

Worldwide decline of eel resources necessitates immediate action Québec Declaration of Concern

The steep decline in populations of eels (*Anguilla* spp.) endangers the immediate future of these legendary fish. With less than 1% of major juvenile resources remaining, precautionary action must be taken immediately to sustain the stocks.

Eels are curious animals. Despite decades of scientific research, crucial aspects of their biology remain a mystery. In recent decades, juvenile abundance has declined dramatically (Figure 1): by 99% for the European eel (*A. anguilla*) and by 80% for the Japanese eel (*A. japonica*). Recruitment of American eel (*A. rostrata*) to Lake Ontario, near the species' northern limit, has virtually ceased. Other eel species also show indications of decline. The causes of the

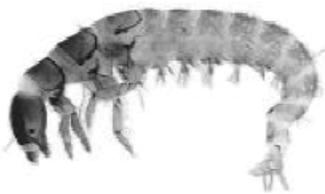
downward trends are yet unclear, in part due to the catadromous life history of these fishes, which has so far made it impossible to observe their spawning adults in the open ocean. Because of this, the annual spawning stocks of eels that successfully complete the long migration to their spawning areas have never been assessed. The lack of access to basic life history information about the oceanic phase of eels makes it especially diffi-

cult to monitor and identify the cause of their population declines. This is in distinct contrast with other declining fishes such as anadromous salmon, whose spawning adults can be relatively easily surveyed when they return to freshwater to spawn, and Atlantic cod, which spawn relatively close to continental margins and can be surveyed by standard fishery techniques. In the case of eels, which depend on freshwater and estuarine habitats for their juvenile growth phase, anthropogenic impacts (e.g., pollution, habitat loss and migration barriers, fisheries) are considerable and may well have been instrumental in prompting these declines. Loss of eel resources will represent a loss of biodiversity but will also have considerable impact on socioeconomics of rural areas, where eel fishing still constitutes a cultural tradition. Research is underway to develop a comprehensive and effective restoration plan. This, however, will require time. The urgent concern is that the rate of decline necessitates swifter protective measures. As scientists in eel biology from 18 countries assembled at the International Eel Symposium 2003 organized in conjunction with the 2003 American Fisheries Society Annual Meeting in Québec, Canada, we unanimously agree that we must raise an urgent alarm now. With less than 1% of juvenile resources remaining for major populations, time is running out. Precautionary action (e.g., curtailing exploitation, safeguarding migration routes and wetlands, improving access to lost habitats) can and must be taken immediately by all parties involved and, if necessary, independently of each other. Otherwise, opportunities to protect these species and study their biology and the cause of their decline will fade along with the stocks. 

The International Eel Symposium 2003 at the Québec City AFS Annual Meeting, convened by Casselman and Cairns, focused on worldwide concern about the declining status of anguillid eels, their assessment and management. The symposium resulted in a universal call to action. Since the symposium, the concern is now being widely publicized. The declaration stemming from the symposium is provided here.

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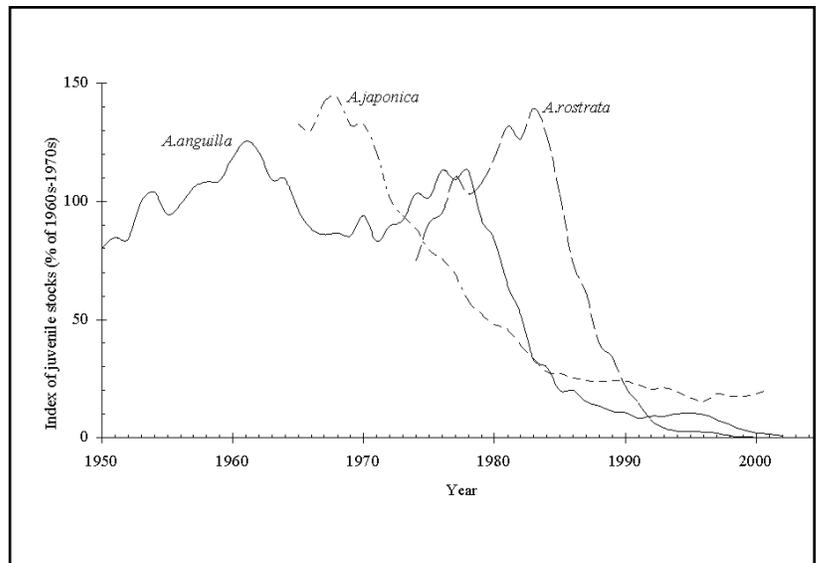


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Figure 1. Time trends in juvenile abundance of the major eel stocks of the world. For *Anguilla anguilla*, the average trend of the four longest data series is shown, which trend appears to occur almost continent-wide; for *A. rostrata*, data represent recruitment to Lake Ontario; for *A. japonica*, data represent landings of glass eel in Japan



Prepared Québec City, 14 August 2003. Submitted by the undersigned:

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Background to this correspondence

This letter was prepared as a result of the plenary discussion at the end of the International Eel Symposium. Following a suggestion by Giulio A. De Leo (University of Parma, Italy), we unanimously agreed to bring this immediate concern to light. Signatories to this letter have been selected to represent the scientific communities working on each of the *Anguilla* species, listed in order of magnitude of the resource, with representation by Aboriginal Nations because of their longstanding association with eel. Participants in this discussion were, in alphabetical order by country (affiliation) and name:

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BELGIUM: C. Belpaire, G.E. Maes

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JAPAN: J. Aoyama, M. Miller,

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B. Knights, B. Williams

UNITED STATES OF AMERICA:

L. Brown, S. Hammond,

A. Haro, L. M. Lee, J. McCleave,

V. Vecchio, J. Weeder, S. Welsh



For recent publicity about the decline in eel populations, see:

nationalgeographic.com/news/2003/10/1009_031009_endangereedeels.html

www.nature.com/nsu/030929/030929-1.html

www.sciencemag.org (*Science* Vol 302, 10 October 2003, available with subscription)

www.ices.dk/marineworld/eel.asp

Annotated list of selected literature references documenting declines

European eel *Anguilla anguilla*:

Moriarty, C. 1997. The European eel fishery in 1993 and 1994: First report of a working group funded by the European Union Concerted Action AIR A94-1939. *Fisheries Bulletin* (Dublin) 14: 52 pp.

In 1994-1997, a concerted action was sponsored by the European Commission to compile an overview of existing information on the European eel. In this first report, factual information on eel fisheries throughout Europe was compiled.

Moriarty, C., and Dekker, W. (eds.) 1997.

Management of the European Eel. *Fisheries Bulletin* (Dublin) 15: 110 pp.

This report, following Moriarty (1997), discusses the status of the European eel stock in the early 1990s, and explores options for restoration of the stock and fisheries.

ICES (International Council for the Exploration of the Sea). 2002. ICES cooperative research report N° 255, Report of the ICES Advisory Committee on Fishery Management, 2002: 940-948.

Upon request by the European Commission, the International Council for the Exploration of the Sea (ICES) has provided scientific advice for sustainable management of the European eel stock. ICES recommends that an international

recovery plan be developed for the whole stock on an urgent basis and that exploitation and other anthropogenic mortalities be reduced to as close to zero as possible, until such a plan is agreed upon and implemented. www.ices.dk/products/cooperative.asp

_____. 2003. Report of the ICES/EIFAC Working Group on Eels. ICES C.M. 2002/ACFM:06

Management advice by ICES is based on a lengthy report of the joined ICES/EIFAC working group on eels, which elaborates on the time series, the anthropogenic impacts, and the required management measures. This report is the most recent, in an ongoing process of gathering information and compiling management advice. www.ices.dk/reports/acfm/2002/wgeel/WGEEL02.pdf

Dekker, W. 2003. Status of the European eel stock and fisheries. pages 237-254 in K. Aida, K. Tsukamoto, and K. Yamauchi eds., *Eel Biology*, Springer-Verlag, Tokyo.

This paper provides an overview of existing information on geographical distribution and time-trend in fisheries for the various life stages, discusses causes and consequences of the decline, and considers required research for sustainable management of the European eel stock.

American eel *Anguilla rostrata*:

Castonguay, M., P. V. Hodson, C. M. Couillard, M. J. Eckersley, J-D Dutil, and G. Verreault. 1994. Why is recruitment of the American eel, *Anguilla rostrata*, declining in the St. Lawrence River and Gulf? *Canadian Journal of Fisheries and Aquatic Sciences* 51:479-488.

Drastic declines in juvenile American eel recruitment to the upper St. Lawrence River-Lake Ontario stock are documented. Potential causes are discussed: there is little evidence that commercial fishing and oceanic changes are the cause. Emphasizes that recruitment declines could be species-wide.

Casselman, J. M., L. A. Marcogliese, T. Stewart, and P. V. Hodson. 1997. Status of the upper St. Lawrence River and Lake Ontario American eel stock—1996. Pages 106-120 in R.H. Peterson ed. *The American eel in eastern Canada: stock status and management strategies*. Proceedings of eel workshop, January 13-14, 1997, Québec City, QC. Canadian Technical Report of Fisheries and Aquatic Sciences 2196.

In an extensive review of the American eel in eastern Canada, stock status and management strategies, long-term catch records, along with



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numerous scientific indices, are examined for the once large upper St. Lawrence River-Lake Ontario stock. Declines in the 1990s are unprecedented and correlate with well-documented recruitment declines, which in the past two decades amount to a decrease of three orders of magnitude. Important and valuable commercial fisheries have virtually disappeared.

Richkus, W. A., and K. Whalen. 2000. Evidence for a decline in the abundance of the American eel, *Anguilla rostrata* (LeSueur), in North America since the early 1980s. *Dana* 12:83-97.

The preponderance of data suggests a continent-wide decline in American eel abundance. There are statistically significant negative trends in Ontario, Québec, Virginia, and New York. There are no statistically significant increasing trends. Possible reasons: ocean conditions, pollution, habitat degradation, recruitment overfishing, growth overfishing, hydroelectric dams.

EIFAC/ICES Working Group on Eels. 2001. Report of the EIFAC/ICES Working Group on Eels, St. Andrews, N.B., 28 August—1 September 2000. Advisory Committee on Fisheries Management, International Council for the Exploration of the Sea, ICES CM 2001/ACFM:03, Copenhagen.

This report reviews American eel abundance trends, impacts caused by fisheries and by dams, assessment and management tools, and conservation needs. Reductions in habitat, declining or neutral abundance trends, severe decline in abundance in northern areas, continuous exploitation, and unknown oceanographic effects support the adoption of the precautionary approach. Efforts should be made to reduce human-induced mortality wherever possible. www.ices.dk/reports/acfm/2000/wgeel/wgeel00.pdf.

Casselmann, J. M. 2003. Dynamics of resources of the American eel, *Anguilla rostrata*: declining abundance in the 1990s. Pages 255-274, chapter 18, in K. Aida, K. Tsukamoto, K. Yamauchi (eds.) *Eel Biology*, Springer-Verlag Tokyo.

Reviews dynamics and status of American eel from prehistoric and historic times to the present, emphasizing the past 50 years. Long-term catch and scientific indices are numerous and emphasize unprecedented and dramatic declines, particularly in association with commercial harvest during the past decade throughout the entire species range. Recruitment decreases precipitously and in synchrony with catch and resource declines. Causal factors are reviewed but are inconclusive. Encourages joint management plans and reductions in human-induced mortality.

Japanese eel *Anguilla japonica*:

Tatsukawa, K. 2003. Eel resources in East Asia. pages 293-300 in K. Aida, K. Tsukamoto and K. Yamauchi, eds., *Eel Biology*, Springer-Verlag, Tokyo.

This paper provides an overview of existing information on time-trend in fisheries for the various life stages, and discusses causes of observed declines.

Tzeng, W.-N. 1997. Short- and long-term fluctuations in catches of elvers of the Japanese eel *Anguilla japonica* in Taiwan. In D. A. Hancock, D.C. Smith, A. Grand

and J. P. Beumer, ed. *Developing and sustaining world fisheries resources: the state of science and management*. 2nd World Fisheries Congress Proceedings, CSIRO publishing, Collingwood, Australia.

This paper provides catch data for the Japanese eel elver in Taiwan, China, Korea and Japan since 1972-1992. The catch revealed an approximately 11-year cycle with a peak in 1979 and a drastic decline in recent years. This corresponds to trends in the American (*A. rostrata*) and European (*A. anguilla*) eels. Overfishing and habitat degradation were probably the main causes of the recent declines.

New Zealand eels *Anguilla australis* and *Anguilla dieffenbachii*:

Glova, G. J., Jellyman, D. J. and Bonnett, M. L. 2001. Spatiotemporal variation in the distribution of eel (*Anguilla* spp.) populations in three New Zealand lowland streams. *Ecology of Freshwater Fish* 10:147-153.

The density of small longfin eels, *Anguilla dieffenbachii* (< 100 mm) in three study streams was consistently lower for three years of study, indicating poor recruitment of this species

Hoyle, S. D., and D. J. Jellyman, 2002. Longfin eels need reserves: modelling the effects of commercial harvest on stocks of New Zealand eels. *Marine and Freshwater Research* 53: 887-895.

Results of a conceptual model of spawner per recruit suggests that present level of exploitation of *Anguilla dieffenbachii* might result in severe depletion of the spawning stock and the current management measure of an upper size limit is ineffectual as the probability of capture before achieving this size is high. www.publish.csiro.au/?act=view_file&file_id=MF00020.pdf

McCleave, J. D. and D. J. Jellyman. In press. Male dominance in the longfin eel population of a New Zealand river: probable causes and implications for management. *North American Journal of Fisheries Management*.

Female *Anguilla dieffenbachii* were virtually absent in an extensive study of eels from a southern New Zealand river, despite dominating this area historically. These changes are attributed to extensive commercial harvest.

Jellyman, D. J., E. Graynoth, R. I. C. C. Francis, B. L. Chisnall, and M. P. Beentjes. 2000. A review of the evidence for a decline in the abundance of longfinned eels (*Anguilla dieffenbachii*) in New Zealand. Final Research Report, Ministry of Fisheries Research Project EEL9802.

This report reviewed available data for evidence of a decline in recruitment of longfin eels, *Anguilla dieffenbachii*—it included information on glass eel and elver catches and species proportions, age composition of both juvenile and adult eels, changes in abundance and size distribution of longfins; computer models were used to simulate the influence of changes in recruitment on size and age composition of populations. The report concluded that longfins are being overfished and this has significantly affected recruitment.