

# PHOSPHORUS AND IRON IN *SAGITTA SETOSA* AND *SAGITTA ELEGANS*

By R. J. Harrison

Gonville and Caius College, Cambridge

(Text-fig. 1)

Cooper (1939) reported much more iron in *Sagitta setosa* than in *S. elegans*. The analyses had been made in different years, while for *S. setosa* only one sample had been examined and this may conceivably have been contaminated. In the spring of 1939 the problem was accordingly attacked afresh.

## METHODS

To reduce the likelihood of contamination, the galvanized iron bucket of the ring trawl was replaced by a glass breffit from which the animals were removed by a glass pipette on to a filter paper; from this they were transferred by a glass seeker to a tared micro-beaker. Each sample was dried overnight in an aluminium-lined electric oven at 110° C. After weighing, concentrated sulphuric acid (0.1 ml.) was added, and the mixture heated at 120° C. for 1 hr in a hot-air bath made from a fire-clay crucible. The carbonaceous residue was oxidized with Merck's perhydrol which was found to contain a negligible amount of phosphorus and no iron; three to four drops were sufficient. The solution was then made up to 25 ml.

The method used for estimating the phosphorus was similar to that used by Cooper (1934) except that the addition of the stannous chloride followed that of the acid molybdate reagent.

The iron was estimated by the 2:2'-dipyridyl method (Cooper, 1935). Economy of this rather expensive reagent was achieved without loss of accuracy by the following procedure. Ten ml. of sample were treated with 0.1 ml. 4*N* hydrochloric acid and 0.2 ml. 10% sodium sulphite as reducing agent. After 1 hr 0.5 ml. of a 0.2% solution of dipyridyl in *N*/50 hydrochloric acid together with 0.4 ml. of a 10*N* solution of ammonium acetate were added. Four hours later the samples were compared with a standard (3.75 µg. Fe in 10 ml. water) in a Kober colorimeter.

Table I shows that there was a gradual decrease in the amount of iron in *S. setosa* until February 24. During this period the *Sagitta* were all immature, being mostly in stage II (see Russell, 1932, p. 133). In March the iron content was still somewhat low, but in April it had risen almost to that of the first sample. In the samples taken in March and April the *Sagitta* were more mature.

TABLE I

Sample no.	Date of capture	No. of animals analysed	Stage	Length in mm.	Dry weight of one animal mg.	Dry weight / Wet weight %
<i>Sagitta setosa</i>						
17a	13. ii. 39	12	II	11-12	0.251	8.82
17b	13. ii. 39	12	II	11-12	0.242	8.83
17c	13. ii. 39	12	II	11-12	0.277	9.28
18a	21. ii. 39	18	I-II	10-13	0.196	9.20
18b	21. ii. 39	21	I-II	10-13	0.182	8.89
18c	21. ii. 39	12	I-II	10-13	0.189	..
22	24. ii. 39	63	II	10-12	0.183	11.10
23	10. iii. 39	20	II-III	..	0.219	8.70
25	14. iii. 39	27	III	..	0.269	..
27	I. iv. 39	50	II-III	..	0.268	..
<i>Sagitta elegans</i>						
24	10. iii. 39	11	III	13-15	0.362	10.90
26	14. iii. 39	25	III	..	0.371	..

Sample no.	% composition on dry weight		Content of one animal		Ratio in mg.-atoms Fe/P
	P	Fe	P µg.	Fe µg.	
<i>Sagitta setosa</i>					
17a	0.88	0.118	2.20	0.29	..
17b	0.83	0.120	2.01	0.29	0.076
17c	0.89	0.120	2.46	0.33	..
18a	0.79	0.084	1.55	0.16	..
18b	0.85	0.081	1.56	0.15	0.053
18c	0.79	0.092	1.49	0.17	..
22	0.99	0.043	1.81	0.08	0.025
23	1.20	0.085	2.63	0.19	0.039
25	0.99	0.059	2.66	0.16	0.033
27	1.00	0.108	2.68	0.29	0.061
<i>Sagitta elegans</i>					
24	1.25	0.086	4.54	0.31	0.038
26	1.16	0.029	4.30	0.11	0.014

The numbers of *S. setosa* caught in half-hour oblique trawls with the 2 m. stramin ring trawl over the period of the observations are given below. These figures were kindly given me by Mr F. S. Russell.

Date	Numbers of <i>S. setosa</i>
8. ii. 39	9620
13. ii. 39	8030
21. ii. 39	571
27. ii. 39	199
6. iii. 39	22
14. iii. 39	91
20. iii. 39	3
27. iii. 39	..

It is noteworthy that the numbers of *Sagitta* decreased very considerably towards the end of February. This decrease was probably due to the dying off of the brood that had lived over the winter.

Fig. 1 shows the logarithms of the numbers of *S. setosa* in the ring trawl hauls and the ratios Fe/P plotted against time. This figure and Table I show clearly that as the numbers of *S. setosa* decreased, the content of iron, both absolutely and relatively to phosphorus, also fell away. Finally only a few individuals of higher iron content were found.

The sequence of generations in the life cycle of *S. setosa* is not clear (Russell, 1933), but it is possible that by April individuals of a different generation from that in February are prevalent. If this be so it is perhaps significant that in April the iron content was high. It is not possible to draw definite con-

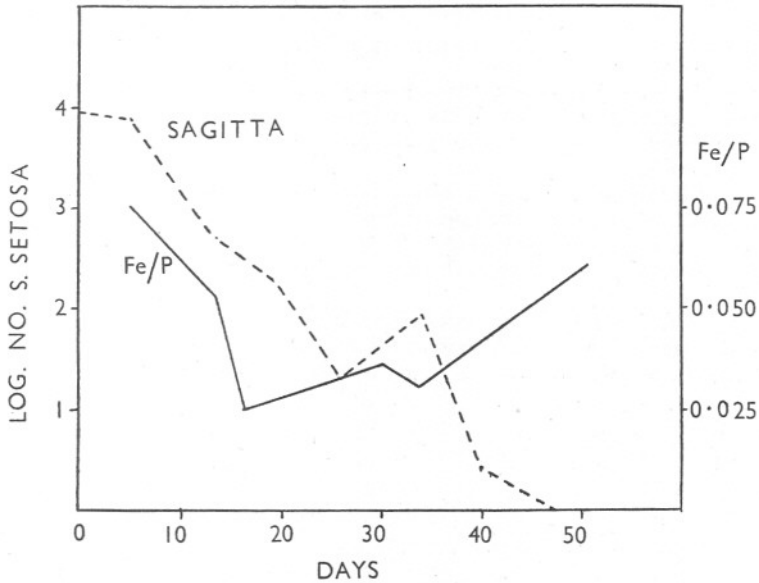


Fig. 1. Numbers of *Sagitta setosa* in ring trawl catches plotted logarithmically (—); and ratio of iron to phosphorus in mg.-atoms (---), during the period of observations.

clusions from the results, but the decrease in iron content during the period of dying off of the February population may perhaps suggest that the viability of *Sagitta* is associated with their content of iron. At any rate we have definite indications that the iron content may vary considerably from time to time and that, therefore, the problem is well worth following throughout the successive generations of *Sagitta* during a year.

*S. elegans* was scarce during the whole period of the investigation, but the only two samples with sufficient numbers for analysis showed a considerable decrease in iron content between March 10 and 14.

The high iron content found by Cooper in *S. setosa* in May 1934 has not yet been reproduced, the amount of iron appearing to be of the same order in the two species.

My thanks are due to Mr F. S. Russell, F.R.S., for suggesting the problem and for assistance in the sampling and to Dr L. H. N. Cooper for much helpful advice on the chemical technique.

#### SUMMARY

The amount of iron and phosphorus in *Sagitta setosa* and *S. elegans* has been estimated. As the winter population decreased in numbers the iron content per animal also decreased, rising again in what may have been the next brood.

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