4 Field Observations of Daphnid Grazing

4.1 Two Different Lakes in Holland

From mesocosm studies and plankton eco-assays examining toxicant exposure, it has become clear that the grazing effectiveness of daphnids is an important factor in plankton dynamics, and that the grazing effectiveness can be reduced by toxicant loading. In this chapter, the relevance of daphnid grazing in the field situation will be demonstrated on the basis of field surveys carried out in two Dutch lakes: Lake Geestmerambacht and Lake Amstelmeer.

Lake Geestmerambacht and Lake Amstelmeer are two moderately deep, man-made lakes in the province of North-Holland in the Netherlands (see Fig. 4.1). Both lakes were studied quite intensively during the nineteen nineties, with particular attention paid to their plankton communities. Comparative eco-assay studies were performed with water from both lakes in order to acquire an improved understanding of the variation in the grazing effectiveness of daphnids, and biotic and abiotic factors that may influence it .

Morphology

Lake Geestmerambacht was created from 1967 to 1979 as a consequence of sand excavation. The lake has a surface area of 70 ha and an average depth of 11 metres, with a deep area of 20–21 metres in the center . It is an occasional reservoir (8 Mm^3) for excessive polder water. The water residence time is more than 15 years. The surrounding area is used for recreation and pasture for cattle farming. The water is mildly brackish (salinity 0.25‰). The lake is monomictic, with stratification occurring in summer during the period from May–June to September–October (WL 1996; Van Dokkum and Van der Veen, 2000).

Lake Amstelmeer is a former tidal channel (Amsteldiep) of the Wadden Sea tidal area. In 1925, a dam was constructed separating the channel from the sea, thereby creating the lake. It has a surface area of 650 ha and is moderately deep with an average depth of 4.5 metres and a central section that is 10–16 metres deep. Lake Amstelmeer is an operational reservoir (29 Mm^3) for superfluous polder water from a catchment area consisting of 24 000 ha of polders in agricultural use (flower bulb cultivation, arable land). The residence time of the water is 2–3 months. The lake has slightly brackish water (salinity: 0.5–1.5‰).

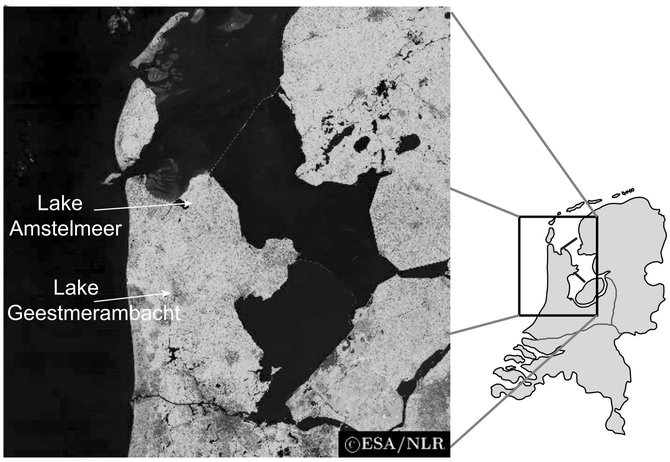

Fig. 4.1. Location of Lake Geestmerambacht and Lake Amstelmeer in the Netherlands

Water Quality

Both lakes are eutrophic: the average total P concentration is 0.45 mg/l in both lakes. The Kjeldal N concentration is higher in Lake Amstelmeer (2.3 mg/l) than in Lake Geestmerambacht (1.4 mg/l).

Lake Geestmerambacht does not have a permanent eutrophied character, and turbidity is generally low with a secchi-depth of 50–320 cm; and chlorophyll-a concentrations ranging from < 8 µg/l during the clear water phase which follows a short spring bloom of up to 185 µg/l during the cyanobacteria blooms that are regularly observed during August–September, (Van Dokkum et al. 1999; Van Dokkum and Hoornsman, 2000; Foekema and Van Dokkum, 2000; Holthaus et al. 2001).

In contrast, Lake Amstelmeer has a permanent eutrophied character (*senso lato,* see Chap. 1): a high turbidity, secchi-depth of 30–140 cm; no submerged vegetation; and a chlorophyll-a concentration typically ranging from 50 up to more than 200 µg/l (Fig. 4.2). A clear water phase is not reached.

4.2 The Plankton Dynamics in Lake Geestmerambacht

Phytoplankton

The phytoplankton dynamics in Lake Geestmerambacht show a typical seasonal pattern (see Fig. 4.3).

In winter, the chlorophyll-a concentration is low and the transparency of the lake is high. In the spring, when the water temperature and day-length increase, phytoplankton starts to develop and the spring bloom can reach chlorophyll concentrations up to 185 µg/l. Diatoms and green algae dominate the plankton (AquaSense 1996) (see Fig, 4.4). After the spring bloom has collapsed, a clear water