Cumulative Impacts on American eel: Challenges and Recent Considerations

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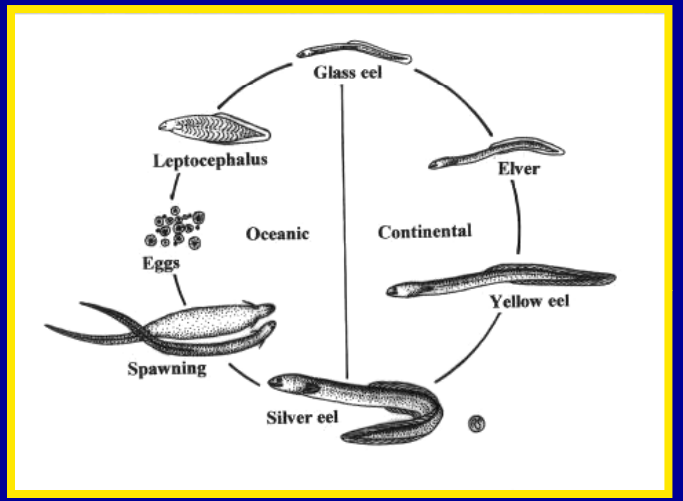
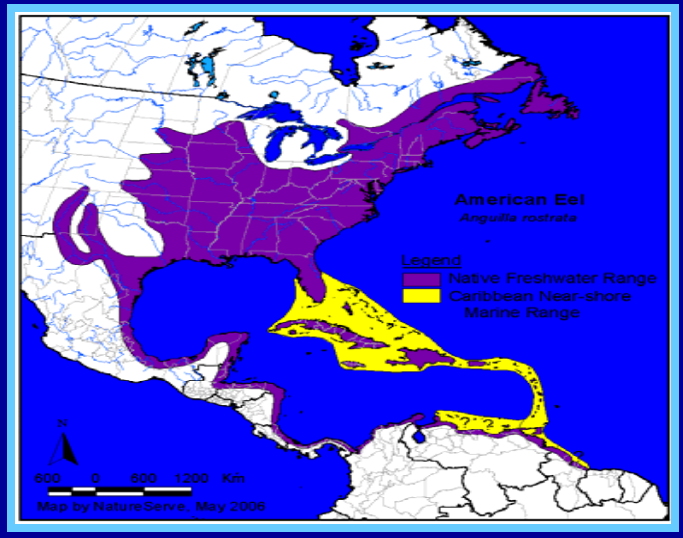
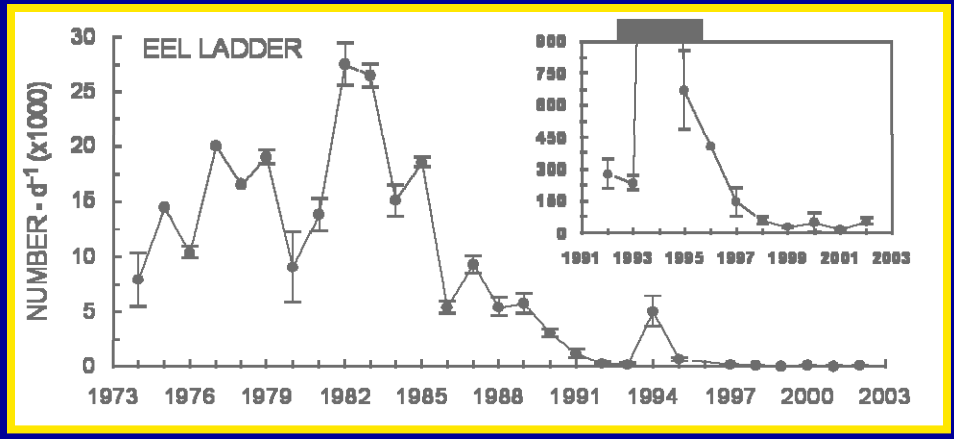
Background

- Complicated life history
  - Facultative diadromy
  - Highly migratory
  - Panmictic, semelparous
  - All highly fecund females in Ontario
- Complicated management
  - 25 jurisdictions
- Strong declines evident
- Listing status
  - Endangered in Ontario
  - Special Concern nationally
- Multiple threats

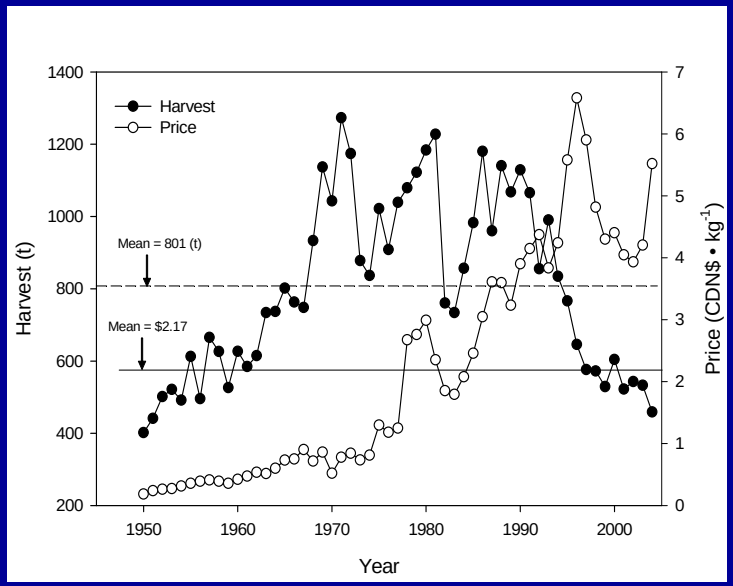




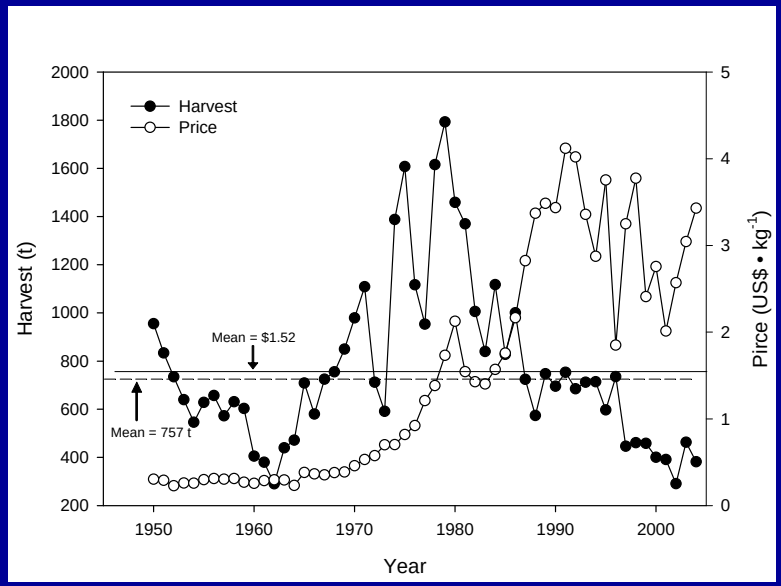
Recruitment and Harvest Declines



Canada



United States



Broad Context

- Declines an example of serious cumulative effects on aquatic ecosystems and biodiversity
  - Fishing at all continental life stages across the range
  - Substantial turbine mortalities across the range
  - Substantial habitat loss across the range
  - Oceanic currents

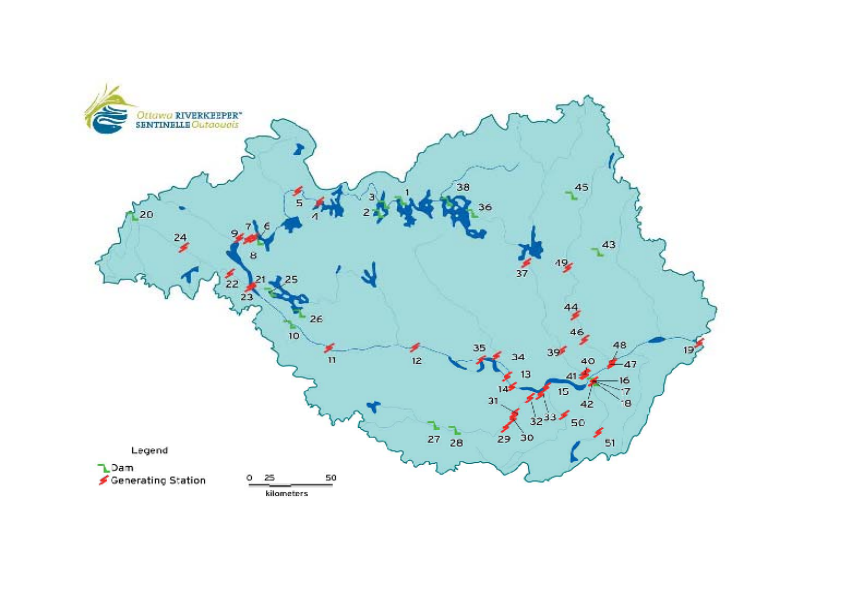
Natural Heritage

"They constitute a wonderful manna for this country, and one that costs nothing but the catching"

- Eel fishing extends back thousands of years in North America
- A major source of sustenance both for Aboriginal People and European settlers
- Abundant and stable supply of food that was easy to catch, easy to store and high in caloric content

"…*the single most important of the fish species of all Iroquoian people…*"

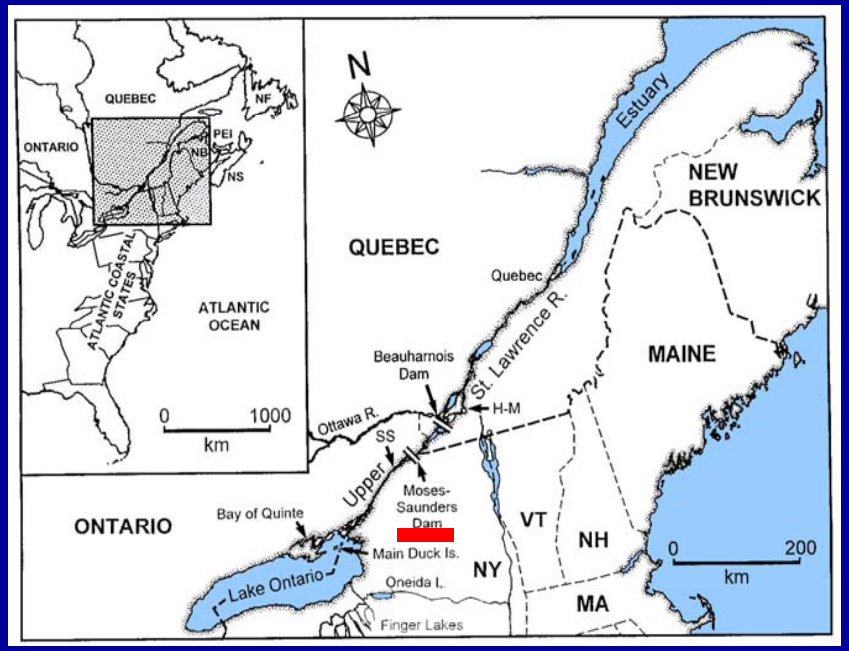
Challenges: Cumulative effects



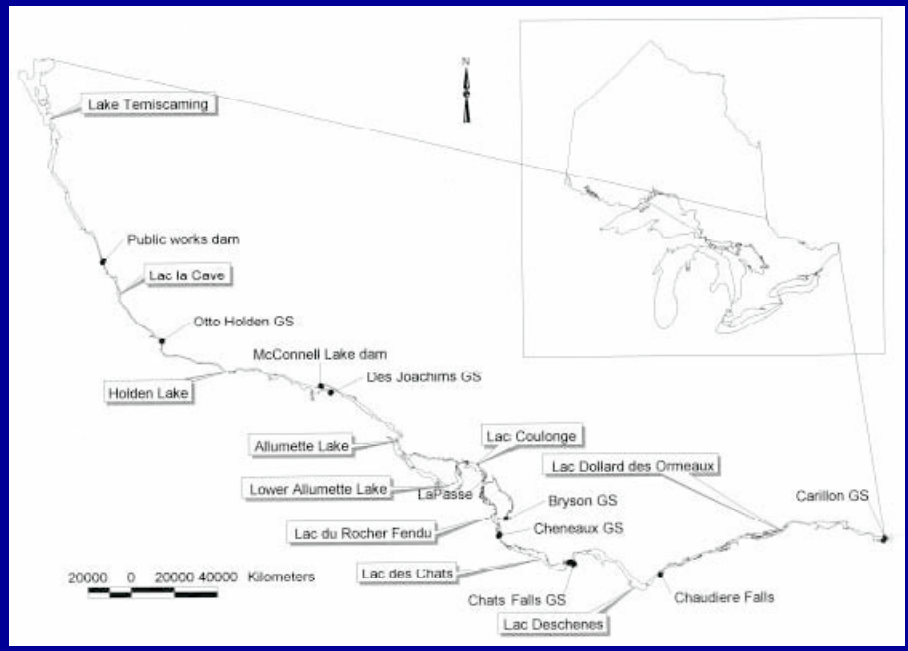
Challenges due to Cumulative Effects

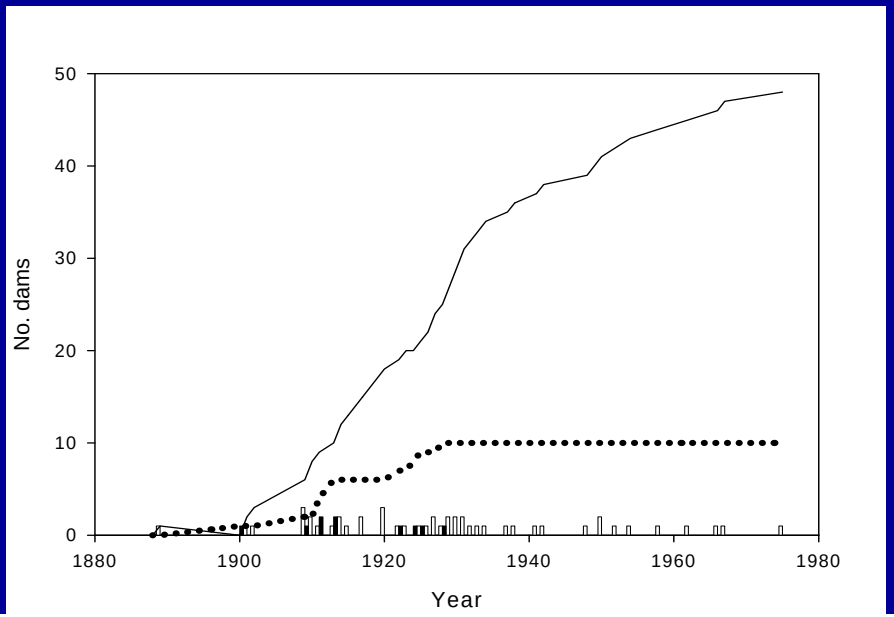
- Note: because eels are panmictic, all effects are cumulative across the range on a single spawning population
  - Cumulative loss of habitat due to thousands of dams (possibly > 85% loss)
  - Cumulative mortalities (fishing, turbines) particularly significant during downstream spawning migrations
- Reduced resilience to inevitable future perturbations
- Reduced population-level fecundity, reduced recruitment, especially to extremities of range
- Depensatory effects

St Lawrence River

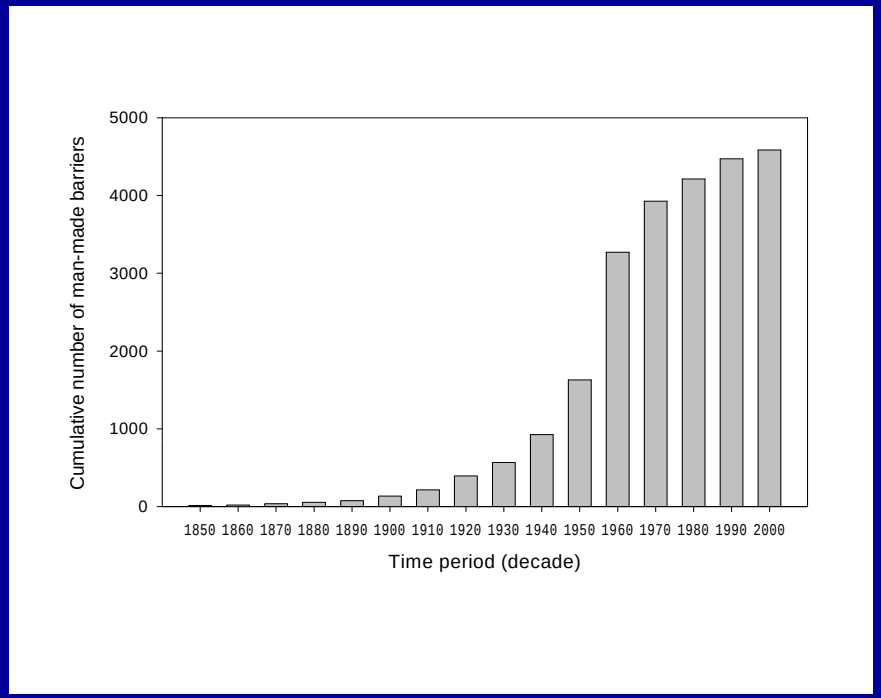


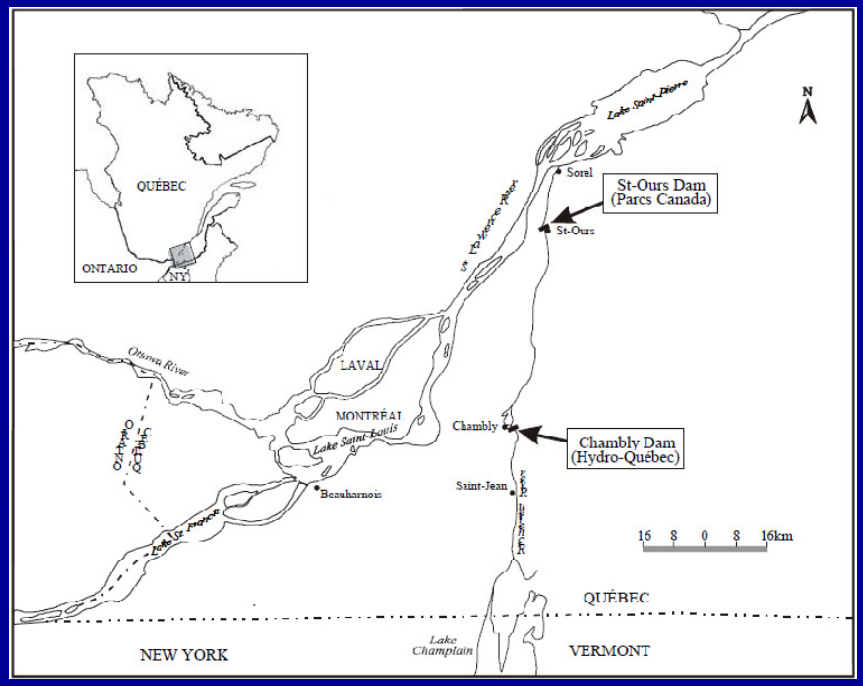
Ontario: Ottawa and Trent R





Quebec/Richelieu River





Challenges

- Life Cycle
- Governance
  - 25 jurisdictions
  - Needs ecosystem approach (consideration habitat access, fishing and turbine mortalities)
- Mortalities due to fishing and turbines
  - Finger pointing
- Recent push for renewable energy
  - Many more hydro-electric facilities proposed
  - Cumulative impacts of existing and new facilities
  - Balancing ecological, natural heritage, cultural values
- Policy and Legislation
  - Inexperience of staff in reviewing hydro-electric proposals
  - Lack of clear policy regarding cumulative impact assessment (continued one-off approaches)
- Mitigation techniques
  - Uncertainty, lack of investment in mitigation

Challenges

- Hydroelectric facilities are major investments and can pose long-term ecological challenges (often a century or more) if unmitigated:
  - Big decision: cannot be taken likely
  - Major push to increase power production from renewable energy sources
  - Ongoing cumulative impacts and risks to: biodiversity, species at risk, natural heritage and cultural values, aboriginal values and rights without mitigation

Challenges

- Difficult to manage mortalities due to fishing if issues related to dams and turbines are not addressed
  - Tragedy of commons
  - Shifting baselines
- Addressing existing facilities regarding cumulative effects in context of new facilities
- Policy gaps:
  - Fish passage: legislation exists but policy/implementation lacking
  - Cumulative effects analyses: often no legislative nor policy requirement, so it is often not done
  - Legal and policy framework for implementing ecosystem approach required

Challenges

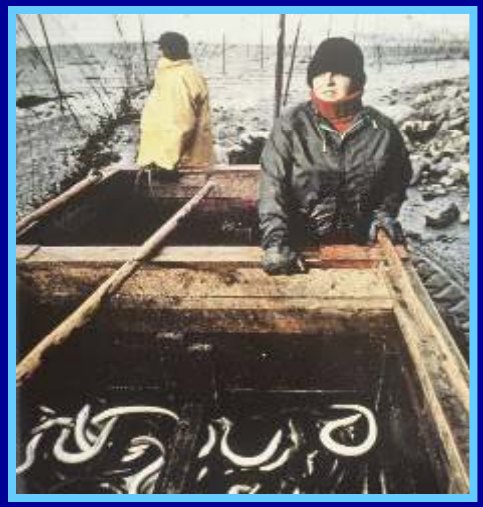
- Fisheries management understands what is required, but approvals processes for power facilities not lined up to achieve objectives
- Competing policies
  - biodiversity and species at risk (is mere persistence enough?)
  - fisheries management
  - renewable energy
  - Aboriginal rights and values
- Risks of repeating/ exacerbating past mistakes for the next century

Recent Actions

- Bi-national MOU for North American range
- Bi-national framework for Lake Ontario/USLR
- National Management Plan
  - Strategic watershed approach, cumulative effects
- OPG Action Plan
- Quebec/Quebec Hydro initiatives
- Ontario Recovery Strategy
- Divisional court decision in Ontario
- Policy evaluations underway
  - Cumulative effects, existing and new facilities etc

Summary

- No longer a strict question of trade-offs
- Need to ensure all benefits work together in balanced fashion:
  - »Fishing
  - »Power production
  - »Biodiversity
  - »Natural heritage
  - »Aboriginal interests



Disclaimer

- The opinions expressed are those of the author and may not reflect those of individual agencies

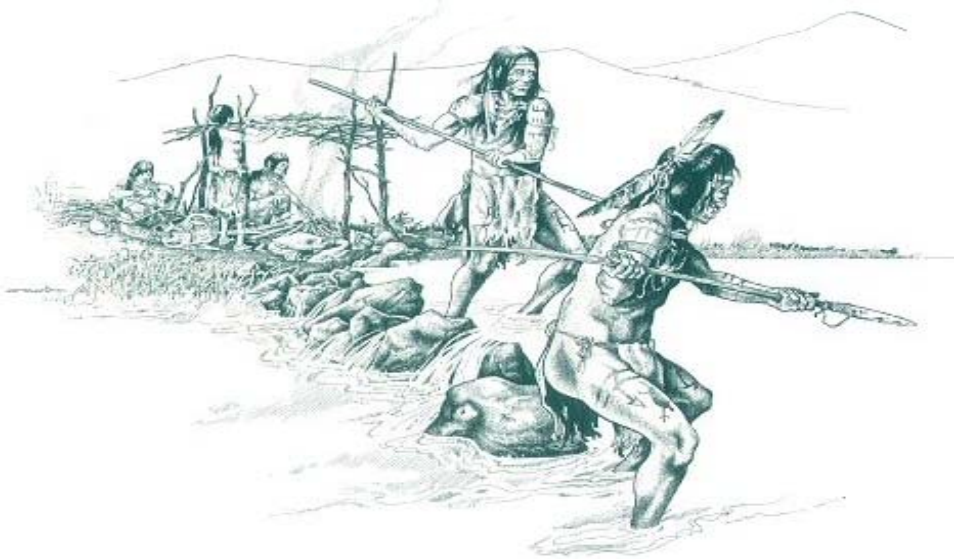
Some Recent Publications

- **MacGregor, R.B., J. M. Casselman, W.A. Allen, T.Haxton, J. M. Dettmers, Alastair Mathers, Steve LaPan, Thomas C.** Pratt**, P. Thompson, M. Stanfield, L. Marcogliese , Jean-Denis Dutil (in press). Natural heritage, anthropogenic impacts and bio-political issues related to the status and sustainable management of American eel: A retrospective analysis and management perspective at the population level. InHaro, A. J., K. L. Smith, R. A. Rulifson, C. M. Moffitt, R. J. Klauda, M. J. Dadswell, R. A. Cunjak, J. E. Cooper, K. L. Beal, and T. S. Avery, editors. 2009. Pages xx-yy.** ***Challenges for Diadromous Fishes in a Dynamic Global Environment*****. American Fisheries Society, Symposium 69, Bethesda, Maryland.**

- **MacGregor, R.B., A. Mathers, P. Thompson, J. M. Casselman, J. M. Dettmers, S. LaPan, T. C. Pratt and W.A. Allen. 2008. Declines of American eel in North America: Complexities associated with bi-national management. In M. G. Schechter, W. W. Taylor, and N. J. Leonard, editors. Pages 357-381. International governance of fisheries ecosystems: learning from the past, finding solutions for the future. American Fisheries Society, Bethesda, MD.**

Appendix

Historically: low intensity exploitation



Historical Abundance

- *"…an almost unlimited supply …eels"*

  Du Creux 1664

- *"…the eel constitutes a manna exceeding all belief…"*

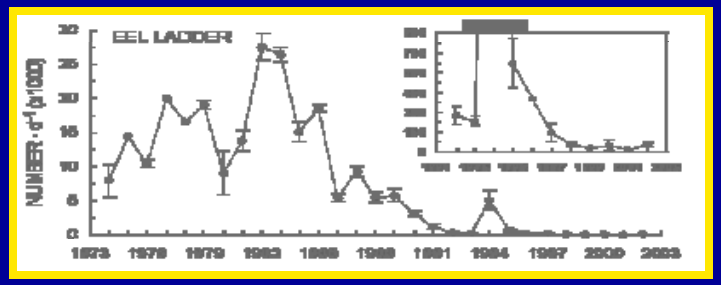
  Le Jeune 1652-1653

- *" …one or two men could catch five or six thousand in a single night…"*

  Le Jeune 1652-1653

Indicators of Concern

- 99% reduction in recruitment to L. Ontario



- Major declines in silver eel landings in St. Lawrence River
- Range-wide declines in commercial harvests, despite recent sustained high market
- ASMFC: yellow eel abundance at historic lows (peer reviewed)

Why the Decline?

- Various factors implicated (mortality, habitat loss, ocean currents)
- Panmictic species: all one single breeding unit - effects likely synergistic and cumulative across the range
- Anthropogenic effects have increased substantially over recent decades:
  - Loss of freshwater habitat
  - Mortality due to fishing at all continental life stages
  - Turbine mortalities during spawning migration
  - Mortality of silver eels – particularly females

FW Habitat and Turbine Mortality

- Loss of access to historically important habitats
  - Cumulative effects of series of dams
  - Some estimates of 84% loss to diadromous fish species, including eels (needs further analysis)
  - SLR/ L.Ont. examples: Ottawa R, Trent River system, Richelieu, Oneida Lake, Lake Ontario
  - Thousands of dams in N. American range, only a handful with fish passage provisions
  - E.g. 8411 dams in Lake Ontario/St Lawrence R basin
    - 150 with turbines
  - Beauharnois and Saunders on St Lawrence River
    - > 40% combined mortality of large females