

The Fig. 2 shows some differences between catches by the two types of sampling gear. The copepods of the smallest size (0.7 - 0.9 mm) show little difference. Pump appears to be a better gear for copepods for the size range between (1.0 - 1.6 mm). These observations are in agreement with Aron (1958). It would appear that the two gears have collected different numbers and varieties of copepods. The discrepancy in the catch may be attributed to gear selectivity or plankton patchiness.

References

- Aron, W. (1958) The use of large capacity portable pump for plankton sampling with notes on plankton patchiness. *J. Mar. Res.* Vol. 16, pp. 158-72.
- Unesco (1968) Zooplankton sampling. Monograph on Oceanographic methodology Vol. 2. 174 P.

10. *The Japanese Jet Net* — M. Anraku.

M. Anraku gave a talk on the methods of handling and towing the Japanese Jet Net (Tanaka *et al* 1968). This is a high speed sampler and can be conveniently hauled horizontally at 100 m depth at a towing speed of 12 knots. This is a highly sophisticated net, and marks a new step towards high speed sampling.

Reference

- Tanaka, H., Imayama, Y., (1968) A hydrodynamic study of a modified model of the Clarke Jet Net. *Marine Biol.* 1 (3), 204-207.
- Azeta, M., Anraku, M.

11. *Fixation and preservation of plankton samples* — C. B. Lalithambika Devi.

Zooplankton samples were taken from Ernakulam Channel (Cochin Harbour). Representative groups of organisms were sorted out and their body proportions were measured using ocular and stage micrometers, when they were alive and then preserved in different concentrations of formaldehyde. The body proportions were measured after first, second, seventh and thirtieth day for each individual specimen. The figures shown in table 1 indicate the average for each group. To eliminate possible errors due to variations in salinity, different grades of formaldehyde (1.6, 4.0, 5.0 and 10.0 per cent) were prepared in sea water taken at the time of collection. One set of samples was preserved in 4% stock solution of formaldehyde, which is prepared in sea water and kept over a period of six to seven months. Another set of samples was preserved in 4% hexamine buffered formaldehyde prepared in tap water. The preservatives were added to the specimen in small quantities at a time, to avoid distortion. Percentage reduction in standard length of the material in different grades of the preservatives were calculated.

1. Fish larvae (Forms with endoskeleton). The shrinkage values of fish larvae varied with concentration of the formaldehyde used. The maximum total shrinkage after 30 days (at the end of the experiment) of 8.22 per cent was found in 10% and a minimum of 3.9 per cent in 5% formaldehyde (Table 1, Fig. 1). The shrinkage was uneven in 1.6% and in 4% hexamine buffered formaldehyde and in both cases the percentage of shrinkage was low after some days. The shrinkage was 5 times greater in early stages than in advanced forms (Table 5, Fig. 5).

2. Crustaceans (Forms with exoskeleton).

Even though a shrinkage of 3.1 per cent was observed on the first day, there was no change in this value when 4% stock solution was further used. In 10% solution maximum shrinkage of 12.53 per cent was observed on the seventh day but at the end of 30th day the value was reduced to 4 per cent (Table 2, Fig. 2). The shrinkage though less in the initial stages in 4% hexamine buffered formaldehyde, become more or less stable after seven days. In other concentrations there were fluctuations at one time or other.

Table 1-4 Shrinkage of zooplankton in relation to concentration of formaldehyde.

Table 1. Forms with endoskeleton

Strength of formaldehyde %	Percentage reduction one day	Percentage reduction two days	Percentage reduction in standard length seven days	Percentage reduction in standard length after thirty days
1.6	3.06	3.17	4.30	6.12
4.0 S*	3.97	4.81	5.75	7.25
4.0	3.90	4.28	6.05	4.52
4.0 HB*	3.95	4.21	4.21	7.70
5.0	3.13	3.34	4.88	3.89
10.0	3.51	5.77	7.77	8.22

Table 2. Forms with exoskeleton

1.6	0.56	1.12	1.12	3.31
4.0 S	3.41	3.41	3.41	3.41
4.0	1.97	2.68	2.68	3.62
4.0 HB	2.13	4.96	5.91	5.48
5.0	1.32	4.14	4.14	5.16
10.0	7.21	10.52	12.53	4.83

Table 3. Forms without skeleton (a) Chaetognatha

1.6	3.68	4.33	5.79	5.90
4.0 S	2.47	2.65	4.11	5.34
4.0	10.00	10.61	10.61	11.69
4.0 HB	3.31	3.70	4.76	5.32
5.0	2.54	2.90	2.88	3.42
10.0	2.66	1.33	1.33	1.81

Table 4. Forms without skeleton (b) Medusae

1.6	7.72	7.11	7.00	6.98
4.0 S	9.48	13.61	13.94	13.94
4.0	8.49	21.64	21.64	21.64
4.0 HB	2.30	5.12	9.87	19.60
5.0	6.08	8.46	6.91	10.50
10.0	8.47	8.40	8.40	7.48

* S — Stock Solution

* HB — Hexamine buffered

FIG 1

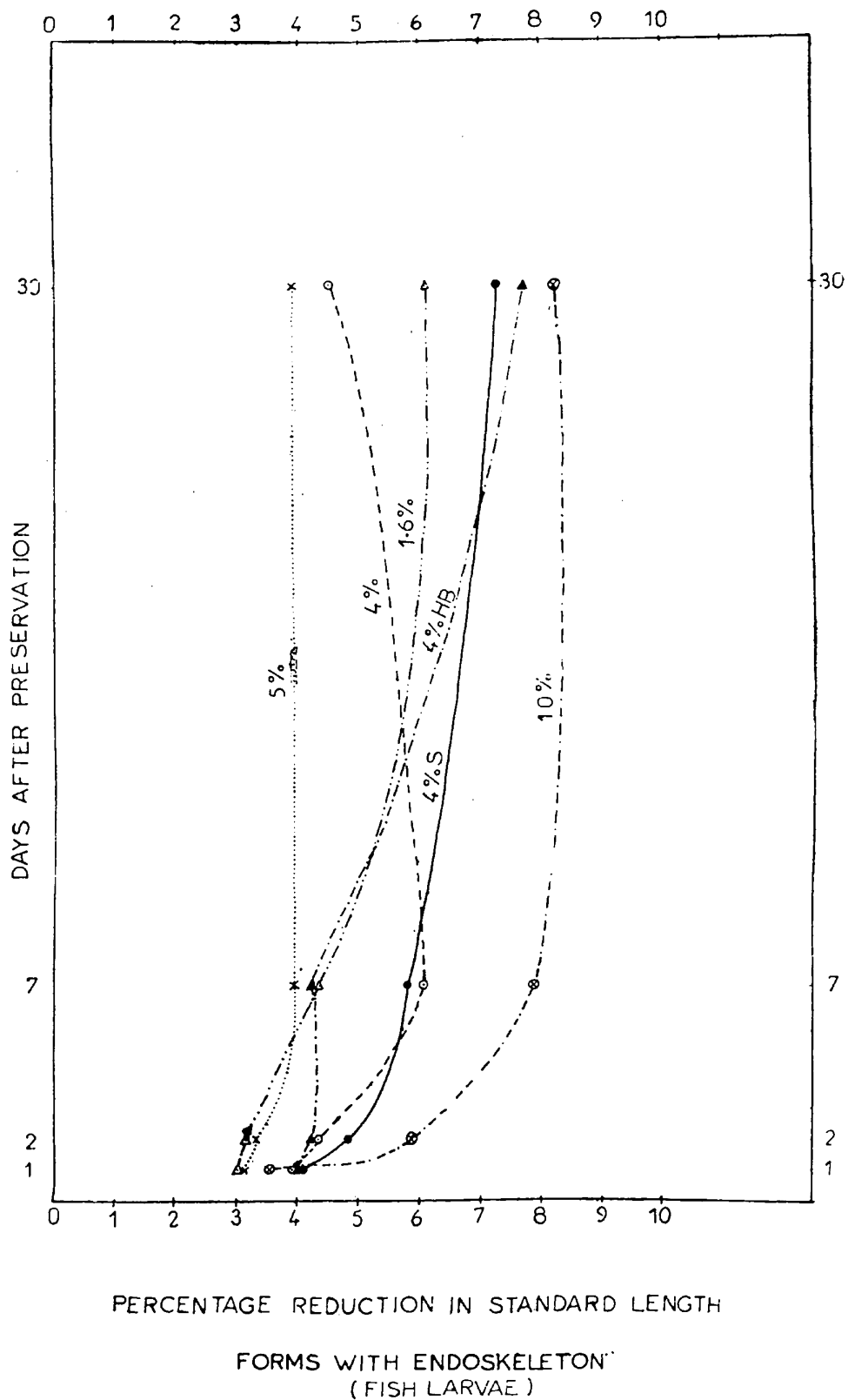


FIG. 2

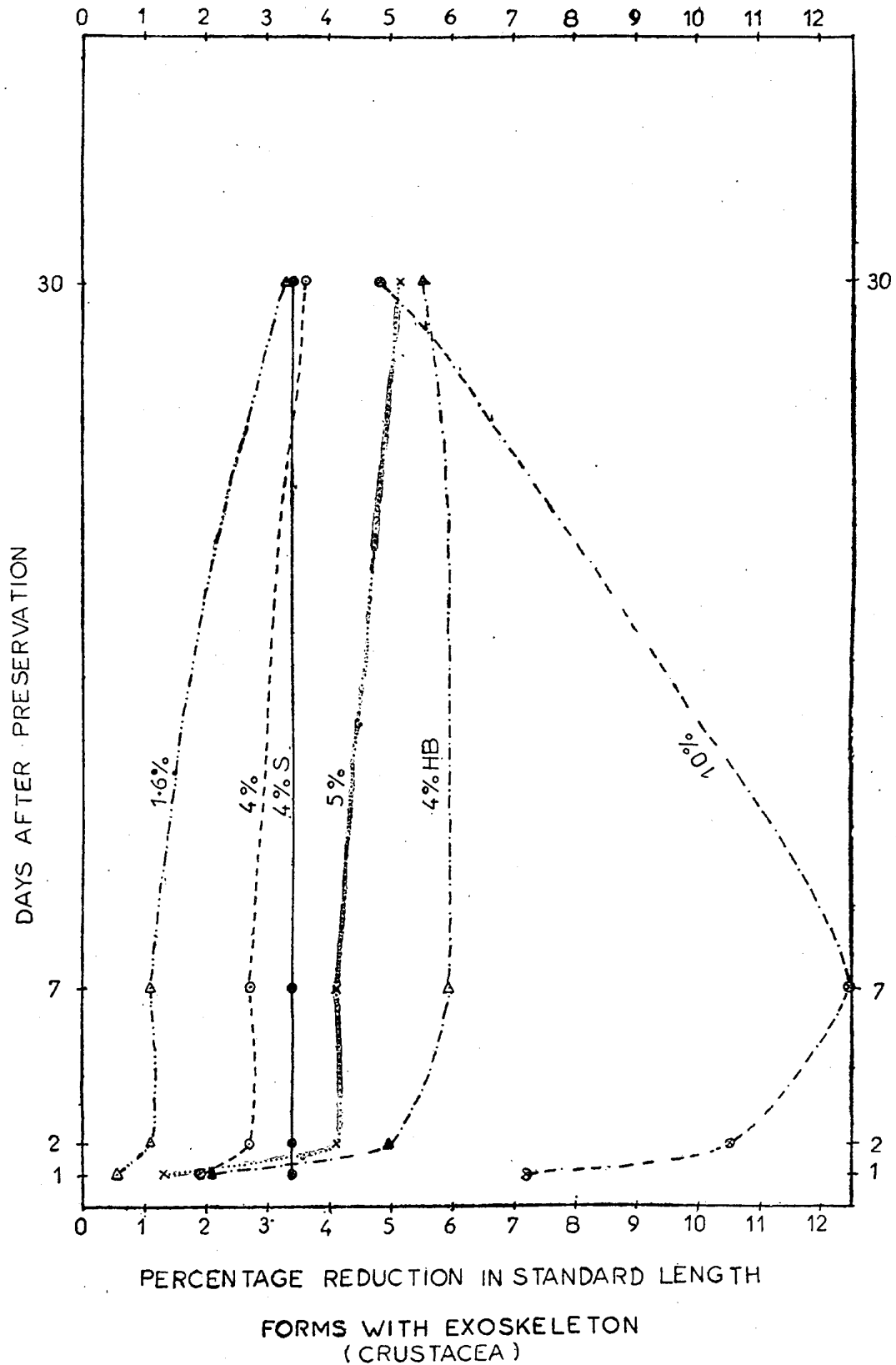


FIG 3

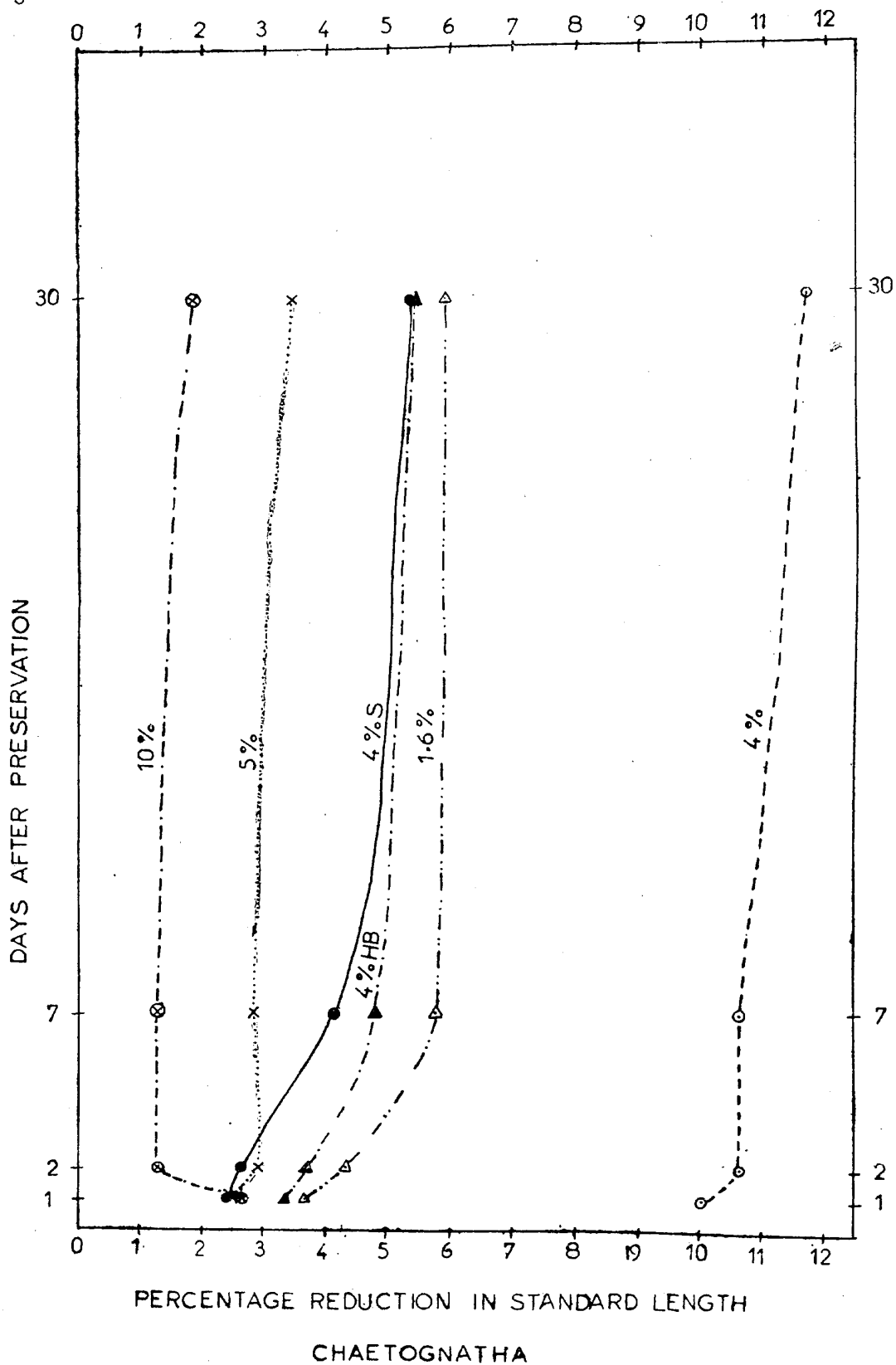


FIG. 4

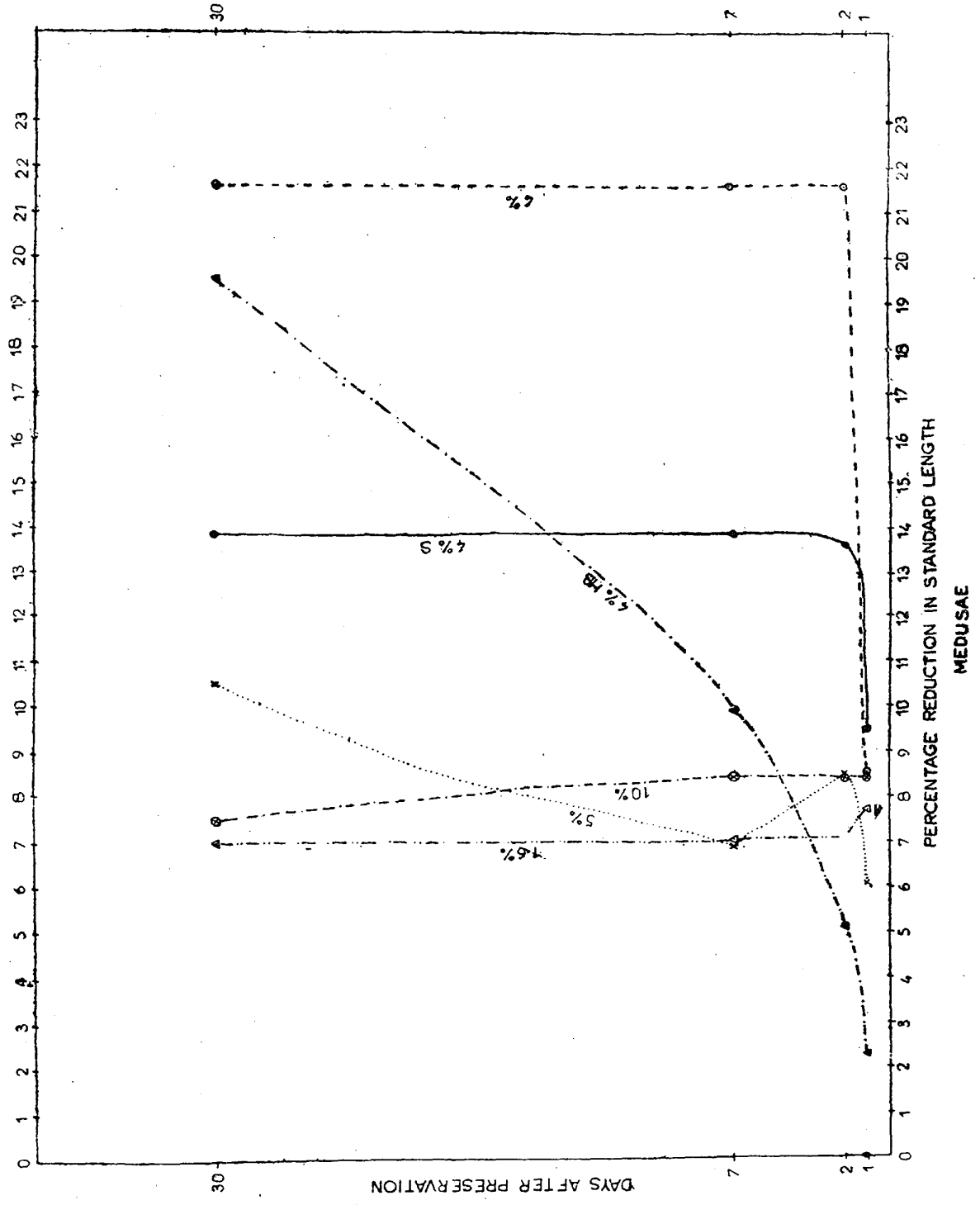


FIG-5

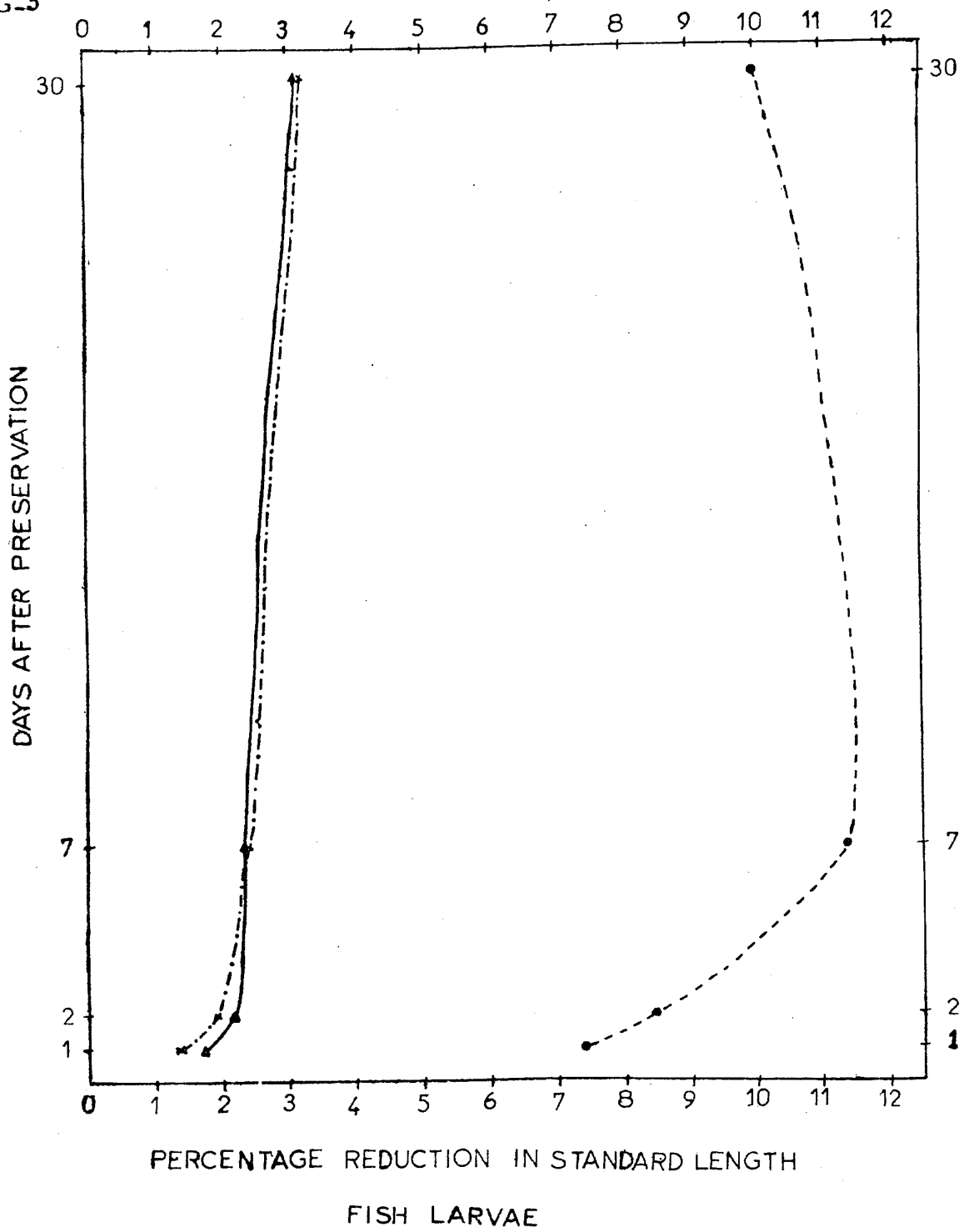


Table 5. Relationship between length group and shrinkage of fish larvae.

Length groups mm	Percentage reduction one day	reduction in two days	in standard length seven days	after: thirty days
1—	7.42	8.49	11.37	10.09
3—	1.72	2.19	2.31	3.17
6—	1.39	1.93	2.36	3.23

3 a. Chaetognatha (Forms without skeleton)

Initially the shrinkage was 2.66 per cent in 10% solution but after two days, it became 1.33 and then began to increase slowly after the 7th day. At the end of 30 days the shrinkage value became 1.81 per cent. The shrinkage was more in 5% solution than that in 10% after 2 days (table 3, Fig. 3). In 4% stock solution the shrinkage values gradually increased. Maximum shrinkage values were obtained when preserved in 4% solution and minimum in 1.6% and 4% hexamine buffered solution.

3 b. Medusae.

Of all the forms, maximum shrinkage was observed in Medusae. As in the case of Chaetognaths, maximum shrinkage was observed in 4% solution. In 1.6% and 10% solutions at the end of 30 days the shrinkage values were less than those of the beginning showing some return to the earlier size. The values of shrinkage fluctuated showing some gain over the past loss in size in 5% solution (Table 4, Fig. 4).

It may be concluded that the reactions of different organisms to the same concentration and the same organism to different concentrations vary considerably. Medusae showed the greatest fluctuation in shrinkage, while it was minimum in crustaceans. Minimum shrinkage was observed in fish larvae when preserved in 5% solution, in crustaceans in 1.6%, in chaetognaths in 10% and in medusae in 1.6%. From the data it could be seen that the shrinkage values were gradual and without fluctuations in 4% stock solution; furthermore it was the only solution in which no increase in length was ever observed. In other concentrations, the values varied at one time or other or with some of the species. It is also found that the shrinkage was predominant in longitudinal muscles and not in circular muscles. It may be due to reduction in coelomic fluid content but does not appear to affect the notochord.

In 71 out of 2445 observations (made on 163 specimens) an increment in length was observed during the first week in different grades of formaldehyde except in 4% stock solution. In hexamine buffered solution and in 10% solution increment in length was observed in cases as late as on 30th day whereas in other concentrations, after the initial increment, shrinkage was noticed after the seventh day. Farris (1963) explains the increment in length which he observed in the larvae of *Sardinops caerulea* as due to errors in measurements. However, since many examples showed that an increase in length was intercalated with, and preceded or followed by periods of shrinkage, it is believed that this is not accidental and that the fluctuations of the measurements with time are not an artifact. They show that the initial fixation of the animal does not make it as rigid and impermeable to osmotic changes as it might be presumed. Some of the examples are:-

Material	Strength of formaldehyde %	(Increases in Standard length (mm) before after preservation)				
		Before.	After one day	After two days	After seven days	After thirty days
Forms with Endoskeleton	4.0 HB	4.27	4.27	4.27	4.27	4.38
Forms with Endoskeleton	1.6	4.73	4.73	4.92	4.92	4.73
Forms without skeleton	10.0	5.65	5.43	5.32	5.32	5.59
"	"	6.57	5.51	5.68	5.68	5.59

Shrinkage can be accounted for by the dehydration of tissues, coelomic fluid and mesogloea caused by the preservative. Increase in length is unlikely to have been caused by change in the osmotic pressure of the preservative since the specimens were always kept in the same fluid. The latter could have evaporated and become more concentrated. The increase in length may perhaps be due to change in body shape caused by continuous dehydration that reduces volume and at the same time causes stretching or elongation.

The 4% stock solution is the one that caused gradual shrinkage and no case of elongation was found in the animals preserved in it.

Reference

Farris, D. A. (1963.) Shrinkage of sardine (*Sardinops caerulea*) larvae upon preservation in buffered formalin. *Copeia* (1), 185—186, (Ichthyological Notes).

12. *Sampling Gear and Techniques in operation for Plankton studies in the Zoological Survey of India* — A. Daniel.

The gear and sampling techniques in operation for plankton studies in the Zoological Survey of India are summarised here in brief. The details of the gear and methods used by earlier scientists (Surgeon Naturalists) are given in a publication by the Trustees of the Indian Museum in 1926.

In 1958, the Marine Survey Unit (later the Marine Survey Division) was started in the Zoological Survey of India for giving impetus to the survey of marine fauna. During the last ten years the following gear have been used: Juday net, Indian Ocean Standard net, Nansens' net, Pleistone net, Ichthyological net, Isaacs-Kidd midwater trawl and ring trawl for collection of plankton and micronekton.

The distribution of the standing crop of zooplankton based on collections made with the Juday net (80/113, 38 meshes per cm) hauled vertically at a speed of 1m/sec. at depths of 25 - 0 m, 50 - 25 m, 100 - 50 m, 200 - 100 m, and 500 - 200 m, at 36 stations in the eastern sector of the Indian Ocean was studied and published (Daniel and Prem Kumar, 1965). Certain discrepancies were noted in the volumes of duplicate plankton hauls made with the Indian Ocean Standard Net. Examples are as follows: