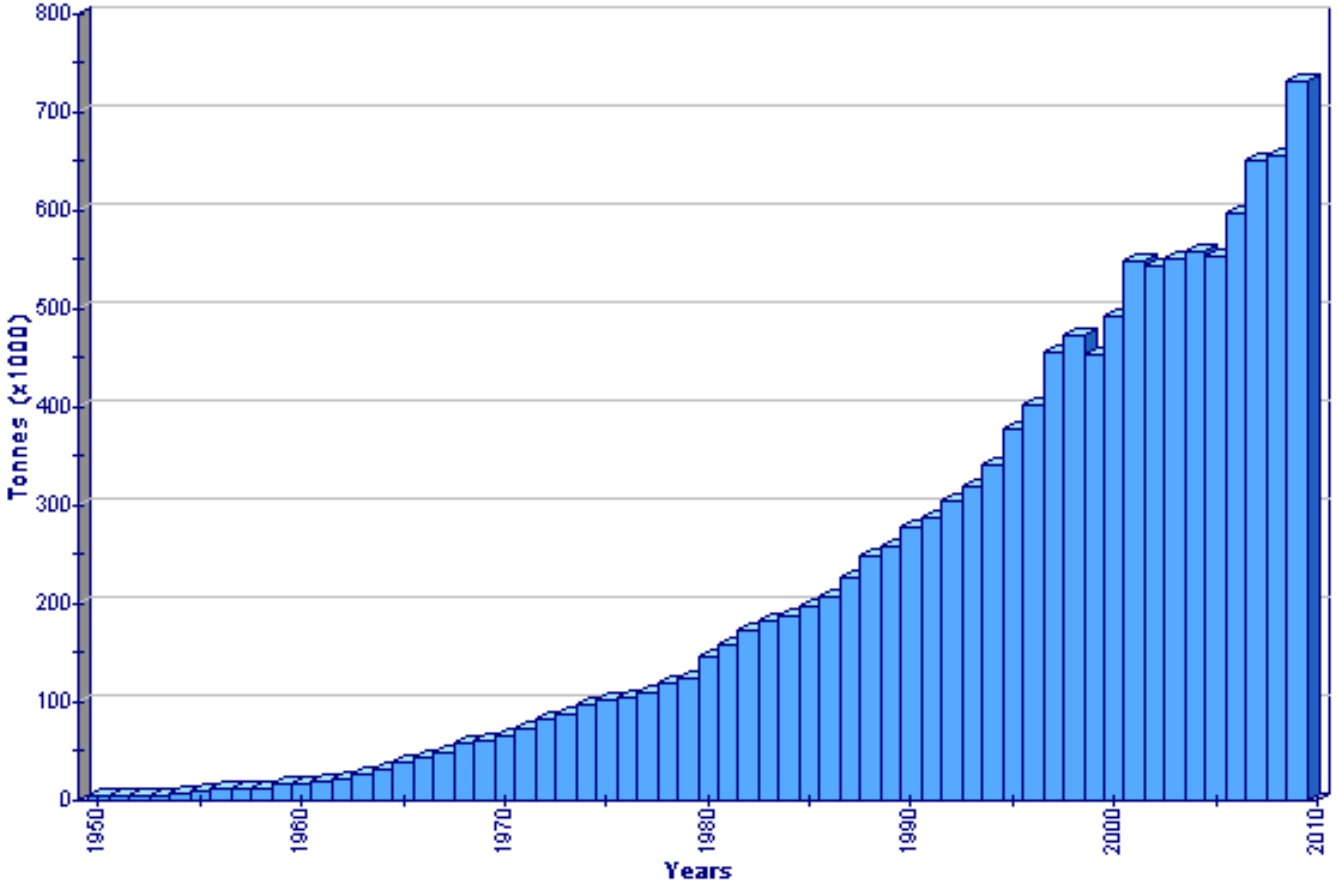




We raise these!

- Introduced by fisheries managers into all the Great Lakes from the west coast

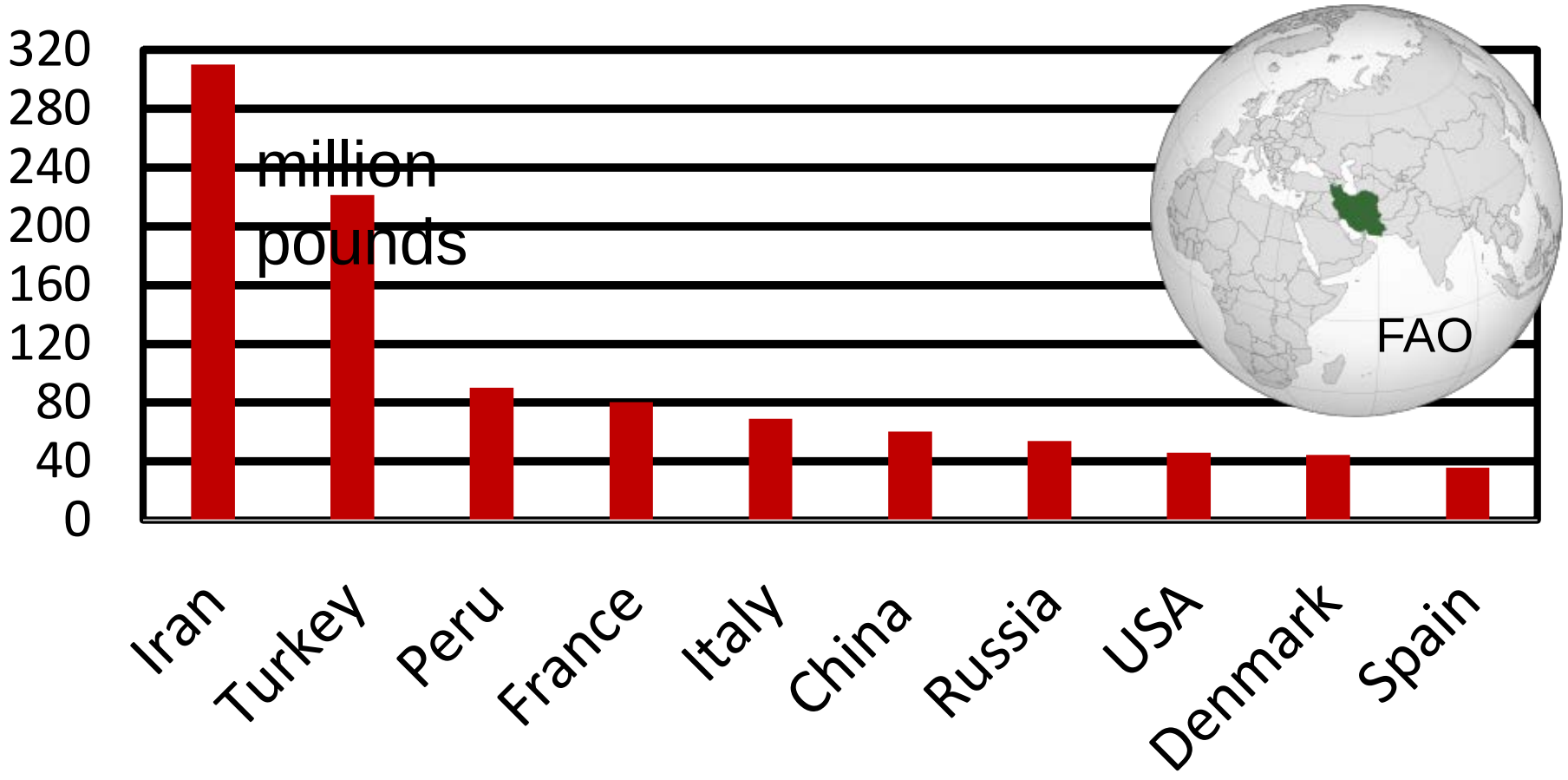
- Genetically plastic, hardy
- Small scale escapes not an issue
- Naturalized

World Production of Rainbow Trout



2009 production of 732,432 tonnes (23% increase over 2006)
2011 production of 770,385 tonnes (31% increase over 2006)

2015 Top 10 Trout Producing Countries



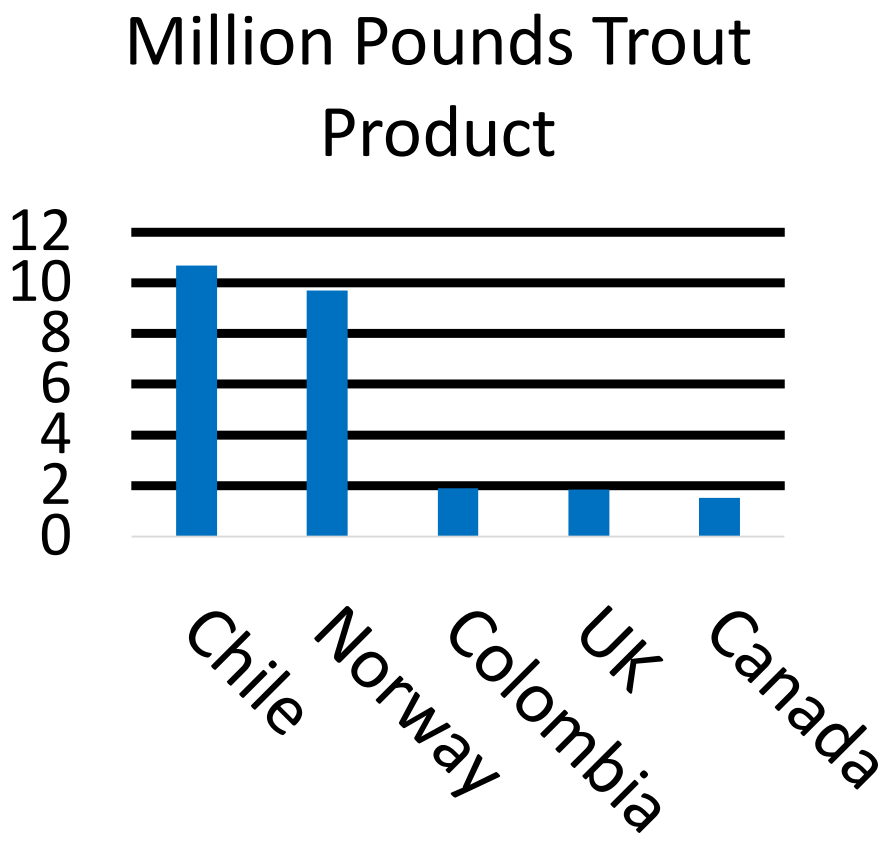





The abundant potential...

- 20% of the world's freshwater,
- Plentiful biophysical resources,
- Developed culture technology,
- Still not meeting domestic demand,
- Substantial export potential with proximity to the U.S. market,
- The industry has the experience, expertise and desire to support development.

US trout imports - 90 % of 2017 Imports came from…

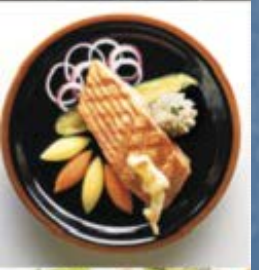


…relative to 2016: 10% down pounds
12% up dollars

NMFS



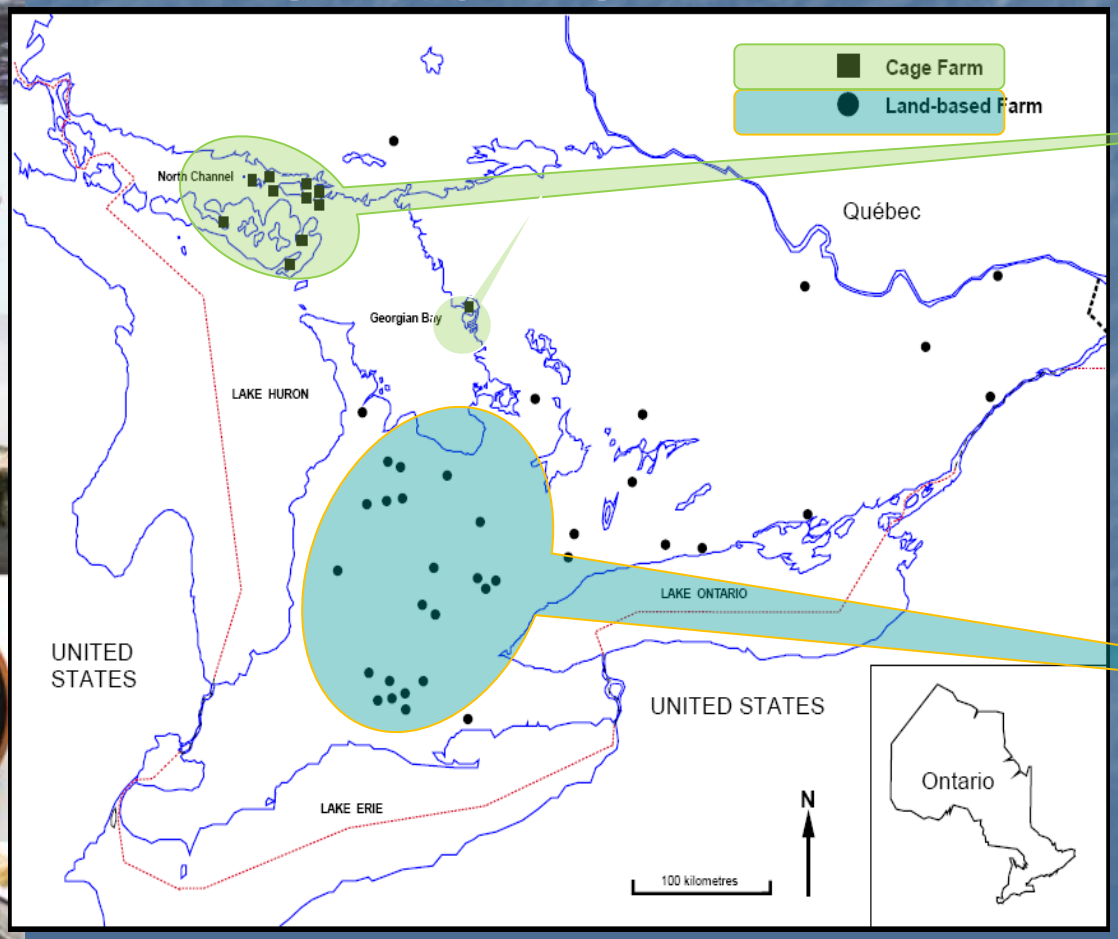


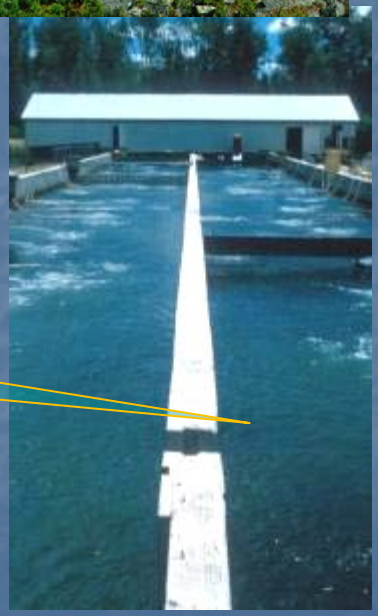



Why Rainbow Trout?

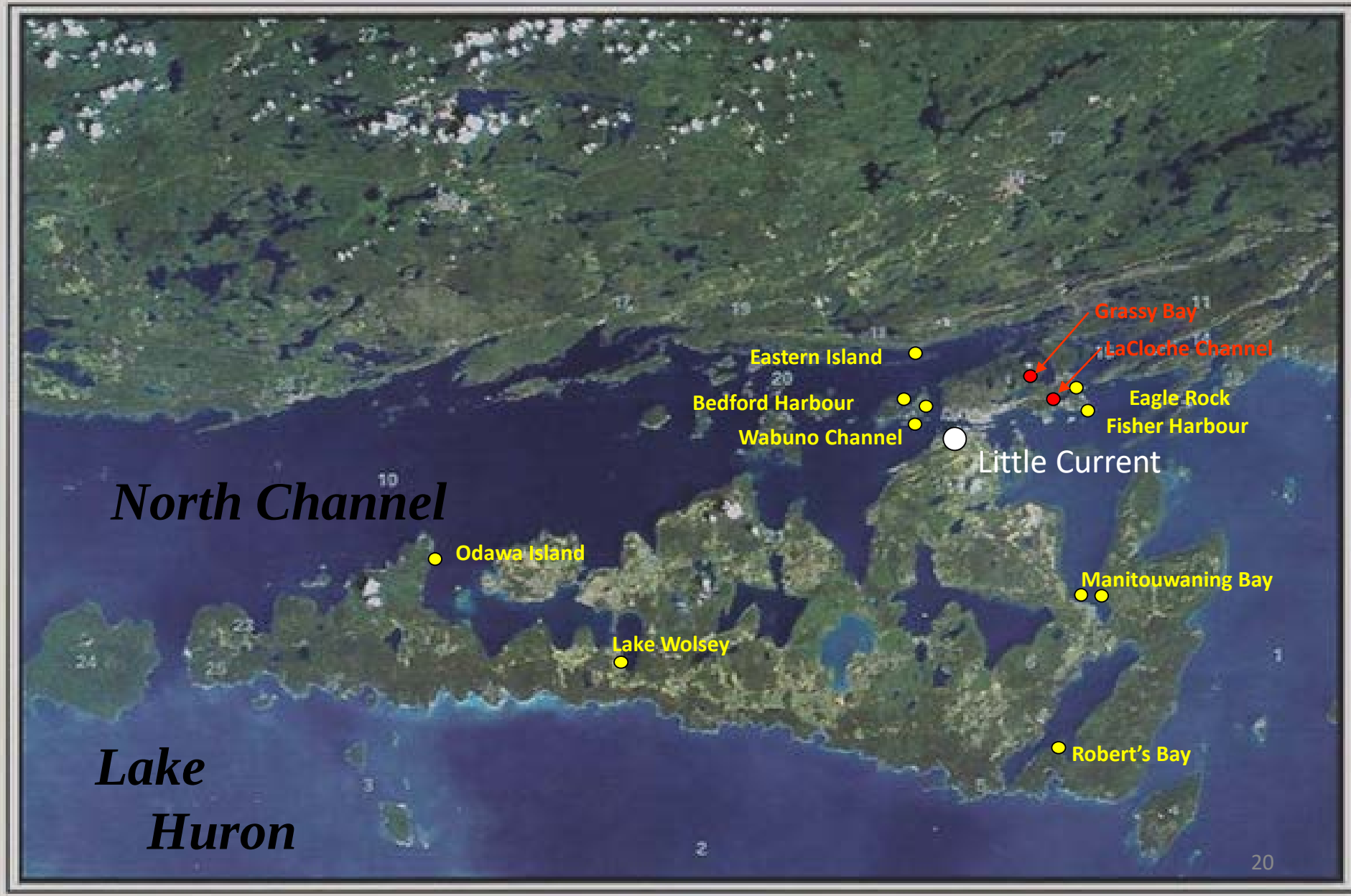
- Culture techniques, based on more than 100 years of research and practice, are well established;
- Domesticated strains of trout have been bred to improve performance and yield;
- Nutritional requirements are well defined and efficient commercial feeds are available from several suppliers;
- Water temperatures and the biophysical resource base throughout much of Canada are near ideal for the species;
- An established market exists for rainbow trout; and
- Naturalized species in most parts of the country and thus poses little to no genetic threat to feral populations.

Distribution of Trout Farms in Ontario

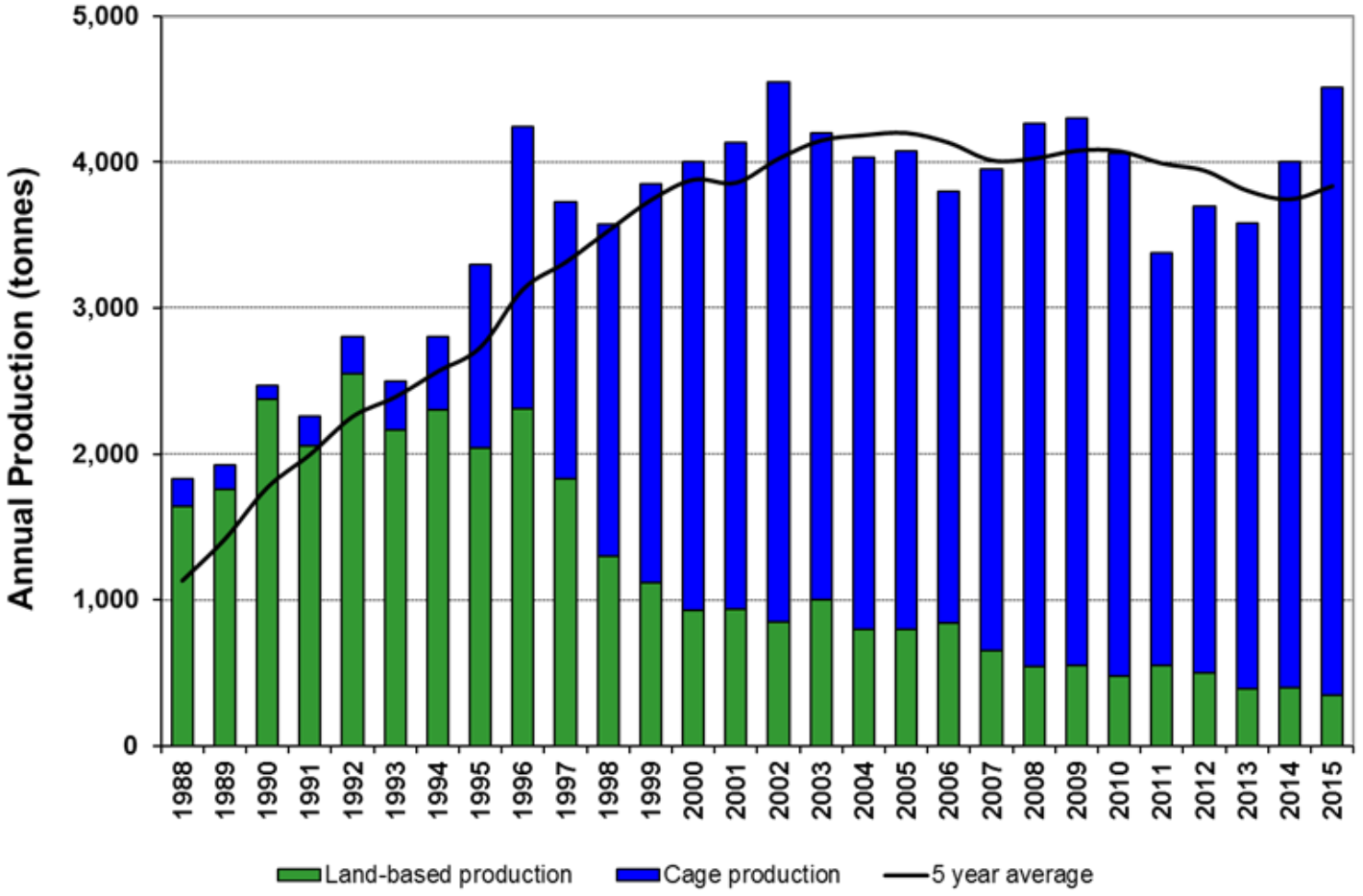




THE NORTH CHANNEL - MANITOULIN ISLAND

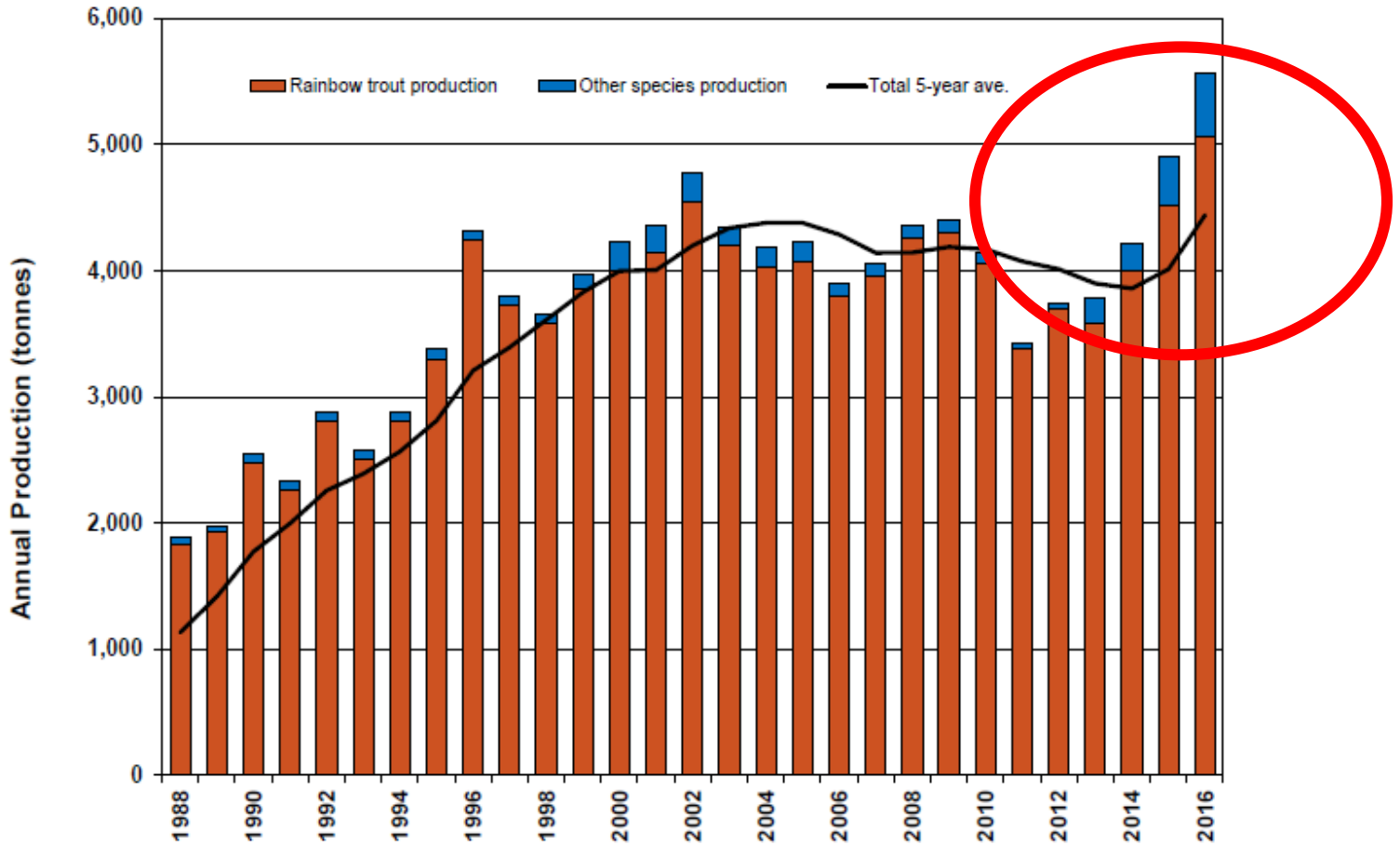


Ontario Farmed Trout Production

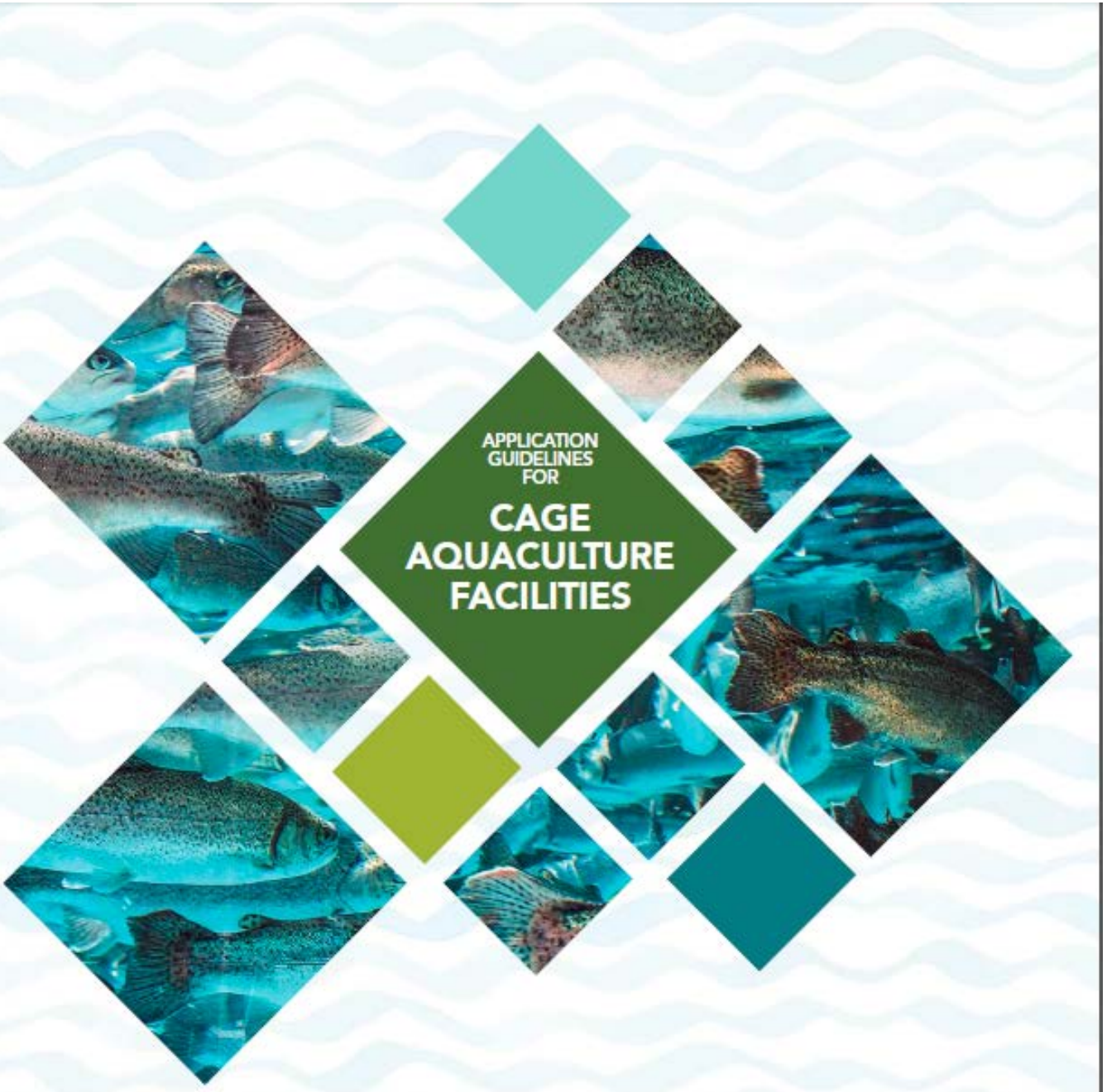


Ontario Aquaculture Production

Figure 1. Ontario aquaculture production between 1988 and 2016.



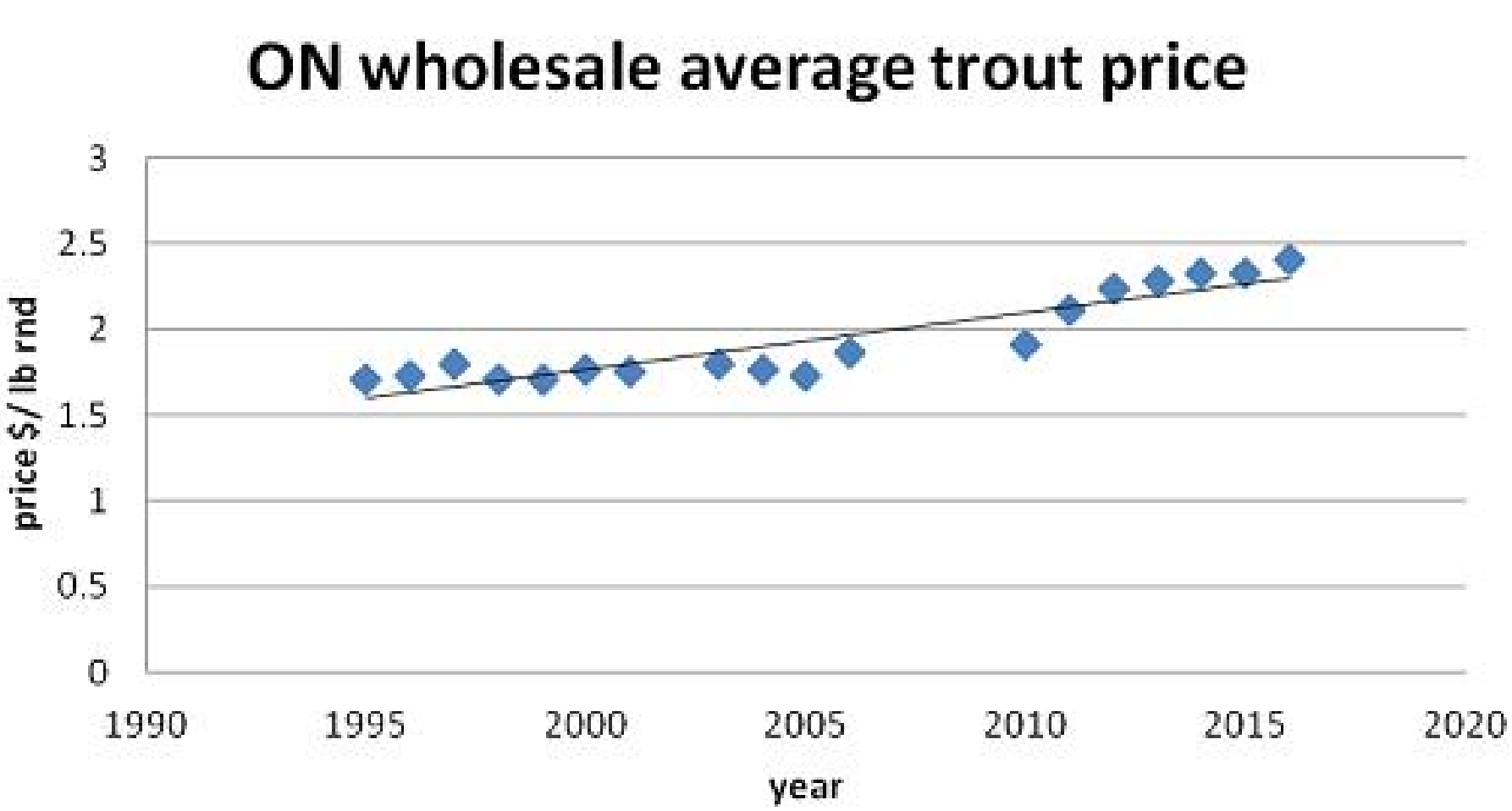
Moccia and Bevan, Aquastats, 2017


APPLICATION
GUIDELINES
FOR
CAGE
AQUACULTURE
FACILITIES

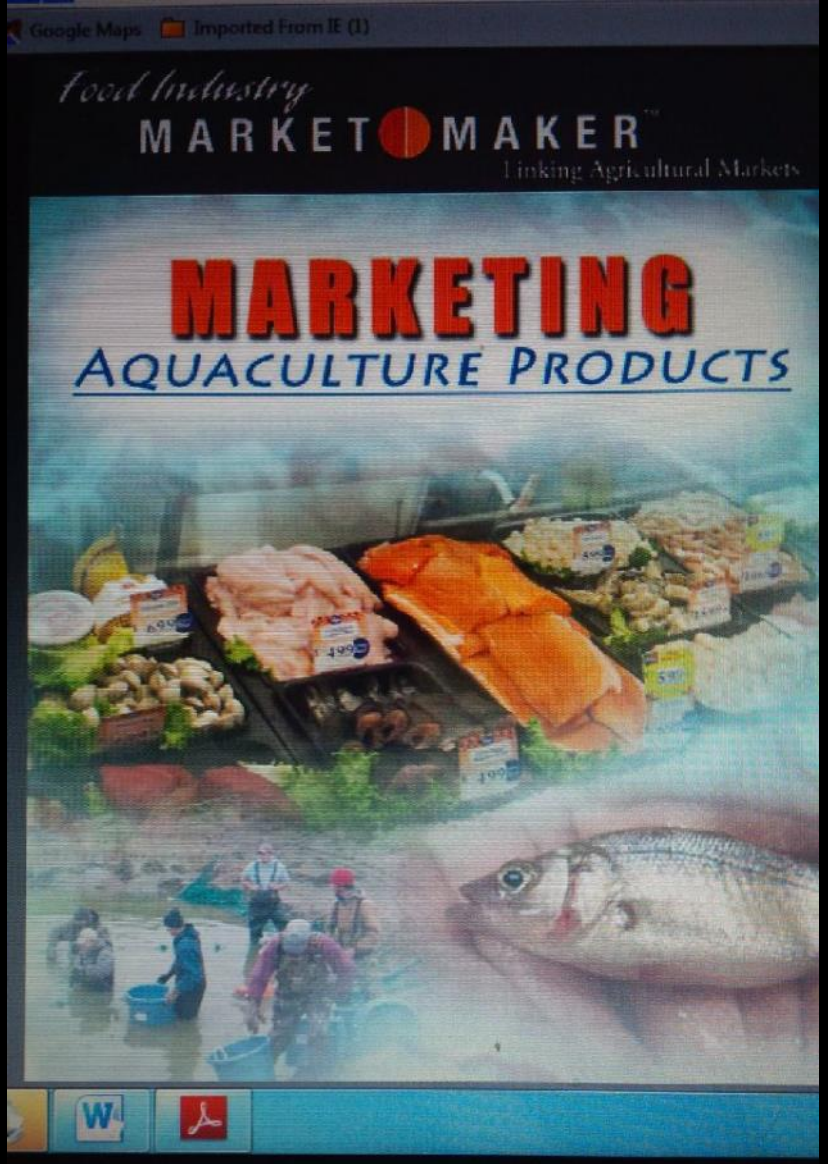
Industry Consolidation over the last several years

Ontario Aquaculture Association (formerly NOAA)

ontarioseafoodfarmers.ca



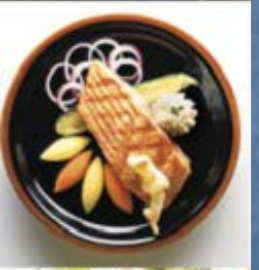
- 2018 wholesale net pen in the round farm-gate ~$2.45 for 2-3 pound fish
- **Land-based farms up to $10/lb –** niche marketing, local
- Price predictability – supply limited



http://www.ncrac.org/files/MarketMaker-Pub-0034.pdf








Market Factors - Consumer Trends

- Safety
  - Contamination; product traceability
- Communications / Media
  - Considerable power to influence consumer behaviour (e.g. salmon); sustainability
- Marketing
  - Consumers influenced most by quality, convenience, value
- Dining out
  - HRI market is dominant
- Sustainability
  - Environmental & Socio-Economic

GTA live fish markets


MAXIMUM
SEAFOOD
A Division of MedEx. Inc.
189 Westcreek Drive Vaughan, Ontario L4L 9N6
905-265-0441
TRAILSTAR


FIRST CHOICE
冠 業 超
FIRST CHOICE
必發
Beaver Fishery INC.
128 MILNER AVENUE, SCARBOROUGH, ONTARIO. CANADA M1S 3R2
(416) 332-2888
www.beaverfishery.com
Beaver Fishery
TESCO


ONNEL ONLY
非請勿進
TONE TAI
Live Stripe Bass
游水鱸魚
$7.59/LB


IN-STORE SPECIAL
本店特價
LIVE AUSTRALIA
BARRAMUNDI
游水澳洲桂花魚
7.99 /lb
IN-STORE SPECIAL
本店特價

鼎泰 TONE TAI

Fresh Australian Bass

桂花魚

$2.99/LB

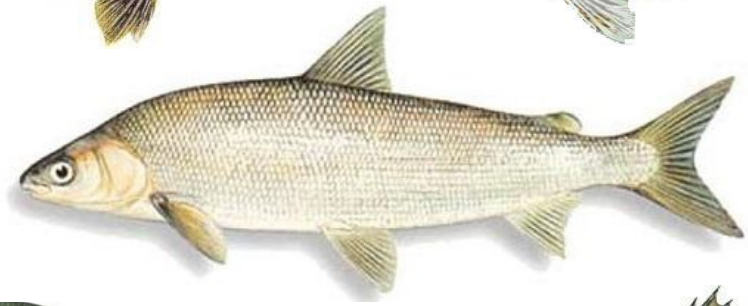
鼎泰


Live Green Bass
游水青斑
$9.99 /LB
AUTHORIZED PERSONNEL ONLY
工作場所 非請勿進


IN STORE SPECIAL
FRESH GREEN BASS
本周新鮮青斑魚
特價
不劏: $3.29/LB
NO CLEAN:
劏:
CLEAN: $3.59/LB
原價：$5.99/LB

Potential “New” Species

- Sturgeon
- Walleye / Saugeye
- Whitefish
- Bass
- Pacific White-legged Shrimp



Pacific White Shrimp

planet shrimp

First Ontario Shrimp

GOOD4U shrimp

Largemouth Bass - Biology and Culture

- Female Largemouth Bass do not always lay all their eggs in one nest. Producers stock more males then females in spawning pools, to increase the likelihood of fertilization.
- Males take the role of guarding nests from predators
- There is no common accepted method of culture.
- Most are farmed in ponds, but raceways may be used too.
- Characteristics including their large mouth, cannibalistic tendency and resistance in accepting feed makes this species a challenging species to culture.

http://www.ncrac.org/NR/rdonlyres/A2E438CC-7C9E-42AE-8B18-219E0066A92D/0/lgmouthbass32900.pdf

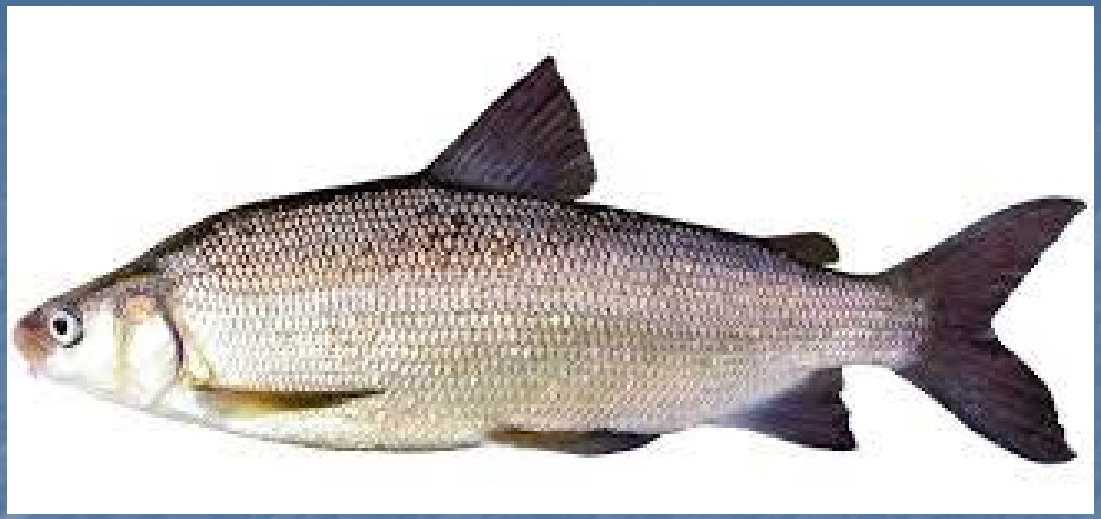
Walleye Culture

- In the last several years techniques have been developed to successfully raise walleye to market size in recirculation systems - from eggs to a 1 kg

- No longer need a fingerling pond production phase.

2 day walleye culture workshop March 2016
- Presentations available through Nick/Steve

Whitefish Culture



- In the last decade techniques have been developed to successfully raise whitefish to market size in recirculation and flow through systems - from eggs to market size.

- Current project looking at open water net pen farming techniques has been promising.

Yellow Perch (Perca flavescens)

- In Canada, this cool-water species can be found in Nova Scotia, Quebec, the Great Slave Lake of the NWT, various watersheds of BC and is especially abundant in the Manitoba & Great Lakes.

- Important both recreationally and commercially, the yellow perch features white, flaky flesh that is common in popular “fish and chips”.

Pacific White Shrimp

planet shrimp

First Ontario Shrimp

GOOD4U shrimp

Organic Aquaculture Production – Standards under CGSB

Meeker’s Aquaculture, Lake Wolsey - Certified Organic

Seafood Certification Programs

Trout & Charr Aquaculture

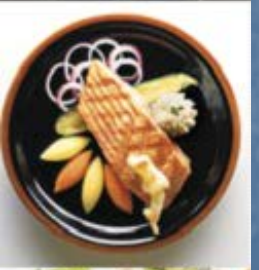






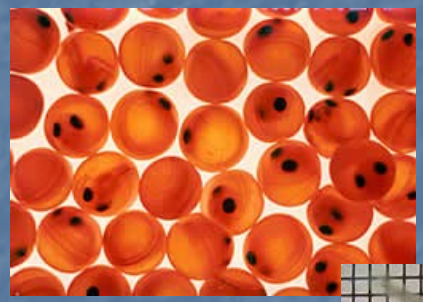




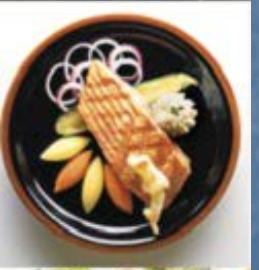

Rainbow Trout / Arctic Char Production Cycle

- Ova
  - Commercial hatcheries
  - Selected brood stock / strains
  - Hatch in 30-100 days
- Sac Fry
  - Absorb nutrients from yolk
  - ~60 days
- Fingerlings
  - Moved to large tanks or cages at ~10-20 grams
- Harvest
  - On-growing for 12-16 months
  - 0.9 – 1.5 kgs
  - Two 8-12 oz fillets per fish








Reproduction
Egg & Milt Collection

- Eggs available 12 months per year from
  - Ontario Hatcheries
  - Troutlodge (Hendrix Genetics)

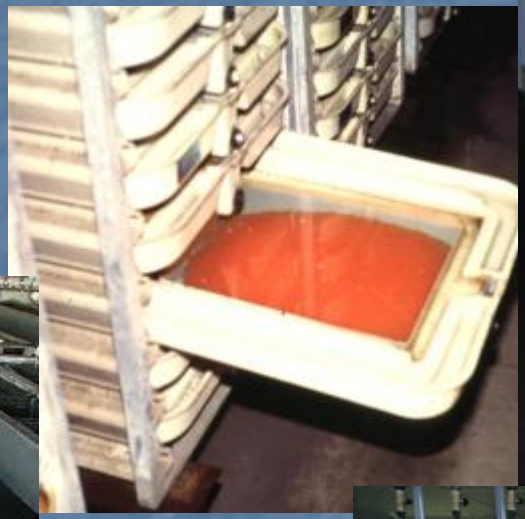




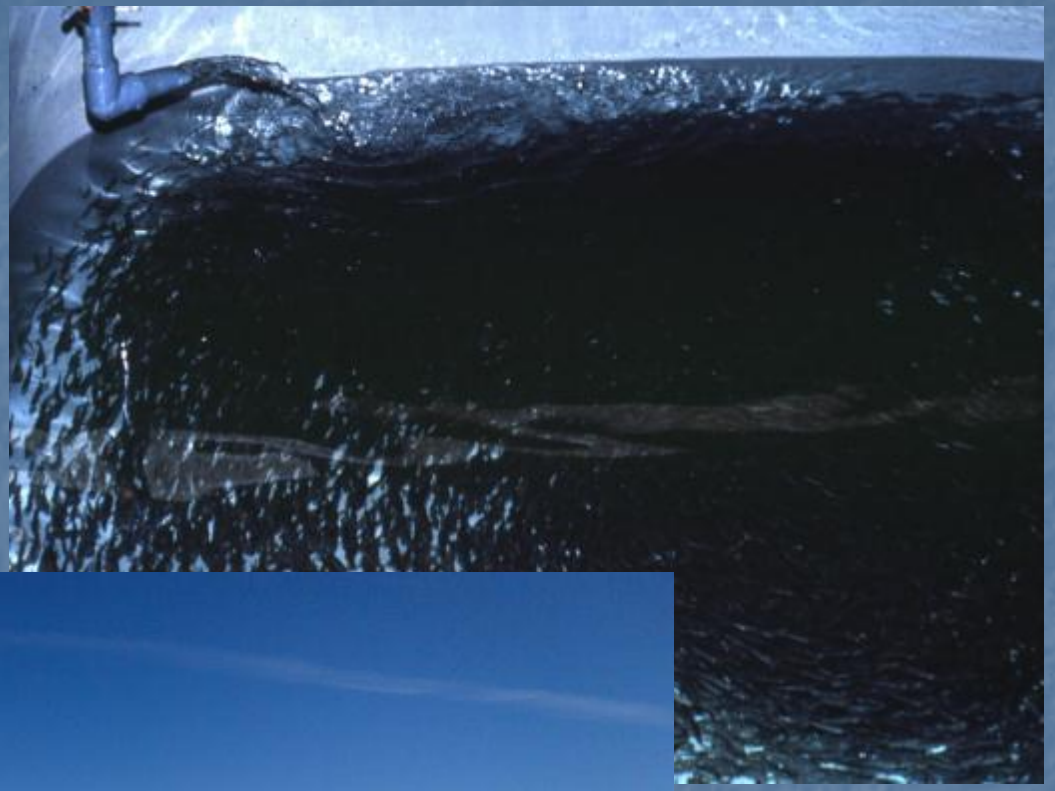


Hatching

- Eggs typically hatched in troughs, tray incubators or bell jars

Fingerlings



Most of our trout now come from Indigenous fish farms

Net Pen Farms and the Environment?

Enhancement of lake fish populations as a by-product of cage aquaculture

Results of five years of rainbow trout cage aquaculture at the Experimental Lakes Area, northwestern Ontario

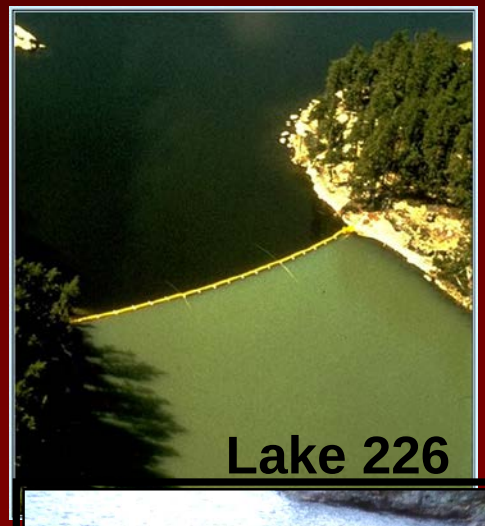
Ken Mills

Fisheries and Oceans Pêches et Océans

Canada

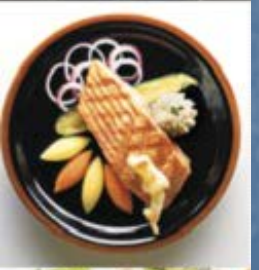
Experimental Lakes Area
(Dept. of Fisheries & Oceans)

- Established in 1968
  - **Controlled experiments to address aquatic issues**

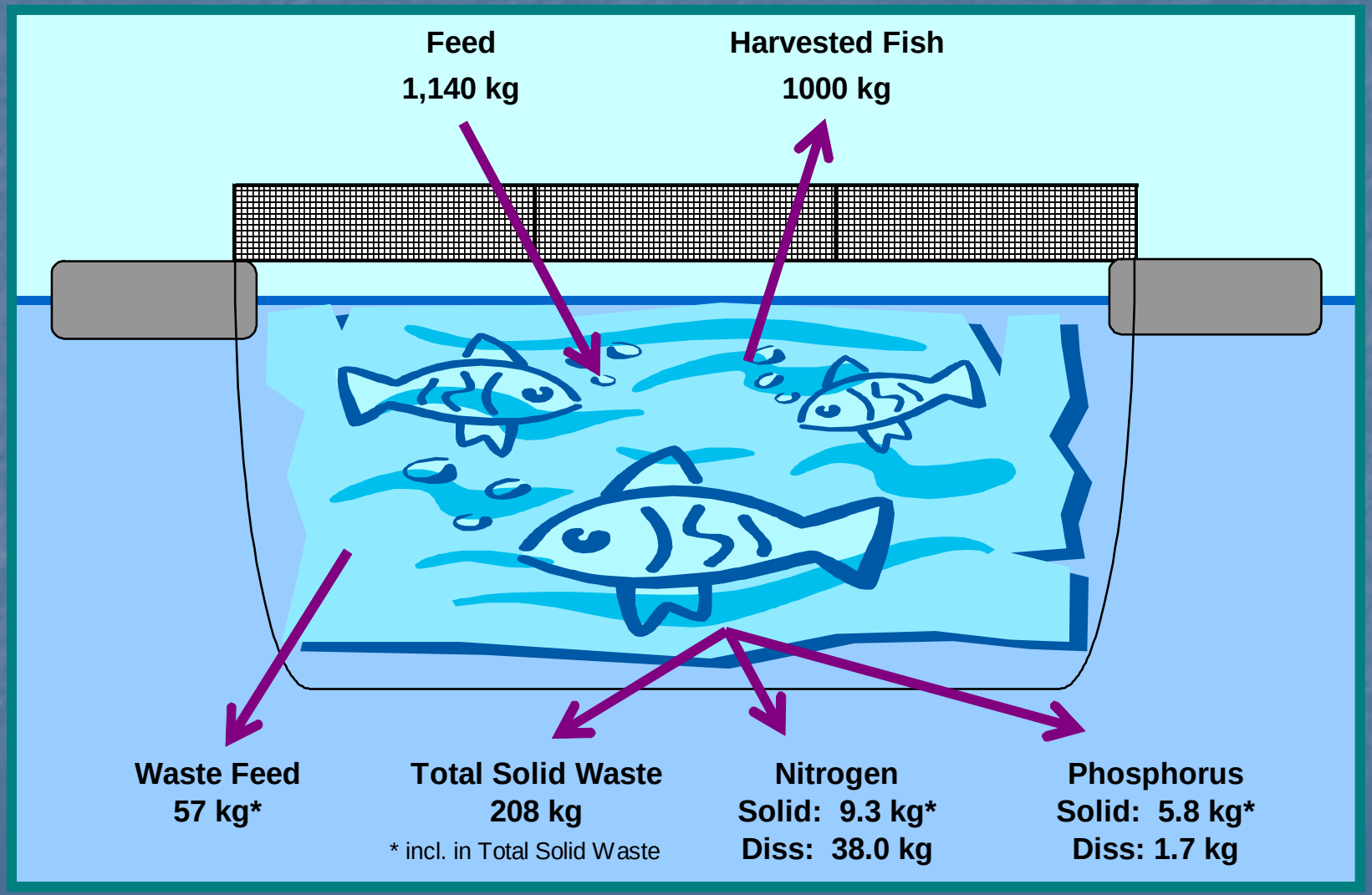









When you feed fish ...



Lake 375 Cage Aquaculture (2003 – 2007)

Approximately 10,000 rainbow trout cultured each year

Added as fingerlings in the spring and harvested each fall

Lake 375
Fish Community

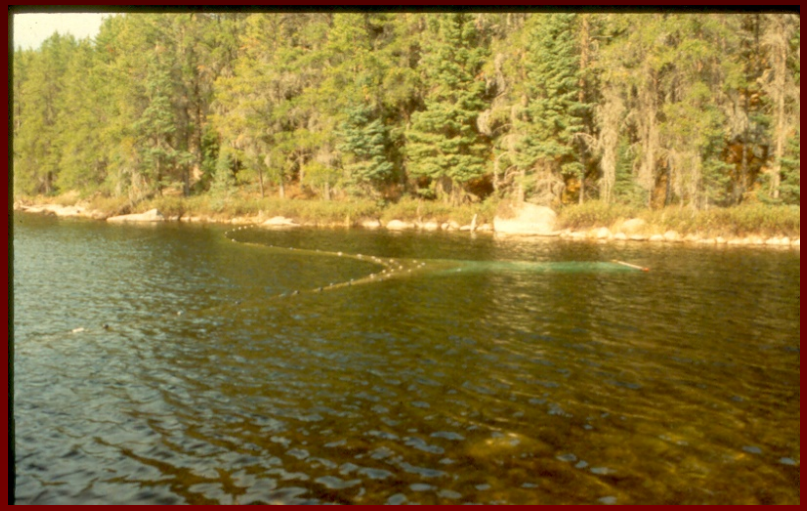
- Abundant (many present)
  - lake trout
  - white sucker
  - fathead minnow
- Much less abundant
  - pearl dace minnow
  - northern redbelly dace minnow
  - finescale dace minnow
  - slimy sculpin

13 Years background data

Fish Population Parameters

- Abundance
- Annual survival
- Recruitment (reproduction)
- Growth
  - Length
  - Fatness
- Age at maturity

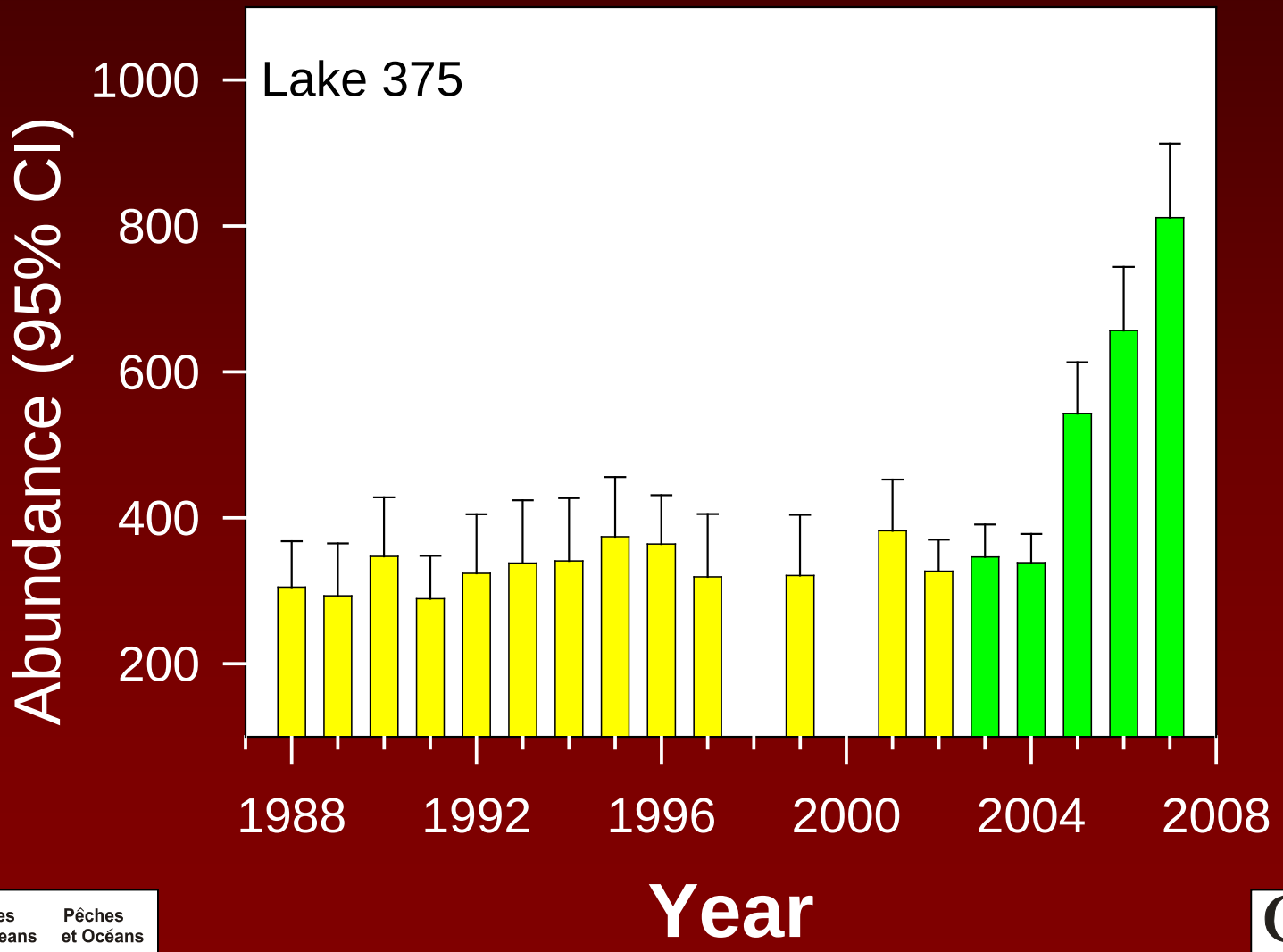
Fish Capture



Lake trout

Lake trout abundance

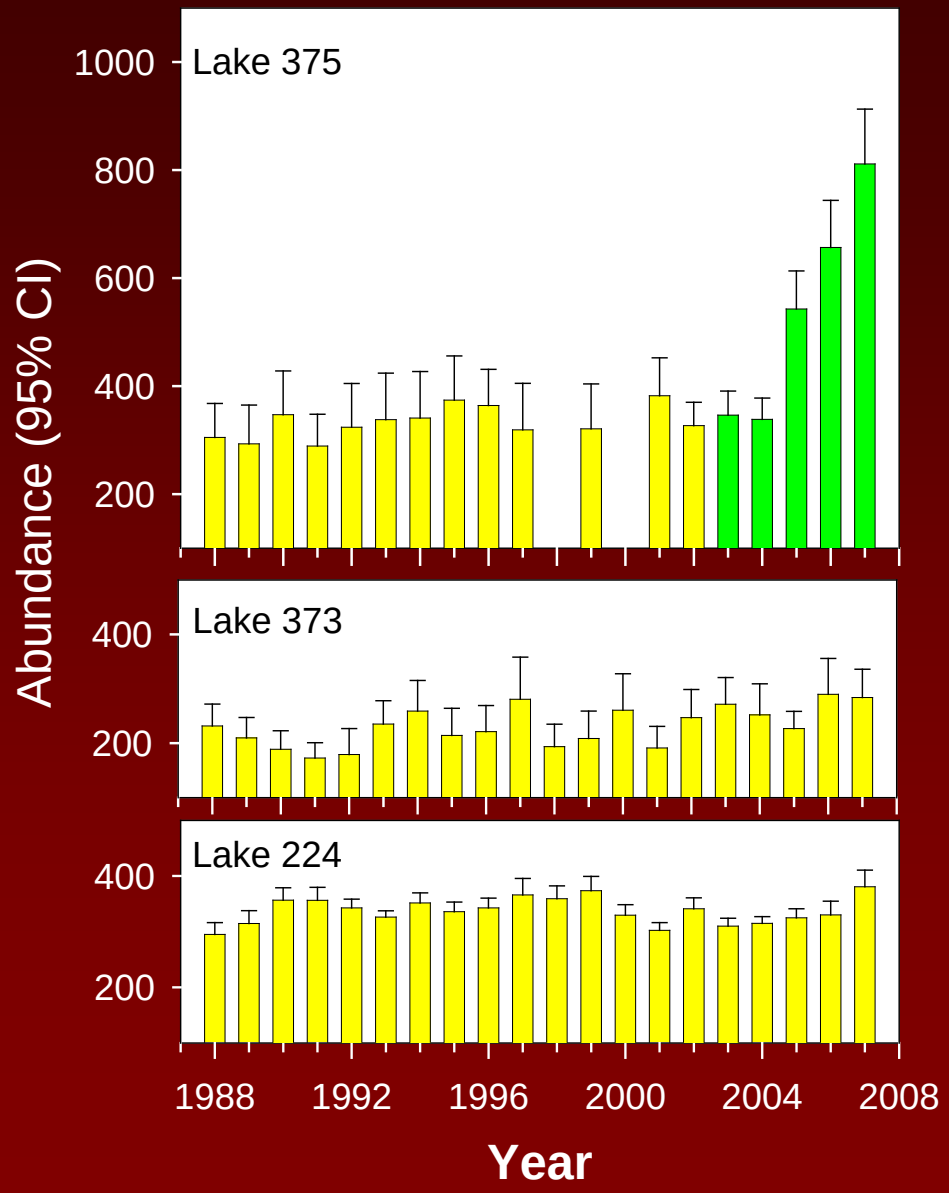
(age 1 and older)



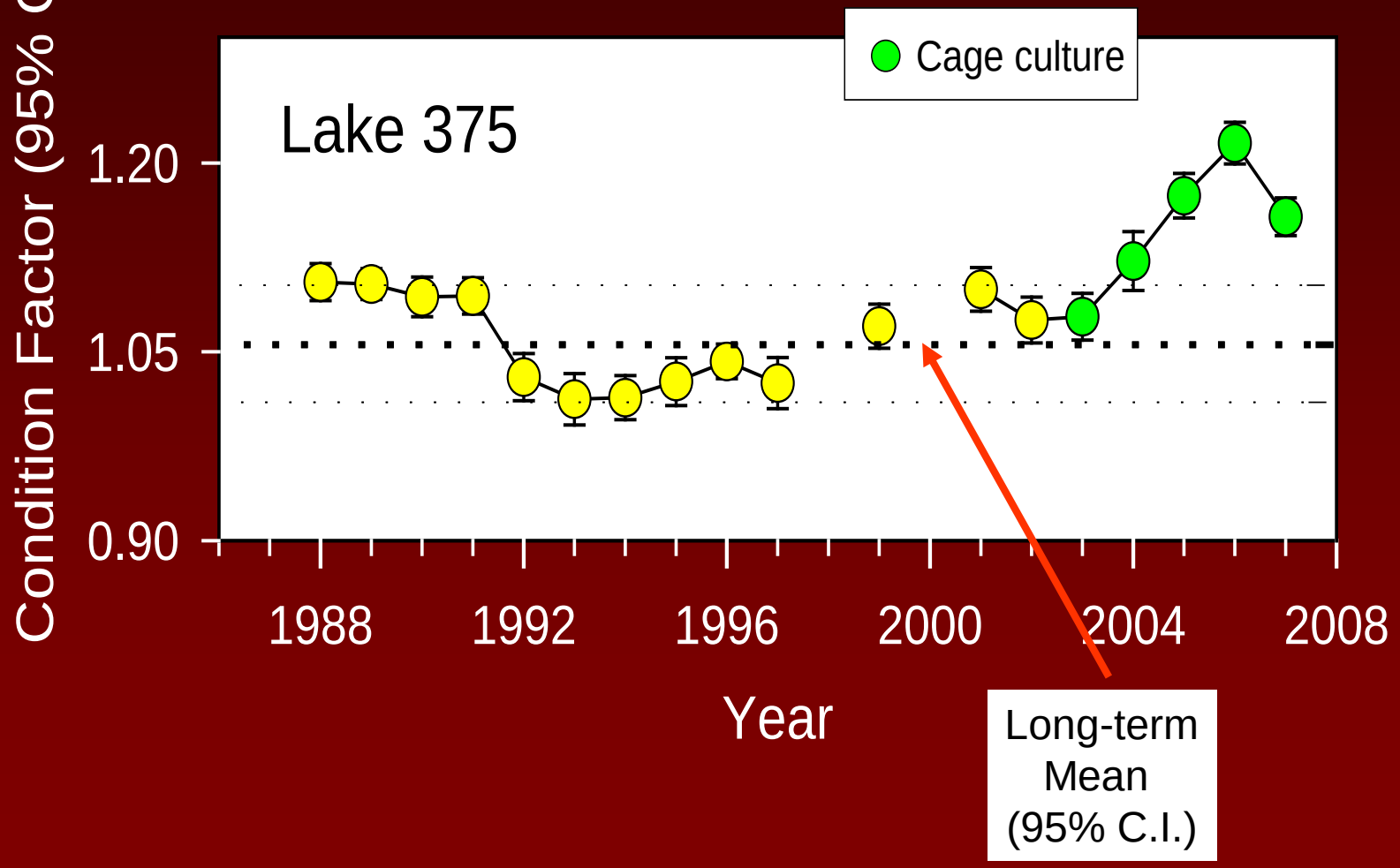
Fisheries and Oceans Pêches et Océans

Canada

Lake trout abundance



Lake trout fatness



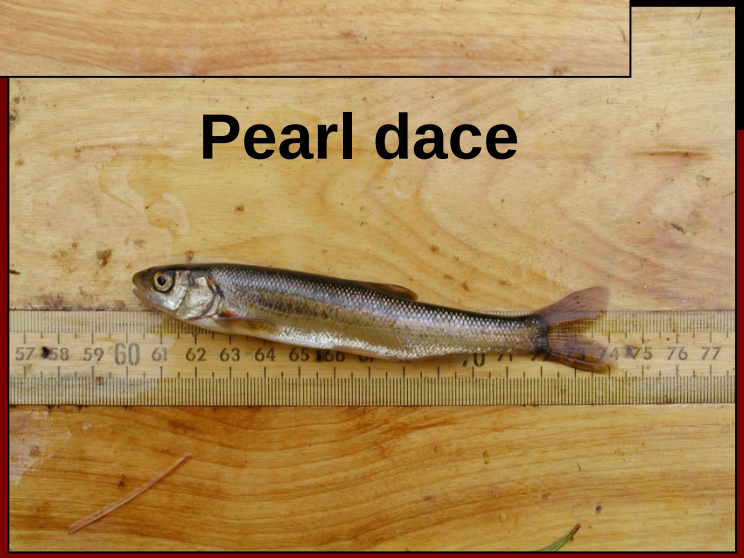
Fisheries and Oceans Pêches et Océans

Canada

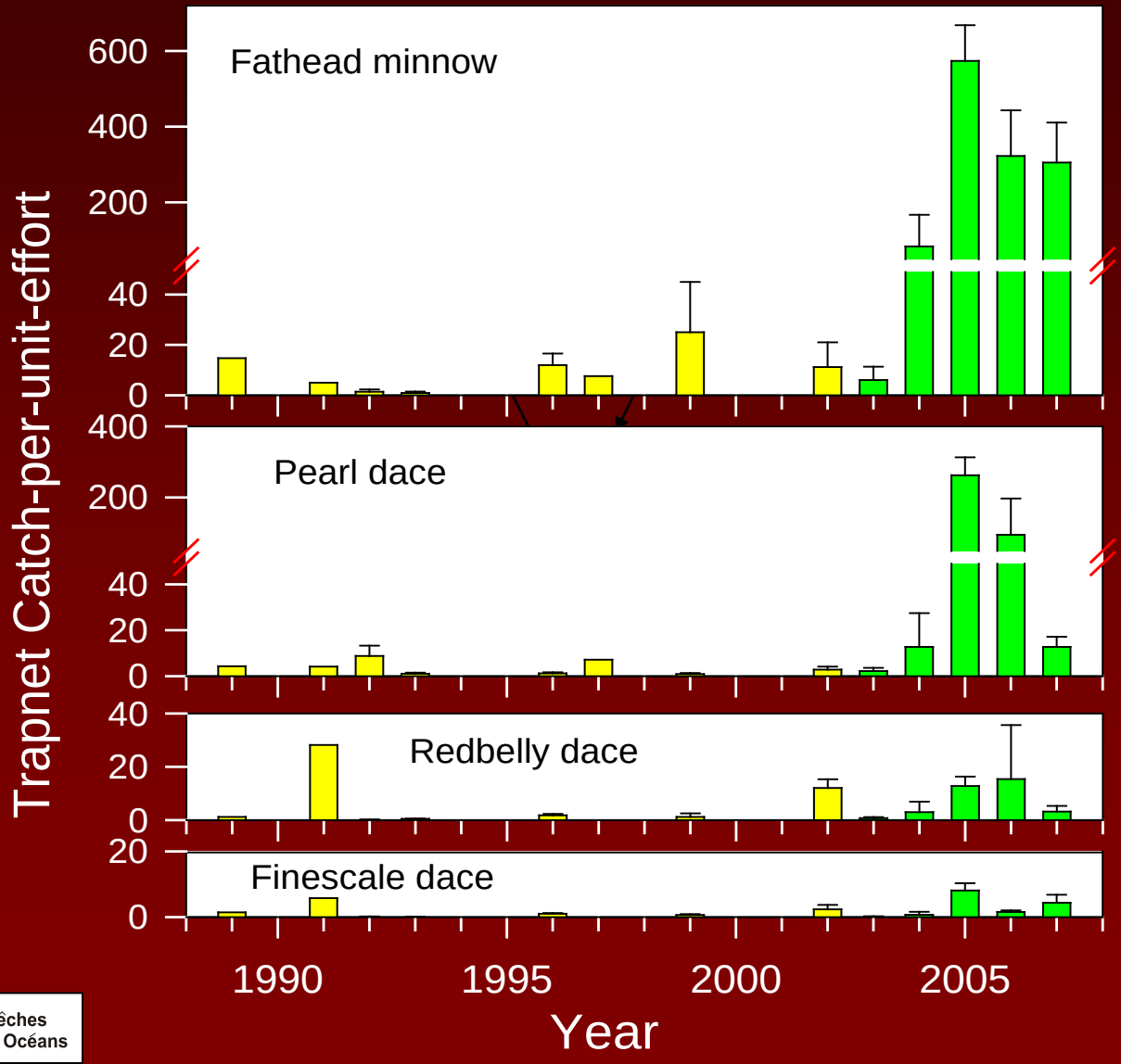
Summary

- Abundance of most fish populations increased during the 5 years of cage culture
  - No negative impacts
- Lake trout
  - Fatter
  - Grew faster
  - Earlier age of sexual maturity
  - More females spawning each year
  - Annual survival increased
  - Increased “recruitment”

Lake trout prey species



Minnow abundance

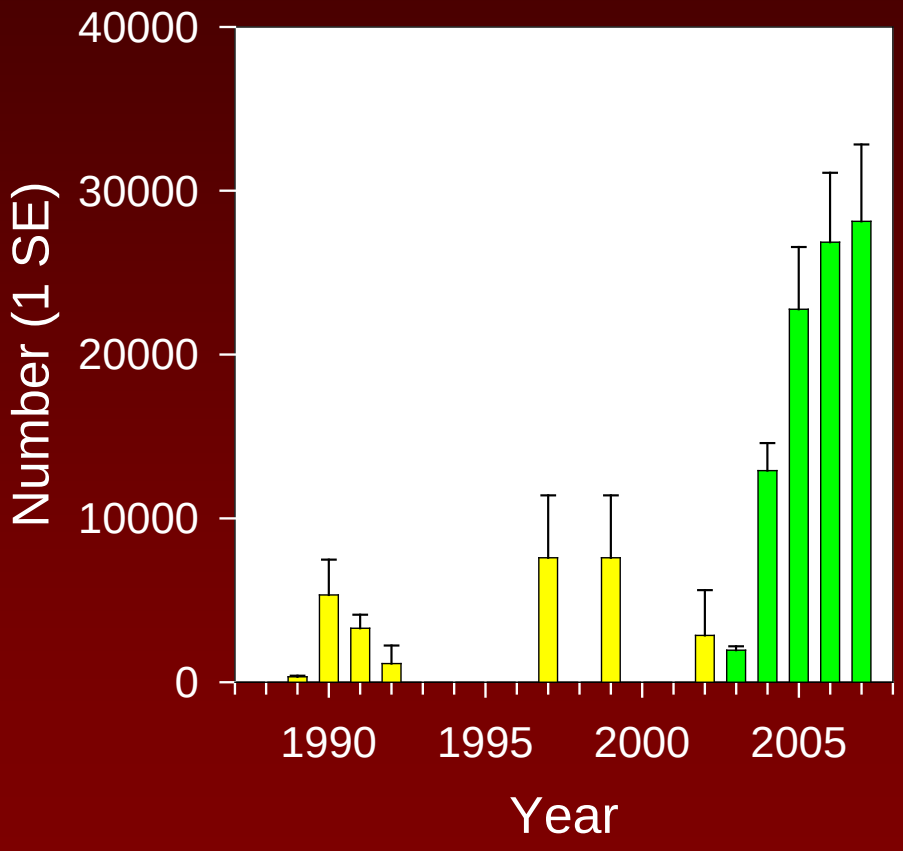


Fisheries and Oceans Pêches et Océans

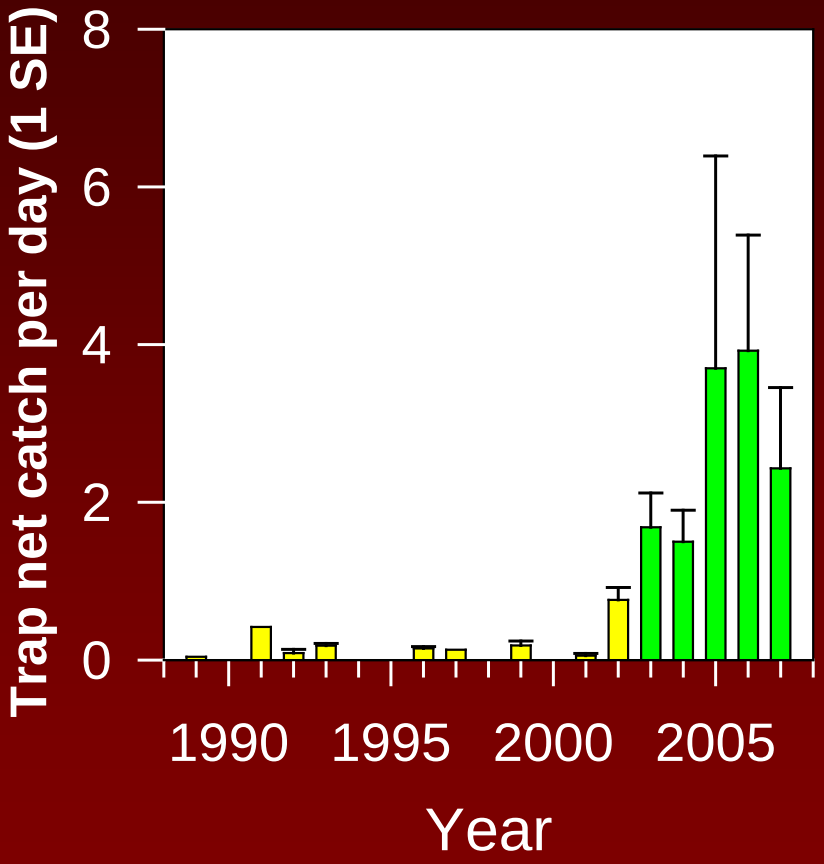
Canada

Abundance

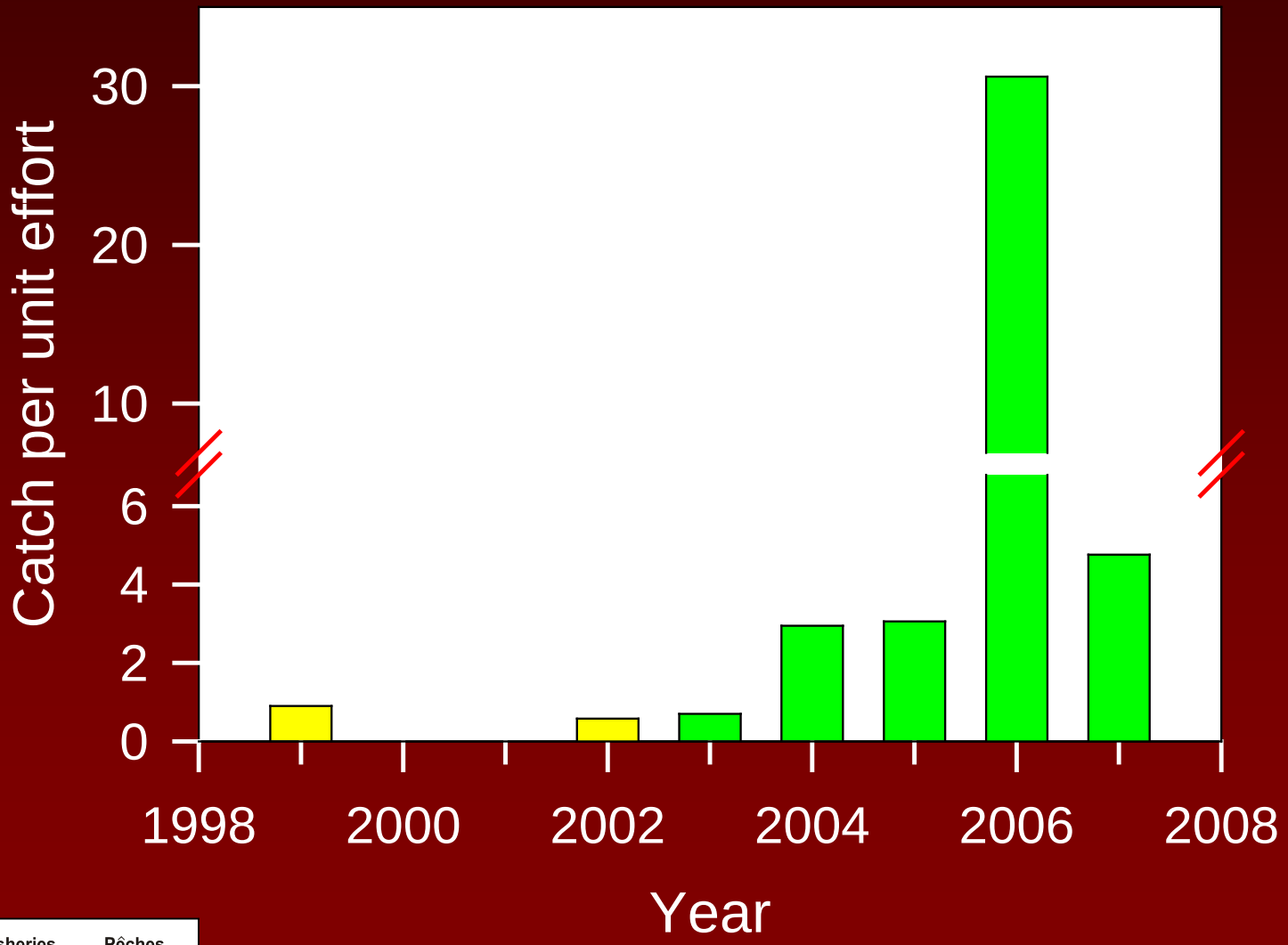
White sucker



Slimy sculpin



Crayfish



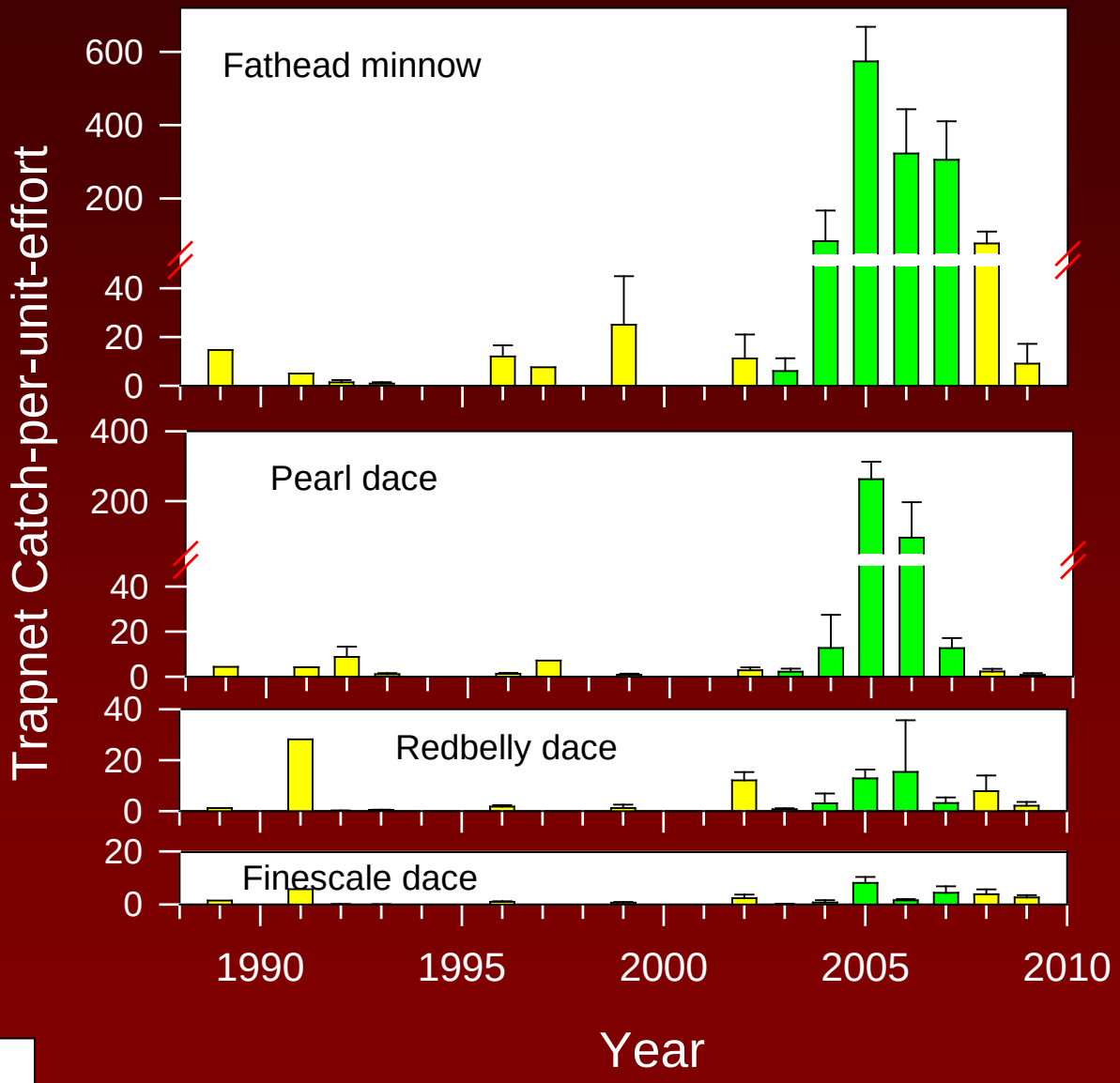
Fisheries and Oceans Pêches et Océans

Canada

Post Cage culture

“The Big Crash?”

Minnow abundance

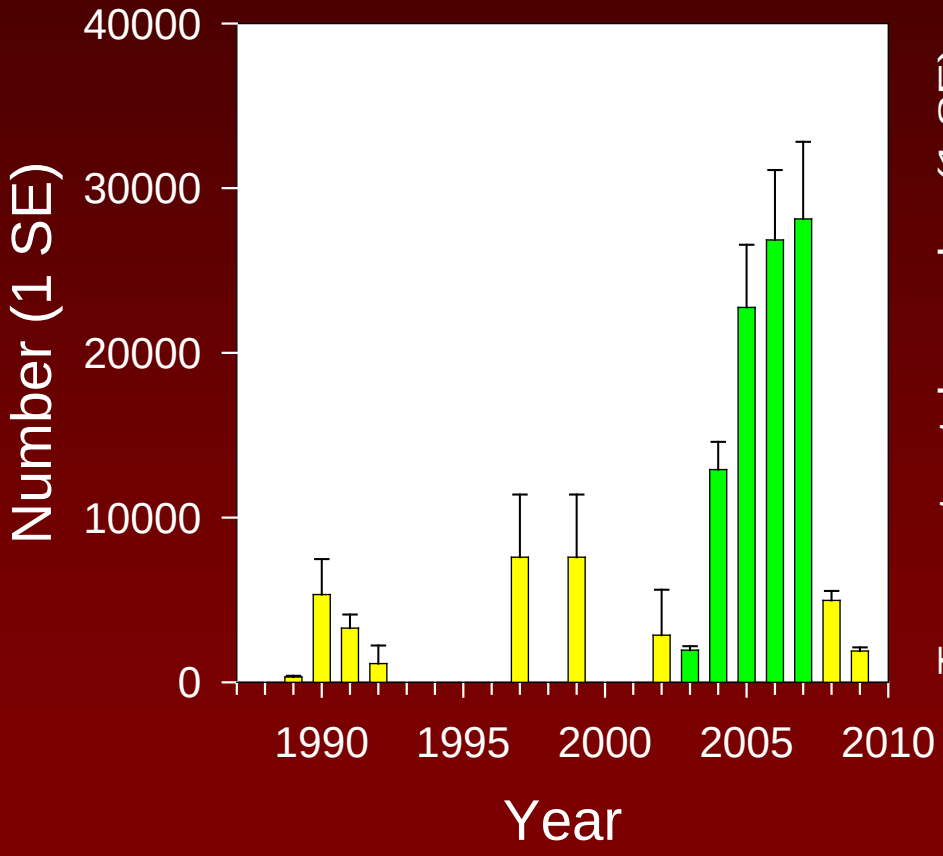


Fisheries and Oceans Pêches et Océans

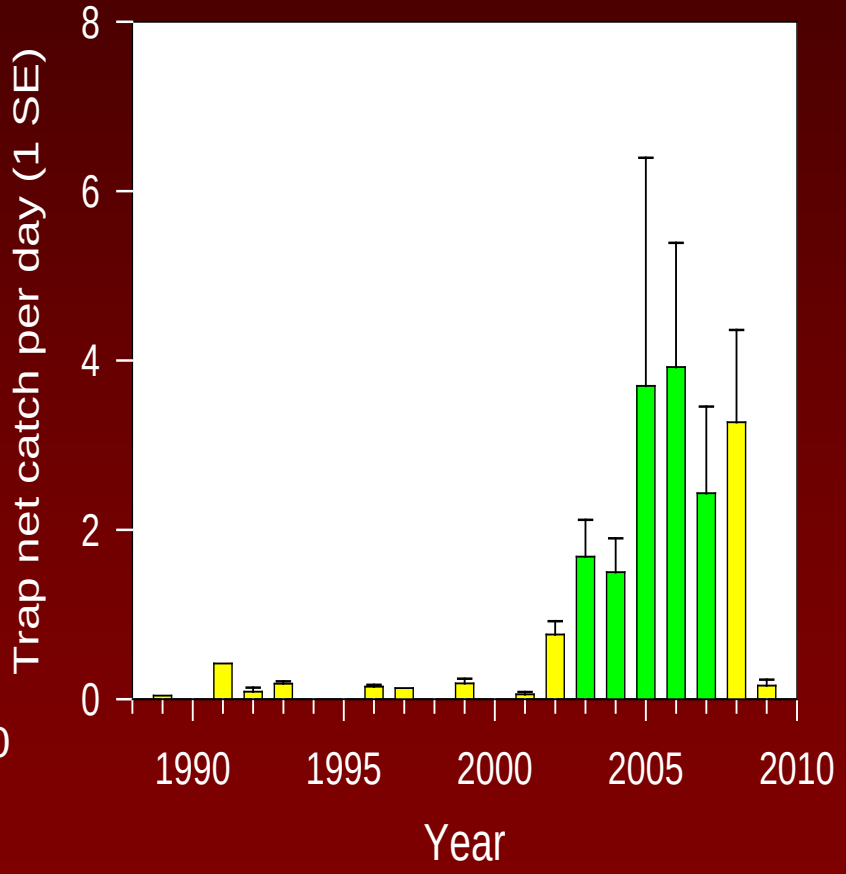
Canada

Abundance

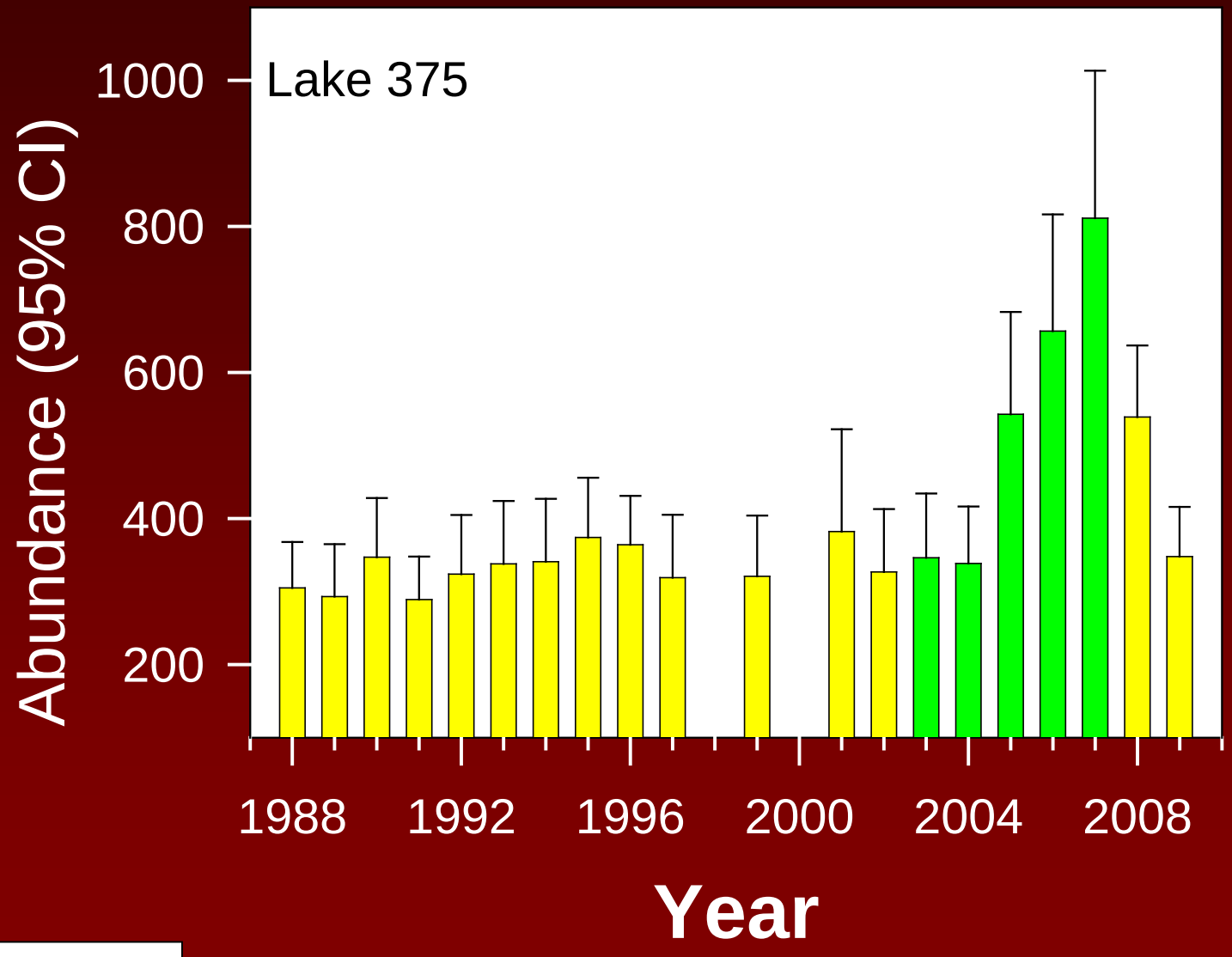
White sucker



Slimy sculpin



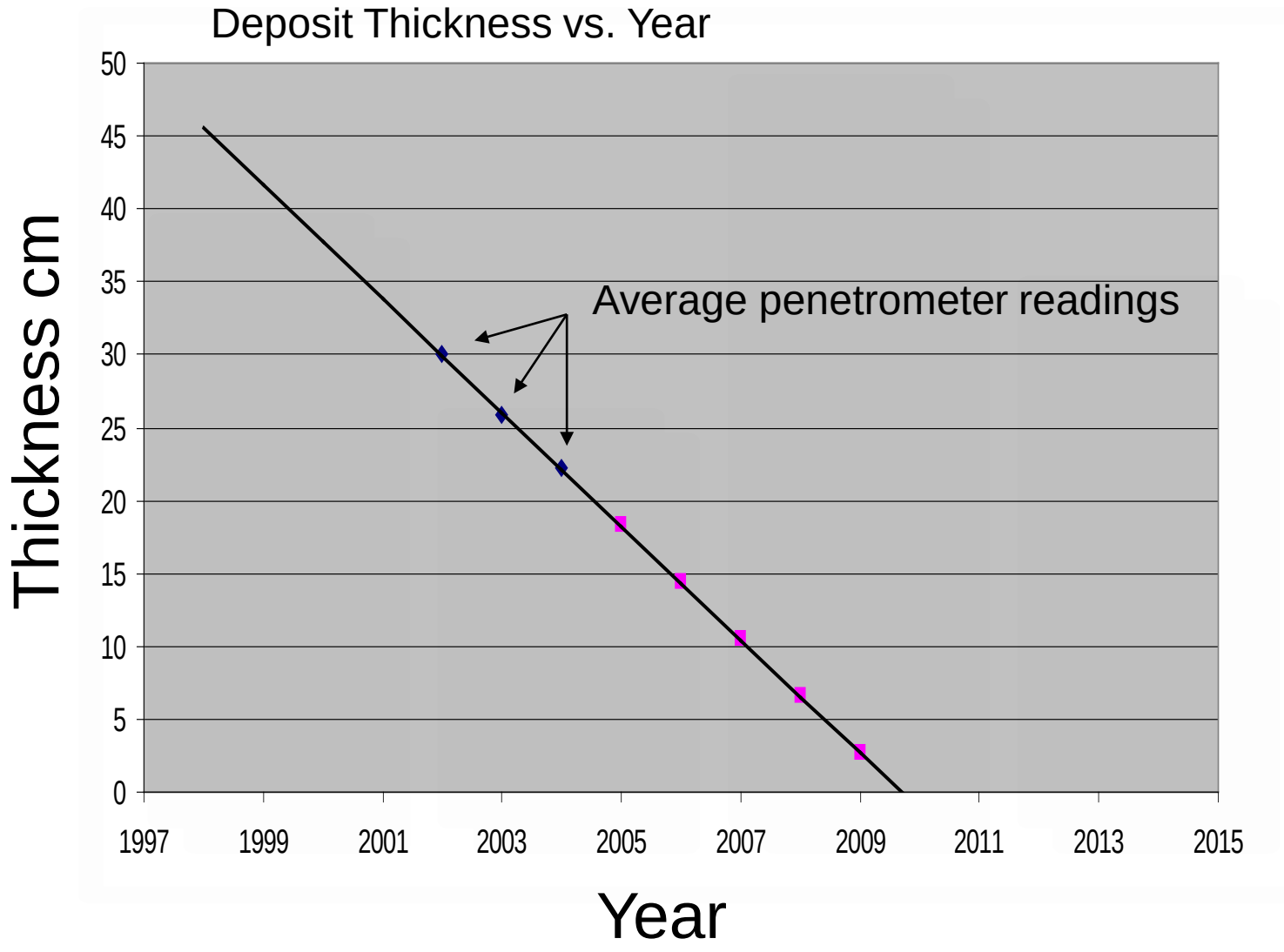
Lake trout


Lake 375
Abundance (95% CI)
1000
800
600
400
200
1988
1992
1996
2000
2004
2008
Year

Summary: Post Culture

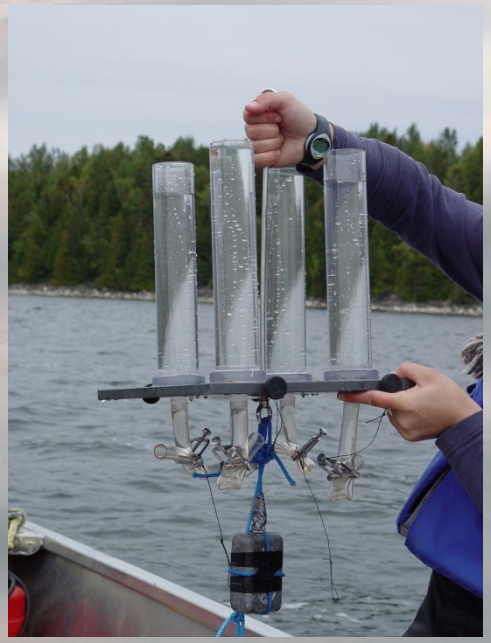
- All fish populations returned to pre-culture abundance two years after cage culture stopped
- Lake trout
  - Fatness decreased
  - Growth decreased
  - Increased age of sexual maturity
  - fewer females spawning each year
  - decreased annual survival
  - greatly decreased “recruitment”

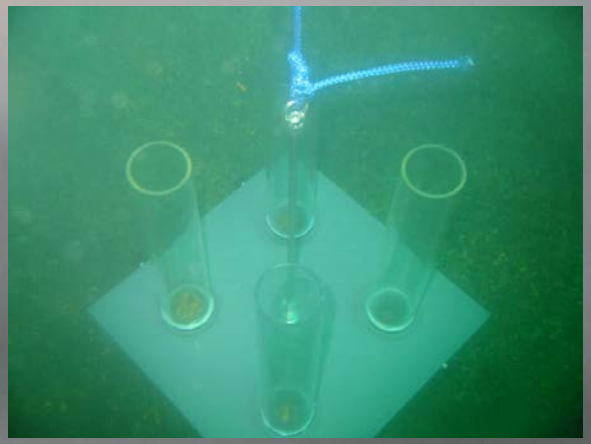
Deposit thickness measurements in 2002, 03, 04 suggest the lifespan of the present deposit extends to 2010 if decomposition is linear.



Murray Charleton, DOE

Measuring sedimentation - North Channel Farms

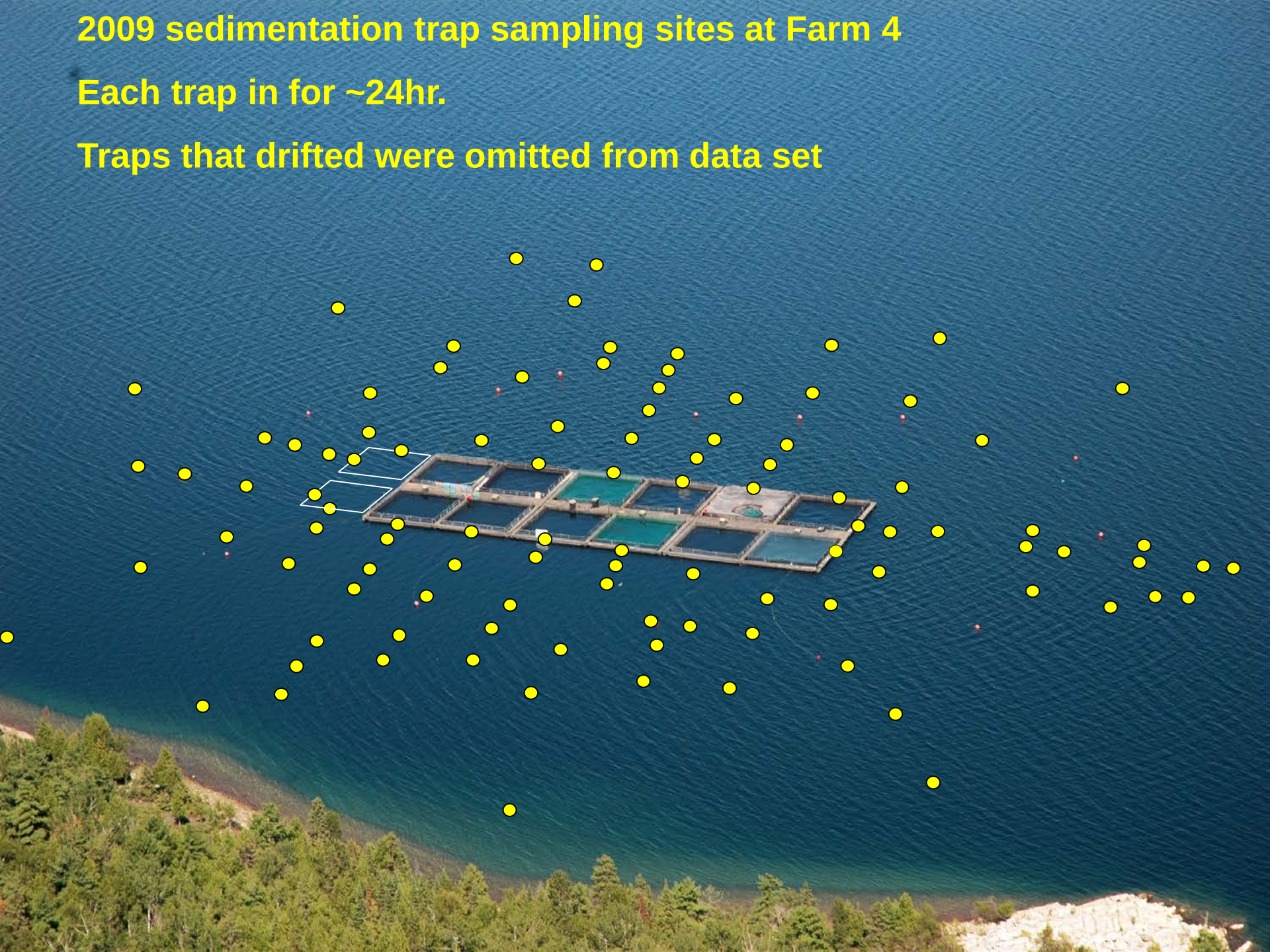


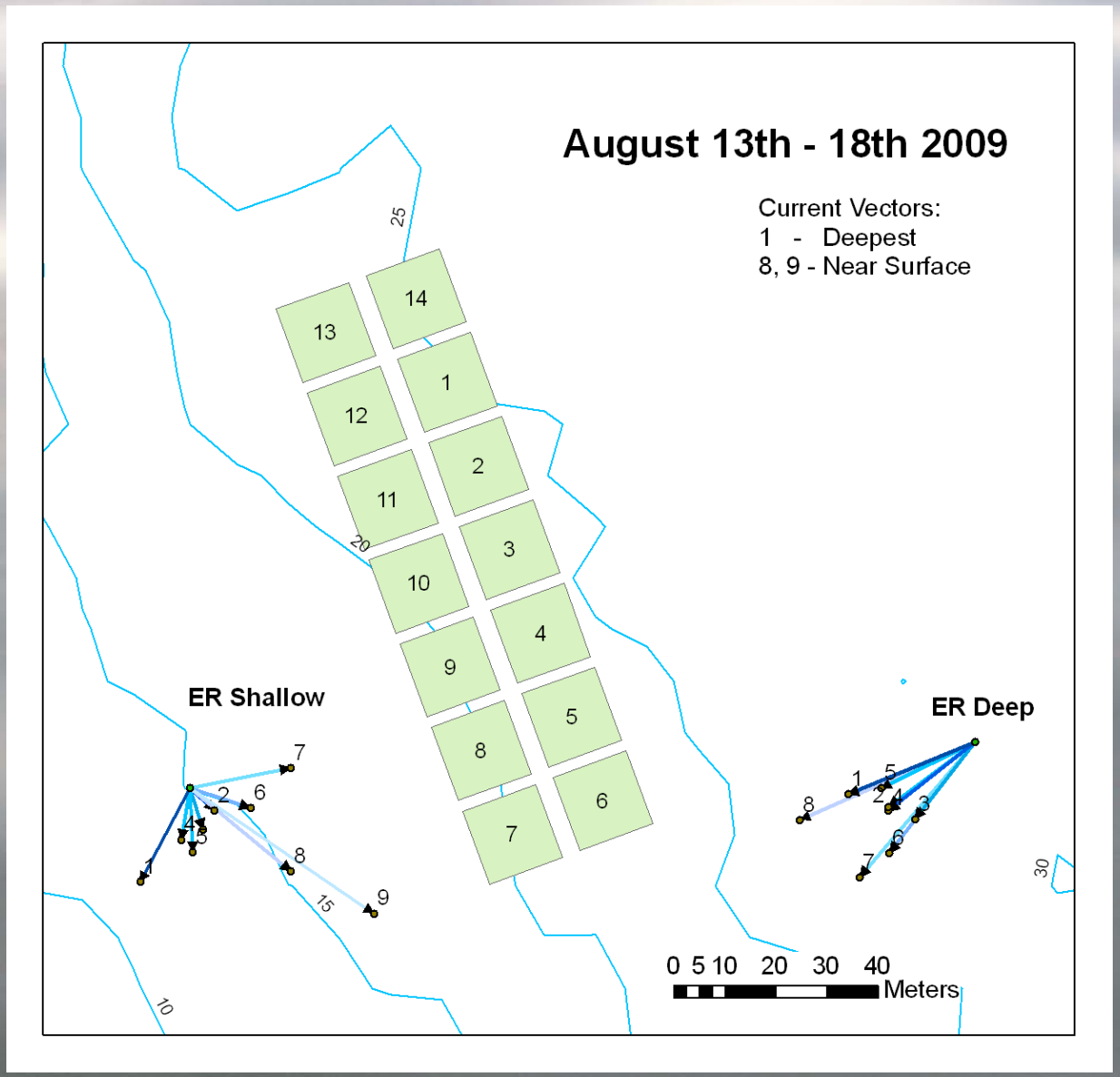


24hr set sedimentation traps around farm.

Material measured as TSS (total suspended solids) and Carbon (C).

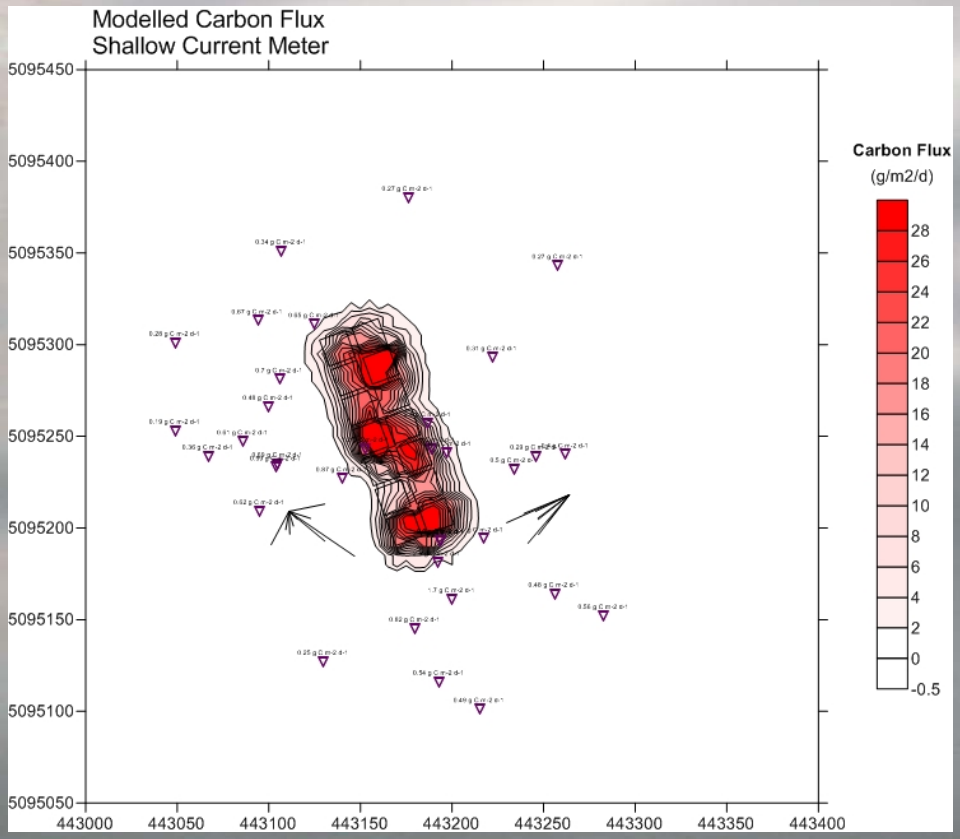
Faecal material is approximately 38% C (ELA) 37.5% (Burynuik et al. 2006, *Salmo salar*)

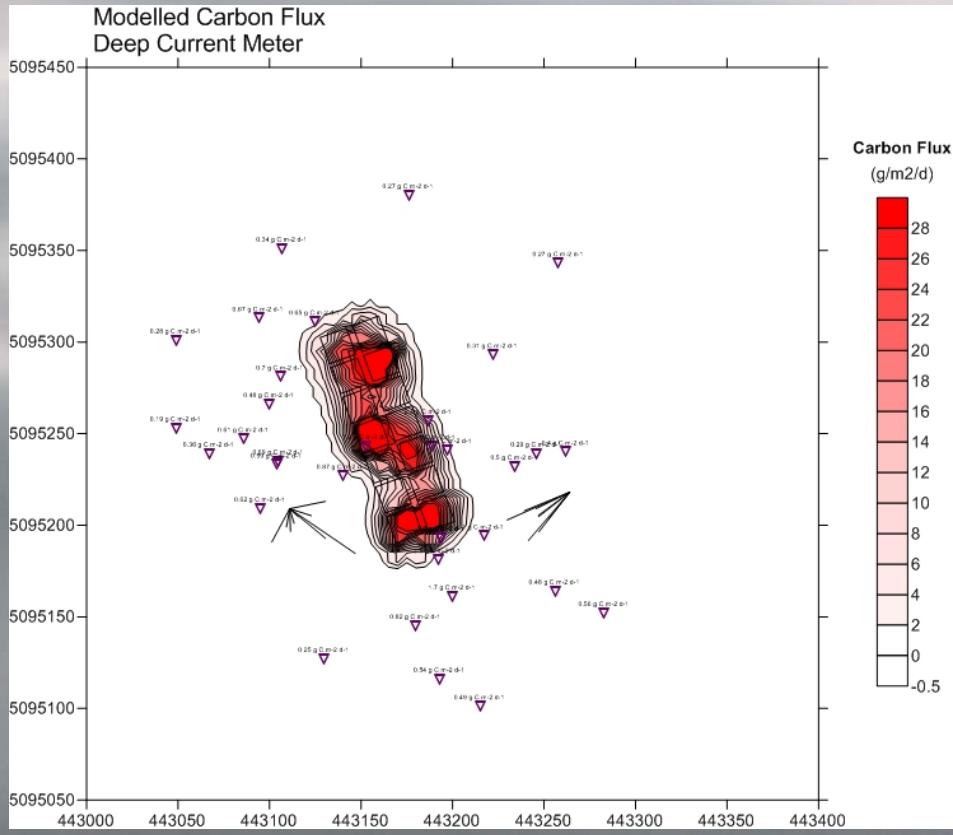

2009 sedimentation trap sampling sites at Farm 4
Each trap in for ~24hr.
Traps that drifted were omitted from data set



2 current meters provide differing resultant vectors – which to use for DEPOMOD?

Comparison of outputs from shallow *versus* deep meter





Current meter location irrelevant

High deposition under cages, limited footprint