Reprinted from the "Proceedings of the Indian Academy of Sciences," Vol. XLVII, 1958

A NOTE ON THE OCCURRENCE AND FEEDING HABITS OF *NOCTILUCA* AND THEIR EFFECTS ON THE PLANKTON COMMUNITY AND FISHERIES

By
R. Raghu Prasad

Reprinted from "The Proceedings of the Indian Academy of Sciences",
Vol. XLVII, No. 6, Sec. B, 1958

A NOTE ON THE OCCURRENCE AND FEEDING HABITS OF *NOCTILUCA* AND THEIR EFFECTS ON THE PLANKTON COMMUNITY AND FISHERIES*

BY R. RAGHU PRASAD
(*Central Marine Fisheries Research Station, Mandapam Camp*)
Received January 8, 1958

(Communicated by Dr. S. Jones, F.A.SC.)

INTRODUCTION

Noctiluca miliaris (Suriray) are widely distributed in the tropical and temperate seas and under favourable conditions they rapidly reproduce by binary fission resulting in the production of great masses of individuals particularly in the inshore waters. The countless numbers thus produced, by their accumulation, impart a reddish, pinkish or greenish (if the *Noctiluca* have the green flagellates in them) colour to the surface waters. There are several reports of such swarming from various parts of the world but except in a few instances the mere swarming of these does not seem to have caused any widespread mortality of the marine fauna.

Along the coasts of India *Noctiluca* are extremely common and some of the effects of their swarming on fishes and fisheries have been reported by Aiyar (1936), Bhimachar and George (1950) and Prasad (1953). The causes responsible for these great outbreaks are not fully known, but according to Brongersma-Sanders (1948) regions where there is rapid replacement of nutrients resulting in their high concentration and consequent phytoplankton production are the obvious places of great outbreaks of *Noctiluca* as these organisms are holozoic and feed on phytoplankton. Among these regions, she considers those of upwelling near the coast to be by far the most important. Prasad and Jayaraman (1954) made preliminary observations on certain changes in the plankton and hydrological conditions associated with the swarming of *Noctiluca* in the environs of Mandapam. These studies were continued by the present author to ascertain the conditions which favour swarming, the feeding habits of *Noctiluca* and their possible effects on the plankton community and fisheries.

* Published with the permission of the Chief Research Officer, Central Marine Fisheries Reserach Station, Mandapam Camp.

OCCURRENCE, FOOD AND FEEDING HABITS

The occurrence of *Noctiluca* in Palk Bay and the Gulf of Mannar during the years 1952–56 is shown in Table I. In all these years only the 'green *Noctiluca*' were present in this area and they were more abundant (except in 1954) in Palk Bay where, it is interesting to note, in 1952 a large population persisted for a considerable period of time. In general, the population of *Noctiluca* showed a decline from 1952 up to 1954, then it increased in 1955 and again decreased in 1956. Further, it will be seen from Table I that there are marked differences in the time of occurrence and magnitude of populations between the areas and also within the same area from year to year.

The factors which create conditions favourable for swarming are not fully understood but the present study has clearly revealed two conditions which are essential. Firstly, it has been observed locally that *Noctiluca* are able to multiply rapidly and form swarms only when calm conditions prevail in the area. Turbulent conditions seem to be not only unfavourable for their rapid growth and accumulation to form swarms but even large populations which are sometimes brought into turbulent areas do not seem to remain there for any length of time. Secondly, there is a definite indication that swarming is closely associated with diatom blooms which themselves, in this area, coincide with the calm conditions following turbulence and consequent replenishment of nutrient salts from the bottom. The available data suggest that if *Noctiluca* are present in an area where there is rich diatom population or if they are carried into such regions, they rapidly multiply and form swarms provided the sea is calm; the magnitude of the population depending upon the richness of the diatom population. If, on the other hand, the diatom population is low in the particular area swarms are not formed and even large populations brought into regions of low diatom production rapidly decrease in number. The diatom cycles and the periods of turbulence in Palk Bay and the Gulf of Mannar are different (see Prasad, 1958) and the observed differences in the occurrence, time of maxima and magnitude of population of *Noctiluca* between the two regions can be explained in terms of the two main factors mentioned above which seem to control to a very large extent the swarming. It should be pointed out here that although the hydrological conditions of the environment show certain changes during the actual swarming of *Noctiluca* (Prasad and Jayaraman, 1954) it has not been possible to detect any changes in the physico-chemical or biological conditions of the environment which precede and would thus forewarn these outbursts.

Noctiluca are known to be voracious feeders engulfing particulate food such as diatoms and other small organisms. Devanesan (1942) remarked

TABLE I

The distribution of Noctiluca *in Palk Bay (P) and the Gulf of Mannar (G). The numbers represent the monthly average numbers present in* 1 *c.c. of the standardized sample. Fractions are omitted*

Months	1952		1953		1954		1955		1956	
	P	G	P	G	P	G	P	G	P	G
January	..	..	61	..	*	482	..	2	..	106
February	..	..	357	22	49	314	*	748	..	..
March	19	41	116	7	1	2	..	..	..	1
April	866	140	172	4	37	..	..	124	926	..
May	1,125	..	3	..	37	..	*	37	17	..
June	1,209	..	1	..	..	1	1,961	..	..	..
July	1,846	911	..	..	89	2	811	..	..	33
August	364	..	111	..	..	..	469	1,135	..	10
September ..	1,000	..	90	..	..	..	502	..	..	..
October	1,186	688	1907	534	..	..	20	6	..	2
November ..	122	913	598	998	..	..	1	..	..	..
December ..	..	343	..	48	..	..	*	824	*	..

* Data not available.

ing on the mackerel fishery of this area it is not possible to make a definite statement because although mackerel do occur in this neighbourhood there is no regular mackerel fishery as such and only relatively small shoals appear here. There is, however, some indication that the catches are poorer when there is a swarming of *Noctiluca*. As sardines, anchovies and mackerel together form a very important fishery resource of India, the swarming of *Noctiluca* will have disastrous consequences if it coincides with the time and place of these fisheries.

Nakai (1954) remarked that *Noctiluca* can be useful as it " reveals fishing grounds of sardines through phosphorescence at night." At the same time he remarked that these can affect the catches because " fish evades the nets through luminosity."

SUMMARY AND CONCLUSIONS

It becomes evident from the above facts that the effects of *Noctiluca* swarms on fisheries are more adverse than beneficial. Swarming takes place only when the sea is calm and there is an abundant supply of diatoms, the outbursts being usually preceded by diatom blooms. *Noctiluca* voraciously feed on several species of diatoms and to a very small extent on some of the smaller zooplankters. The presence of a large number of *Noctiluca* in an area seems to exclude other zooplankters, particularly the copepods. The rapid grazing down of diatoms and the exclusion of other zooplankters result in an almost monospecific population of these abnoxious cystoflagellates. Such a plankton adversely affects the important fisheries for sardines, anchovies, mackerel, etc., as these fishes do not occur in the presence of *Noctiluca* swarms. The negative indication continues as long as the swarms persist but transient swarms do not seriously affect either the plankton community or fisheries.

ACKNOWLEDGEMENTS

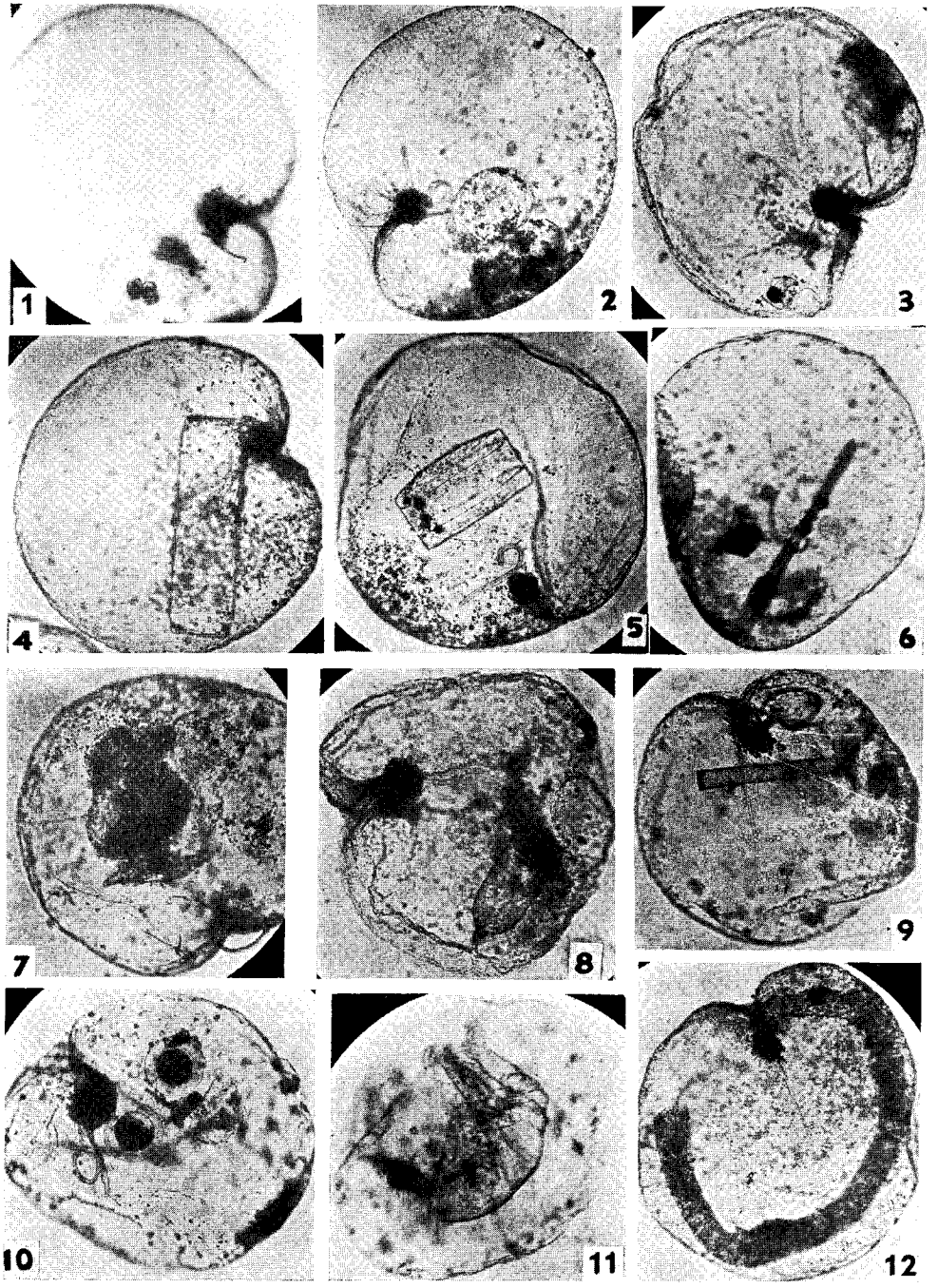
The author wishes to thank Dr. S. Jones, Chief Research Officer, for his comments and criticisms and Shri K. G. Nambiar for taking the photomicrographs.

REFERENCES

Aiyar, R. G. .. "Mortality of fish of the Madras Coast in June 1935," *Curr. Sci.*, 1936, **4**, 488–89.

Bainbridge, R. .. "Studies on the interrelationships of zooplankton and phytoplankton," *J. Mar. biol. Ass. U.K.*, 1953, **32**, 385–447.

Bhimachar, B. S. and George, P. C. "Abrupt setbacks in the fisheries of the Malabar and Kanara coasts and 'Red water' phenomenon as their probable cause," *Proc. Indian Acad. Sci.*, 1950, **31 B**, 339–50.



PHOTOGRAPHS 1–12 show *Noctiluca* with various ingested organisms. 1. *Melosira sulcata.* 2. *Bacteriastrum hyalinum.* 3. *Chætoceros diversus.* 4. *Biddulphia* sp. 5. *Grammatophora* sp. 6. *Climacosphenia elongata.* 7. *Pleurosigma normanii.* 8. *Cyttarocylis ehrenbergi.* 9. *Tintinnopsis nordqvisti.* 10. Pelagic copepod eggs. 11. Copepod. 12. *Sagitta* sp.

Brongersma-Sanders, M. .. "The importance of upwelling water to vertebrate palæontology and oil geology," *Kon. Ned. Ak. Wet., Verh. Afd. Nat.* (*Tweede Sectie*), 1948, **45,** 1–112.

Devanesan, D. W. .. "Plankton studies in the fisheries branch of the Department of Industries and Commerce, Madras," *Curr. Sci.*, 1942, **11,** 142–43.

Enomoto, Y. .. "On the occurrence and the food of *Noctiluca scintillans* (Macartney) in the waters adjacent to the west coast of Kyushu, with special reference to the possibility of the damage caused to the fish eggs by that plankton," *Bull. Japanese Soc. Sci. Fish.*, 1956, **22,** 82–88.

Nakai, Z. .. "On the methodology of marine plankton collection, with a suggested classification," Symposium on marine and freshwater plankton in the Indo-Pacific, 1954, *Indo-Pacific Fish. Council, Bangkok*, 71–77.

Prasad, R. R. .. "Swarming of *Noctiluca* in the Palk Bay and its effects on the 'Choodai' fishery, with a note on the possible use of *Noctiluca* as an indicator species," *Proc. Indian Acad. Sci.*, 1953, **38 B,** 40–47.

——— .. "Plankton Calendars of the Inshore Waters at Mandapam, with a note on the Productivity of the Area," *Indian J. Fish.*, 1958, **5,** 170–88.

——— and Jayaraman, R. .. "Preliminary studies on certain changes in the plankton and hydrological conditions associated with the swarming of *Noctiluca*," *Proc. Indian Acad. Sci.*, 1954, **40 B,** 49–57.