Zeitschrift: Mitteilungen der Naturforschenden Gesellschaft in Bern
Herausgeber: Naturforschende Gesellschaft in Bern
Band: 38 (1981)

Artikel: Primärproduktion und Phytoplankton im Bielersee : Berechnung der Tagesprimärproduktion aus Kurzzeitmessungen
Autor: Friedli, Peter / Tschumi, Pierre-André
Kapitel: 7: Summary
DOI: https://doi.org/10.5169/seals-318469

précédentes. Dans le lac de Bienne, les groupes d'algues importants pour la biomasse du phytoplancton sont les Diatomées, les Cryptophycées et les Chrysophycées, alors que les Chlorophycées ne jouent un rôle qu'en été et les Cyanophycées en automne seulement (fig. 7, 8).

7. L'évolution du lac de Bienne de 1930 à 1980 a été reconstituée sur la base de publications et de nos propres travaux (table 3). Durant cette période, le lac a passé d'un état oligo-mésotrophique à un degré élevé d'eutrophisation dû à un accroissement de l'apport d'agents nutritifs. De 1930 à 1971 la perte quotidienne moyenne d'oxygène dans la zone tropholytique a doublé. En 1971 la concentration du phosphore, mesurée en surface au mois de décembre, fut six fois supérieure à celle de 1951. Par contre, la concentration du nitrate ne s'est guère accrue de 1930 à 1975. Depuis la mise en service de la précipitation des phosphates dans les stations d'épuration du bassin de réception (table 12), les déficits du lac de Bienne en oxygène et les concentrations en phosphore ont nettement diminué. De ce fait, le déficit en oxygène est tombé de 2400 mg d'O_2 /m^2 · d en 1972 à 1500 mg d'O_2 /m^2 · d en 1980 et la concentration du phosphore en phase de circulation s'est abaissée de 124 à 45 mg PO_4-P/m^3. En revanche, les concentrations en nitrates ont nettement augmenté ces dernières années résultant probablement de l'intensification du fumage des sols agricoles.

7. SUMMARY

1. Primary production and respiration of the biocoenosis in the pelagic zone of Lake Biel (fig. 1) were measured on 18 sampling days between March 1975 and March 1976 at 3 week intervals (fig. 10). Simultaneously various related parameters were recorded – temperature (fig. 2), Secchi disk depth (fig. 3), oxygen (fig. 4), phosphate (fig. 5), nitrate (fig. 6), chlorophyll a (fig. 9).
2. On each sampling day 4 primary production experiments were carried out. Respiration was measured from sunset to sunrise (I), and gross production, net production and respiration from sunrise to 1200 (II), from 0900 to 1500 (III) and from 1200 to sunset (IV). The period III corresponds to the standard exposure period used in previous years.
3. *Daylight production* was estimated from the addition of the experimental results II and IV (equations (7)–(9)) and the *24 hour production* from the experimental results I, II and IV (equations (10)–(12)). These values were defined as *"measured values"*.

   From the results of period III the *daylight production* was extrapolated (equations (1)–(3)), as also was the *24 hour production* (equations (4)–(6)). In extrapolating, total incident radiation was used and a constant respiration rate assumed. These values were defined as *"estimated values"*.

4. The "estimated values" were always lower than the "measured values", at times considerably (tables 5, 6, 7). The degree of underestimation varies between sampling days and amounts to a yearly average (N = 17) of 26.4 % (a. M.; arithmetic mean) and 24.8 % (g. M.; weighted mean) for gross production, 40.5 % (a. M.) and 37.7 % (g. M.) for daylight net production and 67.0 % (a. M.) and 52.1 % (g. M.) for 24 hour net production.
5. The most important causes of the observed underestimation are given in chapter 4.8.4. and ways of more accurate extrapolation from period III to daylight or 24 hour primary production for conditions prevailing in Lake Biel are proposed in chapter 4.8.5.
6. Biomass and succession of the phytoplankton were estimated from cell counts. Two maxima (spring and late summer) appear in the course of the year and a minimum has been found in June as in all previous years of investigation. With respect to the phytoplankton biomass, the most important algal groups in Lake Biel are the Bacillariophyceae, the Cryptophyceae and the Chrysophyceae. Chlorophyceae are of some importance only in summer and Cyanophyceae only in autumn (fig. 7, 8).
7. The trophic state of Lake Biel can be followed over a period of 50 years between 1930 and 1980 by combining our own data with those of other authors (table 3). During this period it has changed from an oligo-mesotrophic to an eutrophic condition due to the increasing nutrient inflow. In the tropholytic layer, oxygen consumption rates doubled between 1930 and 1971. A sixfold increase in surface phosphorus concentrations occured between december 1951 and december 1971. No significant change occured, however, in the nitrate concentrations measured between 1930 and 1975.

   Since the introduction of phosphorus elimination in the most important sewage plants within the Lake Biel drainage area (table 12), a marked reduction in oxygen consumption rates and phosphorus concentrations has been measured. The oxygen consumption rate decreased from approximately 2400 in 1972 to 1500 mg $O_2/m^2 \cdot d$ in 1980. During the same period the phosphorus concentration decreased from 124 to 45 mg PO_4-P/m^3. However, in recent years the spring overturn concentrations of nitrate-nitrogen have increased markedly, most probably due to intensified application of agricultural fertilizers.

8. LITERATURVERZEICHNIS

1 Åberg, B.: Physiologische und ökologische Studien über die pflanzliche Photomorphose. Symb. Bot. Ups. 8, 1–189 (1943)

1a Ambühl, H.: Der Zustand der Gewässer in der Schweiz. Informationstagung "Landwirtschaft und Gewässerschutz". Dokumentation der Eidg. Forschungsanstalt, CH-3097 Liebefeld (1978)

2 Anderson, R. S.: Diurnal primary production patterns in seven lakes and ponds in Alberta (Canada). Oecologia 14, 1–17 (1974)