Biology Curators Group Newsletter

Title: Phenoxetol: An Unsatisfactory Preservative for Fishes

Author(s): Crimmen, O. A.

Source: Crimmen, O. A. (1989). Phenoxetol: An Unsatisfactory Preservative for Fishes. *Biology Curators Group Newsletter*, *Vol 5 No 3*, 26 - 27.

URL: http://www.natsca.org/article/895

Techniques

PHENOXETOL: AN UNSATISFACTORY PRESERVATIVE FOR FISHES

The standard procedure for the preservation of fishes in the British Museum (Natural History) collections consists of initial fixation in formalin and subsequent storage in 70% Industrial Methylated Spirit (IMS). However, because of the relatively high rate of evaporation of alcohol and pressure to find a less expensive substitute, some formalin fixed specimens were, in 1965, consigned to tanks containing a 1% solution of 'Phenoxetol' BPC, in water. Phenoxetol is the registered trade name for the compound 1-phenoxyethanol. A derivative, propylene phenoxetol, has the chemical name 1 - phenoxy - propan - 2 - ol. Both are supplied by Nipa Laboratories Ltd., Llantwit Fardre, near Pontypridd, Mid Glamorgan.

Phenoxetol is immiscible with cold water, so hot water and ethanol respectively were used as mixing agents in attempts to prevent a layer of unmixed Phenoxetol forming in the water, but without success. Ultimately, the only satisfactory blending agent was found to be propylene glycol (Propane-1, 2 diol or $CH_3.CH(OH).CH_2$ OH). The final mixture of 1 part Phenoxetol : 10 parts propylene glycol : 89 parts water was stirred thoroughly using a power tool. This method was adopted on the advice, and with the help, of the late R H Harris who had achieved good results with invertebrates preserved in this fluid.

The advantages of this mixture over a spirit preservative were thought to be non-flammability and low cost. Phenoxetol is non-volatile and so specimens are less likely to dry out through evaporation (a constant problem with alcohol) and the fire hazard is removed (flash point of IMS at 95%-by-volume is 10.5°C). The phenoxetol mixture was reckoned cheaper than an equivalent volume of 70% spirit solution and was used in large tanks of 200 gallons capacity or more, to keep costs down. However, when the figures were recalculated in 1987 it was found that the phenoxetol preservative then cost 66p per litre, whereas IMS purchased in bulk cost around 60p per litre at 95% strength (as supplied). When diluted to 70% for use in the collections, the cost of spirit is further reduced to 42p per litre. Without the requirements of 100 ml of propylene glycol in every litre, the phenoxetol mixture would indeed be marginally cheaper than 70% spirit, but unfortunately propylene glycol was found to be an essential ingredient in making large volumes of the mixture.

H F Steedman (1976 p 180) commented on various phenoxetol mixtures to be used as preservatives, and on the advantages of including propylene glycol in the mixtures. He reported that propylene phenoxetol, 1% in distilled water will keep well-fixed material in good condition for three to ten years, or longer, at 10-25°C. His experience may have been based largely on planktonic animals. The present note is concerned with the preservation of larger material on a long-term basis.

Various formulae are referred to as 'Steedman's Solution'. H F Steedman (1976 p 80) listed the following formulae for post-fixation preservative solutions.

1 1% propylene phenoxetol in distilled water or sea water

2 propylene phenoxetol, 0.5 ml
propylene glycol, 4.5 ml
distilled water or sea water, 95 ml

3 propylene phenoxetol, 0.5 ml
propylene glycol, 4.5 ml
40% formaldehyde, 2.5 ml
distilled water or sea water, 91.5 ml

Hureau and Rice (1983 p 13) gave 'Steedman's Solution' as that listed at number 3 above (with an extra 1 ml of water to bring the total to 100 ml). They commended it as a preservative.

Lincoln and Sheals (1979) noted that Phenoxetol BPC may be less efficient as a bactericide and a fungicide than propylene phenoxetol. A label from part of the batch used in the afore-mentioned tanks of fishes identifies the fluid used as Phenoxetol BPC.

S J Moore (1980 pp 385-386) differentiated clearly between 'Steedman's fixative' and 'Steedman's post-fixation preservative'. The fixative formula he gave is similar to number 3 above:

propylene phenoxetol, 5 ml
propylene glycol, 25 ml
40% formaldehyde solution, 25 ml
distilled water, 445 ml

and he listed the preservative solution as:

propylene phenoxetol, 5 ml
propylene glycol, 50 ml
distilled water, 445 ml

R H Harris, who worked for many years on the preparation of biological specimens, endorsed the usefulness of Phenoxetol as a trouble-free fluid preservative provided that it is made up correctly (Harris, 1976). He cited

the method formulated by Steedman, using propylene glycol as a humectant, as the best of over 200 formulae tested.

Harris (1976) made references to the successful results achieved by transferring fishes and other specimens in the British Museum (Natural History) to the phenoxetol solution. For long-term preservation, however, the method has proved unsatisfactory for fishes.

Whereas the fishes in the Phenoxetol tanks were in good condition in 1975 (i e after ten years' storage), they were found to have deteriorated seriously by 1979, and we were obliged to remove all specimens from these containers. They had reached various stages of decomposition and in one tank, for example, the pectoral 'wings' of some rays (Rajidae) had completely disintegrated. The tanks smelled strongly of decaying specimens. The deterioration had advanced rapidly in the interval since the last cursory inspection of the tank (one year). It must be emphasised that all these specimens were properly formalin-fixed. We therefore no longer use Phenoxetol in the Fish Section at the British Museum (Natural History), and we cannot recommend its use for similar collections.

The best defence against the effects of vicissitudes in staffing, funding, accommodation, etc, is the use of proven, durable materials wherever possible especially in larger collections where the volume of material poses greater monitoring and curatorial problems.

Unbuffered formalin is considered unsuitable for long-term preservation since it has been reported by various workers in the past to have broken down specimens after many years of storage. It is also known to decalcify fishes. The difficulties of keeping formalin buffered have proved insuperable in a large collection, and there are many problems too in handling this hazardous chemical.

Hureau and Rice (1983) having listed 'Steedman's Solution' made the overall recommendation that specimens be transferred to spirit after formalin fixation. Their approval of alcohol as the best general preservative agrees with the experiences of those working with fishes at the British Museum (Natural History), where an estimated 2.5 million fish specimens are stored, some of them successfully preserved for 200 years.

The Phenoxetols have been noted for various useful properties other than those required for preservation of zoological specimens. They have been used as relaxing agents and anaesthetics for aquatic animals (Owen, 1955; Bagenal, 1963; Sehdev et al, 1963; Hureau and Rice, 1983), in the treatment of fungal fish infections, e g fin rot (Rankin, 1952, 1953), and in the prevention of mould growth in stored dye solutions (Owen and Steedman, 1956). There are also important medical applications.

Acknowledgements

Thanks are due to Patrick Campbell, Jennie Cummings, Simon Moore and Alwyne Wheeler for their help.

References

Bagenal, T B (1963) Propylene phenoxetol as a fish anaesthetic. **Nature**, London, **184**, 370.

Harris, R H (1976) Preparation techniques for biological material. **Newsletter, Biology Curators' Group, 1(3)**, 2.

Harris, R H (1984) **A selective bibliography on preservation, macro and micro-anatomical techniques in Zoology**. Biology Curators' Group Report No 3, Leicester.

Hureau, J C and Rice A L (1983) **Guidelines for marine biological reference collections.** Unesco Reports in Marine Science, No 22, Paris.

Lincoln, R J and Sheals, J G (1979) **Invertebrate Animals; Collection and Preservation.** British Museum (Natural History) and Cambridge University Press, London.

Moore, S J (1980) Problems with glass museum jars solved. **Newsletter, Biology Curators' Group, 2(8)**, 384.

Owen, G (1955) Use of propylene phenoxetol as a relaxing agent. **Nature**, London, **175**, 434.

Owen, G and Steedman, H (1956) Preservation of animal tissue with a note on staining solutions. **Q Jl microsc sci 97**, 319.

Rankin, I M (1952, 1953) **Water Life 7** (1952), 297; **8** (1953), 251.

Sehdev, H S, McBridge, J R and Fagerland, V (1963) 2-phenoxyethanol as a general anaesthetic for sockeye salmon. **J Fish Res Bd Can, 20**, 1435.

Steedman, H F (Ed.) (1976) **Zooplankton fixation and preservation.** Monographs on oceanographic methodology No 4, Unesco Press, Paris.

Steinmann, W, Ebeling, R and Goepel, U (1975) Die Konservierung medizinischer und zoologischer praparate in Phenoxetol. **Praparator 1**, 8.

Oliver A Crimmen
Department of Zoology
Natural History Museum, London