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<td>Author(s)</td>
<td>Iizuka, Syozi; Simizu, Tiaki; Kazihara, Takesi; Irie, Haruhiko</td>
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<tr>
<td>Citation</td>
<td>長崎大学水産学部研究報告, v.9, pp.59-63; 1960</td>
</tr>
<tr>
<td>Issue Date</td>
<td>1960-07-31</td>
</tr>
<tr>
<td>URL</td>
<td><a href="http://hdl.handle.net/10069/31787">http://hdl.handle.net/10069/31787</a></td>
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Spectrophotometric investigation of the plankton pigments — II

On the daily variation of the pigment amount

Syozi IIZUKA, Tiaki SIMIZU, Takesi KAZIHARA, and Haruhiko IRIE

Introduction

In previous report the Authors divided the spectral absorption curves of absolute acetone extracts of natural plankton collections into 3 types according to the values of \(E_{435}\)-\(E_{670}\) ratio and the forms of curve. In present paper we observed the daily variations of the plankton pigments by using the data for 100 days from April 20 to July 31, 1969 at Sakibe Inlet, Sasebo Bay, although observations being carried on all year round. From the data, we determined the rate of daily variation and discussed on the sampling interval, in addition.

Method

Five liter surface water samples at a fixed point in the Inlet were collected at the same time (a.m. 09:00), every day. After filtering with Toyo-filter No. 2, a definite volume (10 ml.) of absolute acetone and powdered magnesium carbonate were added and stirred for 20 minutes. Then, the extracts were centrifuged and the absorbencies at 435 and 670 \(\mu\) of clear extracts were determined on a Beckman Model DU Spectrophotometer.

Observation

The Authors prepared the figure of the daily variations of the absorbencies at 435 and 670 \(\mu\) (\(E_{435}\) and \(E_{670}\)) (Fig. 1). Between variation curves of \(E_{435}\) and \(E_{670}\), there is a parallelism assumed dueing to keep the definite values on the \(E_{435}\)-\(E_{670}\) ratio under the usual field conditions (reference previous report\(^1\)). Therefore, as it is permitted to use either the curve of \(E_{435}\) or \(E_{670}\) in order to obserbate grossly the variations of pigments, the Authors obserbated the daily variations by the curve of \(E_{435}\) in the present paper.

During the observation period, the largest variation occurred from July 9 to July 22 and the maximum rate in the succeeding two or three days is about 3.5 times (16/VII~17/VII) or 1/3 time (13/VII~25/VII) in the increase-or-decrease-curves, respectively, but it seems to be exceptional in the field. As a rule, the variation rate is less than 2 times or more than half in the increase-or-decrease-curves, respectively. Consequently, the daily variation rate is not so large except the special case. In succession of variation as above mentioned, there are four terms of abundant pigments during the
Daily variations of the plankton pigment amounts ($E_{435}$ and $E_{670}$) from April 20 to July 31 at Sakibe Inlet, Sasebo Bay; surface collections

Observation periods, i.e. 6/V~15/V, 23/V~31/V, 8/VI~17/VI and 9/VII~22/VII, the last being remarkable in duration and in amount compared to others. In this term, though there is a depression of the values (15/VII~15/VII), this is attributed to the reason which the surface phytoplankton population disappeared temporarily by heavy rainfall, being total 300 mm. from July 13 to 15, and the variation rate was 1/3 time, in the same time. While, as a result of cell count, the Authors knew that the observation period agreed to the phytoplankton blooming in a year cycle; namely, in April the population being barren like in March, then beginning to show symptom of increase in first decade of May and the phytoplankton blooming succeeding from the middle of May to the middle of July. But in the variation curves of pigments it is not seen any relation indicating the rise and fall of population.
Discussion

Problem on the sampling interval

From observations of wide daily variation of the plankton pigment amounts in the field, the Authors considered about minimum sampling interval to knew the accurate variation-phase of plankton population, as follows. For this purpose, data used are from the values of 70 samples collected during the observation period, the average of absorbencies (E$_{435}$) of total samples being 0.284, the variation curve being prepared in Fig. 2. Assumed that this is a perfect sampling, the averages are 0.298 and 0.270 respectively in the case of two-days interval sampling, and the variation curves were prepared in Fig. 3 & 4. Between the average of perfect sampling and the averages two-days interval sampling, there are not seen the remarkable differences, but in the case of 5-days interval sampling (Fig. 5), the differences are remarkable. According to Table 1, showing the average in the case of perfect sampling and all averages in each case of 2, 3, 5, 10 or 30-days interval sampling, respectively, the averages in the 3-days interval sampling are 0.283, 0.298 and 0.306, but in the 5-days interval the averages of 2 samples among 10 (40%) differ remarkably from the average of perfect sampling. In 10-days interval, 6 samples among 10 (60%) being as mentioned above and in the 30-days interval, 20 samples among 30 (66%) being so. From these considerations, the Authors presumed that the appropriate and minimum sampling interval is twice a week to knew
By means of spectrophotometric method, the Authors observed daily variations of pigment amounts in natural plankton collections for 100 days (from April 20 to July 31), coinciding with the season of phytoplankton blooming, at Sakibe Inlet in Sasebo Bay. In the usual case, the rate of daily variations of $E_{435}$ were less than 2.0 times or more than half in the increase - or decrease - curves, respectively (Fig.1), but in the unusual, there seemed possibility of exceeding those. During the observation period, the maximum rate was 3.5 times or 1/8 time in the increase - or decrease - curves, respectively. Hence, we must keep, there being more wide variation of pigment amount in the field.

**Summary**

By means of spectrophotometric method, the Authors observed daily variations of pigment amounts in natural plankton collections for 100 days (from April 20 to July 31), coinciding with the season of phytoplankton blooming, at Sakibe Inlet in Sasebo Bay. In the usual case, the rate of daily variations of $E_{435}$ were less than 2.0 times or more than half in the increase - or decrease - curves, respectively (Fig.1), but in the unusual, there seemed possibility of exceeding those. During the observation period, the maximum rate was 3.5 times or 1/8 time in the increase - or decrease - curves, respectively.
in minds. Under these circumstances, the Authors assumed to be appropriate twice a week as sampling interval from the data collected.

Reference