

DOBRYNIN, E.G.

The intensity of photosynthesis in salt lakes of Crimea.

Inf. Byull. Biol. vnutr. Vod., 37, 26-29 (1978).

Translated by P. Moorhouse.

Facts about primary production in salt waters have been exhausted in recent times by the articles of S.I. Kuznetsova & V.I. Romanenko (2), and E.G. Dobrynin (1) for the salt lakes of Crimea, and of W.D. Williams (4) for Australia. The works of these authors, however, relate to single observations and give only an approximate idea of phytoplankton production in highly-salted lakes.

The purpose of our work was the study of phytoplankton production of the salt lakes of the Steppe region of Crimea, during the vegetative period of 1974. From May to October Sakscoe and Sasyk Lakes were examined, and from August to October - Moinakskoe Lake. The high insolation and, as a rule, the strong dry winds in the locality of the salt waters transform them in the summer months into intensive evaporators. Thus the concentration of salt in Satscoe Lake increased from 58 g/l in May to 140 g/l in September, and in Sasyk Lake from 77 to 200 g/l in the same period. Such large variations in salinity of these lakes are explained by the lack of settling of NaCl and the dilution of the salt water by the autumn and winter atmospheric precipitation.

The density of the salt water was measured by a hydrometer up to the third mark. The intensity of photosynthesis was determined by the radiocarbon method of V.I. Romanenko and S.I. Kuznetsov (3). The difference from the records in the textbook was that the great density of the salt water allowed only 10 ml of the sample to filter through. The carbonates were determined by titrating 100 ml of salt water with a 0.1 normality solution of HCl with the indicator methyl red.

Primary production under 1 m² they calculated as the product of its value in the surface layer and the depth of the water body. The feasibility of this calculation was guaranteed by the small depth (0.4 - 0.7 m), by the complete transparency and by the vertical mixing of the whole water mass.

Sakskoe Lake was divided by a dam into two parts. Into one of these flows the industrial effluent from the raw materials of the Sakskoe chemical factor. The other (area 160 ha, average depth 0.5 m) is the source of medicinal slime* for the sanatorium and is not subject to outside influence. Phytoplankton production in the lake (table 1) reached high values even in spring, and at the beginning of summer was that caused by the appearance in the plankton of large numbers of filamentous algae. In East Sivash the change of the filamentous alga Cladophora sivashensis, from the sessile state into phytoplankton, occurs at a salinity of about 50 g/l (2). Such a concentration already existed at the start of our observations. Maximal production of planktonic filamentous algae (10.92 mg C/l per day) was recorded in mid-June at a salinity of 70 g/l. With an increase in the salt concentration up to 80 g/l practically all of its mass died off and the intensity of photosynthesis decreased by almost 40 times. During July phytoplankton production was at a low level, but in August (at salinity of 105 g/l) it again revived. With the increase of salinity to 140 g/l in mid-September there was a noticeable reduction of phytoplankton production. The subsequent dilution of the salt-water by the autumn rain brought an increase in the intensity of photosynthesis in October with a decrease in temperature.

Sasyk Lake - area 4,700 ha, average depth 0.7 m. At the start of our observations (13 May) the salt water of the lake had a salinity of 77 g/l, equal to that at which, in Sakskoe Lake, the disappearance of filamentous algae occurred. Therefore in May to the beginning of June the lowest level of primary production in the lake was recorded (table 2). In June-July the intensity of photosynthesis increased, reaching a maximum (3.32 mg c/l per day) at the beginning of August with a salinity of about 150 g/l. A further increase in salt concentration led to a decrease in phytoplankton production.

Moinakskoe Lake - area about 200 ha, depth 0.6 m. Phytoplankton production was not great (table 3); its variation was not so marked as in Sakskoe or Sasyk Lakes. Only in this lake is a clear effect of temperature on the intensity of photosynthesis apparent. This decreased twofold during the drop in temperature from 31-32° in August to 21-24° in September-October. The concentration of salt in the water remained constant during this time (85 - 90 g/l).

From the data presented, it is apparent that the intensity of photosynthesis in Sakskoe and Sasyk Lakes, on average, is extremely high - 1.91 and 1.12 mg c/l per day, respectively. Such high phytoplankton production in a unit of volume caused high values under 1 m² (0.95 and 0.72 g c/m² per day), in spite

* gryaz' = slime, sludge, ooze, slurry.

of the small depth of the photosynthesising layer in these lakes.

Literature

1. DOBRYNIN E.G. (Microbiological characteristics of Sivash and the evaporative basins of the salt mines). Inform. Byull. "Biol. vnutr. vod", (1974) No. 22, 2-7.
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3. ROMANENKO V.I., KUZNETSOV S.I. (Ecology of freshwater organisms) (1974). Leningrad. 194 pp.
4. WILLIAMS W.D. The uniqueness of the salt lake ecosystem. Prod. Probl. freshwater. Proc. IBP-Unesco Symp. (1972), 349-361.

Table 1 The intensity of photosynthesis (P) in the salt-water of Sakscoe Lake.

	15 May	15 June	1 July	15 July	2 Aug.	17 Aug.	1 Sept.	15 Sept.	15 Oct.	Average
Salinity, g/l	58	68	80	100	104	110	125	140	126	-
Temperature, °C	22	28	28	29	29.5	30.5	26	21	21	-
P, mg C/l per day	1.78	10.92	0.26	0.22	0.60	2.02	0.66	0.21	0.49	1.91
P, g C/m ² per day	0.89	5.46	0.13	0.11	0.30	1.01	0.33	0.10	0.25	0.95

Table 2 The intensity of photosynthesis (P) in the salt-water of Sasyk Lake.

	13 May	3 June	16 June	19 July	5 Aug.	22 Aug.	3 Oct.	Average
Salinity, g/l	77	83	90	130	147	165	203	-
Temperature, °C	23	26	28	29	29.5	30.5	18	-
P, mg C/l per day	0.12	0.16	0.97	1.16	3.32	1.57	0.52	1.12
P, g C/m ² per day	0.08	0.11	0.68	0.81	2.32	1.10	0.36	0.78

Table 3 The intensity of photosynthesis (P) in the salt-water of Moinakskoe Lake.

	14 Aug.	2 Sept.	16 Sept.	11 Oct.
Salinity, g/l	85	90	90	84
Temperature, °C	31	24	21	21.5
P, mg C/l per day	0.47	0.25	0.25	0.24
P, g C/m ² per day	0.28	0.15	0.15	0.14

Notice

Please note that these translations were produced to assist the scientific staff of the FBA (Freshwater Biological Association) in their research. These translations were done by scientific staff with relevant language skills and not by professional translators.