Spread of *Elodea canadensis* in Lake Baikal

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Abstract

In Lake Baikal *Elodea canadensis* Michx. was first observed at the end of the 1970's.

Suggestions have been made as to the bringing of *E. canadensis* to Baikal by aquarists or by transport vehicles and transport together with fishes taken from lakes of the Urals where mass development of the plant was observed at the beginning of the present century. The spread of *E. canadensis* along Lake Baikal must be due to navigation, but natural factors also affect its spread.

The quantitative biomass development of *E. canadensis* in various areas of the lake is reviewed, and discussed in relation to historical aspects of spread and regulation by environmental factors.

The fast spread of *E. canadensis*, its high competitive quality and metabolic capacities for purifying sewage waters deserve attention.

Expansion of *E. canadensis* may be referred to as a catastrophic phenomenon. Its effect has now covered practically the whole perimeter of Lake Baikal.

Introduction

Between the mid-1970's and early-1980's our attention was drawn to the appearance of *Elodea canadensis* Michx. first in the River Angara and its reservoirs, then in Lake Baikal. This phenomenon needs investigation on the following grounds: first, there is a big ecological spread of this species on the Euro-Asian continent, it is a major anthropogenic factor able to cause changes in the unique ecosystem of Lake Baikal; third, it is a possible agent of water self-purification.

The traditional habitat of *Elodea canadensis* was North America, from which it was brought to England. During less than two centuries it spread in Europe. Also, it was found in the lakes of the Urals.

*Historical aspects of spread in Baikal*

*Elodea canadensis* seemed to appear in the Irkutsk Reservoir (filled in 1956) after 1959, as in 1956–59) when Kozhova investigated plant periphyton it was not observed. In 1974 it expanded its habitat vigorously. Between the Irkutsk and Bratsk reservoirs the abundant development of *Elodea canadensis* was described in 1976, when it was established that *Elodea canadensis* and other aquatic plants (*Cladophora* spp., *Myriophyllum* spp., *Potamogeton* spp.) clogged up the gratings of water intake arrangements in the region of the town of Angarsk.

The abundant growth of these plants was observed in small lakes on the shores of the Angara river and particularly in a special channel along the shore of Angarsk, where the temperature of the water was some 3–4 °C higher than in the Angara River. Evidently, this factor has contributed to the development of *Elodea canadensis* and other plants (Kozhova *et al.*, 1985).

In Bratsk Reservoir, where plant periphyton was examined 1962–1967 (Kozhova, 1970), *Elodea canadensis* occurred neither in the flowing part of the reservoir nor in its bays. But in 1974
floating fragments of its stem occurred in mass, not only along navigable waterways but also in the upper part of the reservoir.

This is an indication of the probable spread of *Elodea canadensis* both in the Bratsk Reservoir and in lower-located reservoirs. In Lake Baikal *Elodea canadensis* was first observed at the end of the ’70s in the Selenga River shallows (Neronov & Maistrenko, 1981).

There are several assumptions regarding the ways of penetration of *Elodea canadensis* into Lake Baikal. One of them is an expansion by different ways from the Irkutsk Reservoir, where its mass growth was observed earlier than in the lake (1974) (Neronov & Maistrenko, 1981). The second source might be the Selenga River, as stated by Neronov & Maistrenko. But in 1972–3 Pautova (1973, 1974) investigated the Selenga shoal of Lake Baikal and did not observe *Elodea canadensis* in the Selenga River delta. Hence, *Elodea canadensis* appeared – at least in mass – after 1973, most probably in 1974–1977 (Kozhova & Timofeeva, 1986), as at the end of the ’70s it was discovered there in mass.

To explain the above, assumptions have been made as to the bringing of *Elodea canadensis* to Baikal by aquarists (through they use another species of *Elodea*) or by transport vehicles, and one more way may be added – transport of *Elodea canadensis* together with fishes which were taken from the lakes of the Urals, where mass development of the plant was observed at the beginning of the present century.

After comparison of all dates concerning the discovery of *Elodea canadensis* in Lake Baikal and River Angara, it is evident it has happened almost simultaneously – in the middle of the ’70s. It suggests that the appearance of the plant in these waters has occurred by ‘natural’ ways, as in Europe.

After *Elodea canadensis* was observed in the Selenga shallows, it was found in the southern part of the Maloye More strait, in Posolsky Sor (a shallow lagoon), and in the Chivyrkuisky Bay (Azovsky et al., 1983; Kuzmich et al., 1985). In 1981 it formed closed communities with complete cover of the bottom in the southern part of the Maloye More strait, the Mukhor and Sarmin shallow bays. In 1982–3 it existed in many bays of the Maloye More (Khuzhir – Nugo, Kurkut, Bazar, Tutay, Zagly). It was found not only in undistributed bays that deeply indent the coast and in Mukhor, but in a shoreline zone near capes. The phytomass (fresh weight) of *Elodea canadensis* reached 2–5 kg m⁻² in July–August (Kozhova & Timofeeva, 1986). *Elodea canadensis* co-occurs with typical plants for this region.

**Environmental control of biomass development**

As is well-known for the shoreline zone, shallow bays and streams of Baikal are relatively warm and protected from wave disturbances; their vegetation is rather diverse and includes widely spread species of aquatic plants. The most frequent are communities dominated by *Potamogeton perfoliatus* (Meyer, 1930; Kozhov, 1931, 1947; Kozhov & Spelit, 1958; Pautova, 1974; Azovsky et al., 1983). In such regions endemic algae of Baikal—that constitute the main part of the flora— are absent, but during summer such widely spread genera as *Cladophora*, *Spirogyra*, *Oedogonium*, and *Mougeotia* are abundant. In some places *Elodea canadensis* develops as separate growths, with other plants absent. This is an indication that it inhibited the *Potamogeton* spp. communities, spread in the southern part of the Maloye More strait (Kozhova et al., 1986). Neronov & Maistrenko (1981) pointed out the inhibitory effect of *Elodea canadensis* on local species of higher waterplants in Posolsky Sor, though in the ’80s it grew under the cover of *Potamogeton* spp. Sometime later it appeared along open coasts of the lake, where water vegetation is slow to develop and includes mainly *Potamogeton pectinatus*, *P. perfoliatus*, *Ranunculus trichophyllus*, and *Myriophyllum spicatum* (Kuzmich et al., 1985). Bottom algae are the main phytomass in the flora.

On the south-east coast *Elodea canadensis* was found in the regions of Utulik settlement (Kozhova & Timofeeva, 1986), Kluevka station, and on the north-west coast of south Baikal be-