*Short communication*

# Notes on the use of hatching trays in the breeding of European common carp *Cyprinus carpio L.*

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## Abstract

Use was made of Heath Techna trout hatching trays for the large-scale incubation of fertilised eggs of the common carp *Cyprinus carpio*. Hatching results for and the survival of embryos following this procedure compared well with standard procedures usually followed when adhesiveness of the fertilised eggs is first removed before incubation in hatching funnels.

## Introduction

One of the major problems associated with the large-scale spawning of freshwater fish possessing adhesive type eggs, such as the European common carp *Cyprinus carpio L.* and the African sharptooth catfish *Clarias gariepinus* (Burchell), is the removal of egg adhesiveness, which develops when they come into contact with water. This problem has been overcome with varying success by using substances which either remove the glutinosity of the eggs (Woynarovich, 1962; Soin, 1977; Woynarovich and Woynarovich, 1980), by coating the fertilised eggs with an inert powder such as chalk (Klotsch *et al.*, 1980; Schoonbee and Brand, 1982; Hecht *et al.*, 1982) or by using full-cream fresh or powdered cow milk solution where the oil droplets in the mixture fulfill the same function in separating the eggs (Schoonbee *et al.*, 1980; Rothbard, 1981; Schoonbee and Brand, 1982; Hecht *et al.*, 1982). The process of either neutralising or removing the stickiness of eggs so that they can be hatched in large numbers in breeding funnels can be time-consuming and in most cases also involves mechanical stirring of the fertilised eggs – a process which in turn affects the eventual egg hatching rates.

In the present investigation, Heath Techna trout hatching trays were used for the intensive breeding of the common carp *C. carpio*, eliminating the time-consuming processes referred to above. The results obtained were compared with those using the method of egg adhesiveness removal described by Woynarovich and Woynarovich (1980), after which the eggs were transferred to "Zuger" type glass hatching columns.

## Materials and methods

### Hatchery procedures

Pond-reared spawners fed on a formulated 18% protein pelleted diet, were used. Selection of the spawners and hatchery procedures was performed according to Schoonbee and Prinsloo (1984, 1986). Spawners were kept in the hatchery at temperatures varying between 24 and 26°C. Water in the holding tanks passed through a recirculating system provided with a series of biological gravel filters. Pituitary gland homogenate of the sharptooth catfish *C. gariepinus* was used in the induced spawning programs (Schoonbee and Prinsloo, 1986).

Procedures followed in the stripping and fertilisation of the eggs were done according to Schoonbee and Prinsloo (1984, 1986). The removal of egg adhesiveness was based on procedures developed by Woynarovich and Horváth (1980) and Woynarovich and Woynarovich (1980).

After fertilisation of the eggs and before removal of the egg adhesiveness, the eggs of an individual female were subdivided into equal quantities of approximately 250 000 eggs each. This step was necessary to compare the effectiveness of the hatching trays with that of the funnels. One batch was treated according to Woynarovich and Woynarovich (1980) after which the eggs so treated were transferred to three breeding funnels each containing approximately 80 000 eggs. The rest of the untreated fertilised eggs were then transferred to Heath Techna hatching trays (Figure 1) provided with a bottom screen of 1,0 mm mesh size onto which the eggs were spread in thin layers of not more than 1 to 2 eggs deep. Once submerged in water the eggs became adhesive and attached themselves to the screen where they remained until hatching occurred approximately 48 h later. The eggs were covered with a lid containing a screen of 1,3 mm mesh size which allowed the larvae to escape from the trays after hatching but which assisted in the retention of much of the empty egg shells. A set of eight trays was employed, containing approximately 35 000 eggs each stacked upon each other, through which heated water (25, 3°C) was recirculated over the eggs at a volume of 6 $\ell$ per minute. Water samples for limited physical and chemical analysis were collected at the outflows of both systems after the water had passed through the eggs, and analysed according to APHA (1980) (Table 1). Survival of the embryos during the first 36 h after fertilisation, was monitored at regular intervals (Table 2). In the present study results are discussed on the hatching success of a batch of 500 000 eggs equally subdivided and treated according to procedures described, between the funnel and tray systems.

## Results

### Water chemistry

Results obtained on certain physical and chemical conditions of

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TABLE 1

SOME CHANGES IN SELECTED PHYSICAL AND CHEMICAL CONDITIONS IN THE RECIRCULATING WATER FROM HATCHING TRAYS AND BREEDING FUNNELS USED IN THE SPAWNING PROGRAMMES WITH THE COMMON CARP *CYPRINUS CARPIO* OVER A PERIOD OF 51 HOURS

| Time in hours after fertilisation of eggs | Physical and Chemical Parameters | | | | |
|---|---|---|---|---|---|
| | Temperature °C | pH | Conductivity $\mu S\ cm^{-1}$ | Oxygen $mg\ \ell^{-1}$ | Ammonia N $mg\ \ell^{-1}$ |
| **0 hours** | | | | | |
| Hatching trays | 22,1 (21,6 – 22,7) | 7,4 – 8,6 | 63 (59 – 65) | 7,4 (7,2 – 7,6) | 0,05 0,04 – 0,08 |
| Breeding funnels | 23,5 | 7,4 | 64 | 7,1 | 0,24 |
| **8 hours** | | | | | |
| Hatching trays | 22,2 (21,6 – 22,8) | 7,4 – 7,5 | 65 (60 – 69) | 6,1 (5,5 – 6,6) | 0,12 (0,06 – 0,17) |
| Breeding funnels | 24,0 | 7,5 | 70 | 7,9 | 0,21 |
| **12 hours** | | | | | |
| Hatching trays | 23,3 (22,7 – 24,1) | 7,9 – 8,0 | 68 (62 – 72) | 7,4 (7,1 – 7,7) | 0,05 (0,03 – 0,07) |
| Breeding funnels | 25,4 | 7,9 | 73 | 7,6 | 0,28 |
| **21 hours** | | | | | |
| Hatching trays | 23,9 (23,2 – 25,3) | 8,0 – 8,6 | 71 (65 – 75) | 7,4 (7,0 – 7,6) | 0,13 (0,02 – 0,31) |
| Breeding funnels | 27,5 | 8,0 | 75 | 6,5 | 0,20 |
| **30 hours** | | | | | |
| Hatching trays | 24,5 (23,6 – 26,1) | | 74 (67 – 79) | 6,7 (6,3 – 7,4) | 0,26 (0,08 – 0,38) |
| Breeding funnels | 27,5 | 7,8 | 77 | 5,5 | 0,41 |
| **36 hours** | | | | | |
| Hatching trays | 25,3 (24,6 – 26,1) | 7,8 – 8,0 | 80 (67 – 88) | 6,5 (6,3 – 6,7) | 0,80 (0,35 – 1,08) |
| Breeding funnels | 26,8 | 7,8 | 96 | 6,4 | 1,30 |
| **45 hours** | | | | | |
| Hatching trays | 24,8 (24,0 – 26,4) | 7,9 – 8,0 | 80 (66 – 88) | 6,7 (6,1 – 7,0) | 1,09 (0,27 – 1,45) |
| Breeding funnels | 25,7 | 7,8 | 90 | 6,0 | 1,26 |
| **51 hours** | | | | | |
| Hatching trays | 24,7 (23,8 – 26,5) | 7,8 – 7,9 | 81 (68 – 89) | 6,4 (6,0 – 7,2) | 1,25 (0,08 – 1,08) |
| Breeding funnels | 25,5 | 7,7 | 90 | 4,4 | 1,52 |

TABLE 2

SURVIVAL (%) OF EMBRYOS IN BOTH FUNNEL AND TRAY SYSTEMS OVER A PERIOD OF 48 HOURS

| Time in hours after fertilisation | Survival % of embryos in funnels | | Survival % of embryos on trays | |
|---|---|---|---|---|
| | Mean | Range | Mean | Range |
| 8 | 100 | | 99 | 98 – 100 |
| 12 | 99 | 99 – 100 | 95 | 90 – 97 |
| 21 | 95 | 95 – 96 | 95 | 88 – 98 |
| 30 | 93 | 92 – 95 | 95 | 90 – 98 |
| 36 | 93 | 92 – 95 | 95 | 92 – 96 |
| 48 | Commencement of hatching: <90% survival in both funnels and trays | | | |

the recirculating systems of the hatching trays and breeding funnels are summarised in Table 1. In both the trays and the funnels the temperature of the recirculating water increased from an average of 22°C at the beginning of the hatching process, reaching a maximum of 27,5°C for the breeding funnels after 30 h and 25,3°C for the hatching trays after 36 h. For the rest of the breeding period, water temperatures in both recirculating systems fluctuated around 25°C.

The pH of the water in both systems remained alkaline, increasing gradually over the first 21 h, fluctuating between 8,0 to 8,6. For the rest of the time the pH remained slightly below 8 in both recirculating systems. There was a gradual increase in the conductivities of the water over the entire period of investigation. Oxygen values remained high although fluctuations occurred, indicating possible increased bacterial activities in both systems. With the aeration provided to the water, values for dissolved oxygen never declined to critically low levels. There were pronounced increases in values recorded for ammonia in both systems, especially during the last 15 h before hatching. However, water quality conditions as far as this parameter is concerned did not appear to affect the hatching success rate in both systems.

**Survival of embryos and hatching rate.**

Exceptionally high survival rates were recorded for the eggs in both systems, indicating only a slightly inferior survival where eggs were prepared for hatching in breeding funnels. In both cases a hatching success rate in excess of 90% was recorded (Table 2).

## Discussion

The value of using hatching trays in the incubation of eggs of the common carp, thereby excluding a usually time-consuming and expensive method of the removal of egg adhesiveness according to any of the presently-known techniques employed, is clearly demonstrated by this investigation.

An additional advantage of using trays for the hatching of the common carp eggs, is the fact that the egg shells, which may contaminate the water into which the larvae escaped from the breeding funnels are largely retained in the trays from where they can be removed. Our experience further showed that a good survival of larvae can be obtained at a density of approximately 30 000 eggs per tray and that a total floor space of only 3 $m^2$ is required to house a single battery of eight Heath Techna hatching trays with its associated 1 000 $\ell$ water tank (Figure 1). Such a battery of trays will allow the fish breeder to handle approximately 250 000 eggs or larvae per breeding effort.

Although exceptionally good results were obtained in the breeding effort reported here on the survival percentage of embryos in hatching funnels in which the adhesiveness of the eggs was removed (Table 2), this is not always the case and variable hatching successes can be obtained ranging from as low as 20 to 30% to a maximum of more than 90% such as in the present study. Although the variable hatching rate of the larvae was not specifically investigated, indications are that the mechanical stirring process of the eggs during the removal of egg adhesiveness might contribute much towards the eventual hatching success of the larvae.

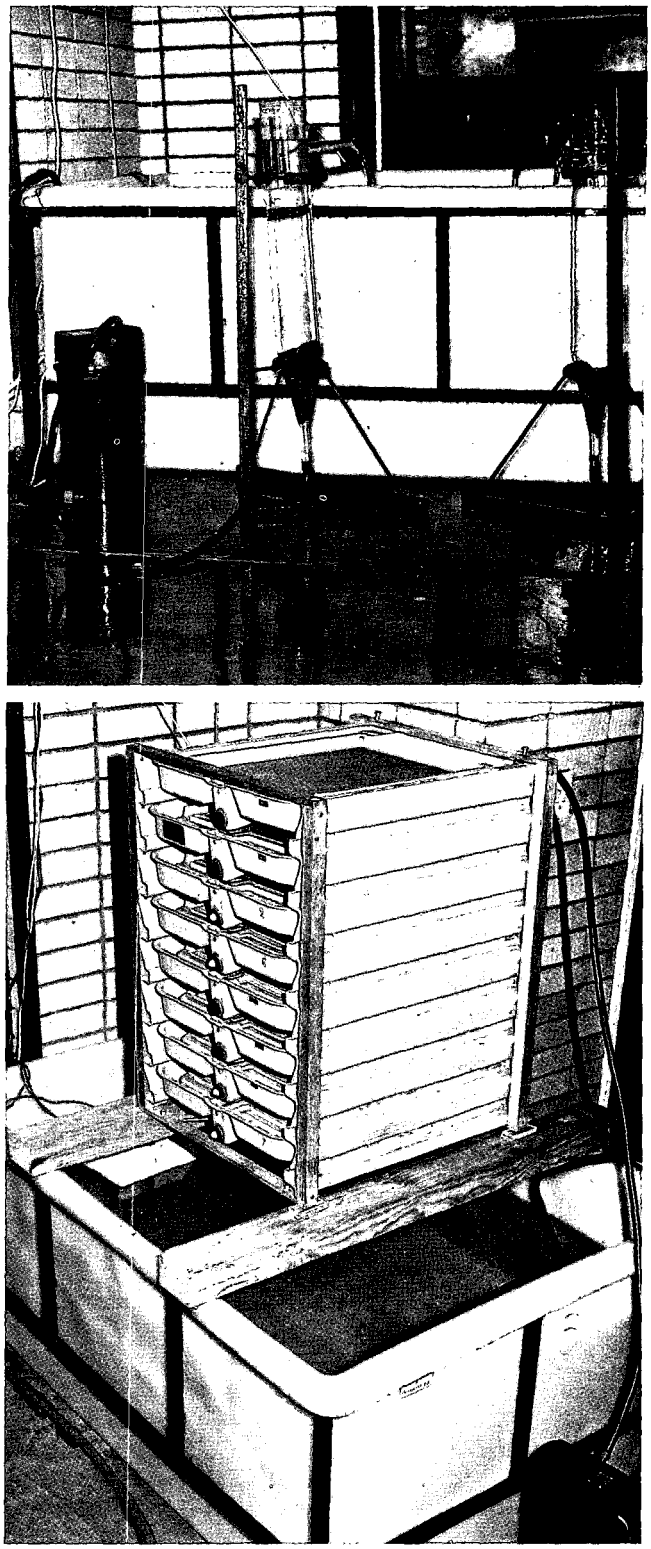

*Figure 1*
*Breeding funnels (top) and Heath Techna trout egg hatching trays (bottom) used in the present investigation for the mass hatching of artificially fertilised common carp eggs.*

## References


APHA (1980) *Standard Methods for the Examination of Water and Wastewater.* 15th Edition. Washington D.C.

HECHT, T., SAAYMAN, J.E. and POLLING, L. (1982) Further observations on the induced spawning of the sharptooth catfish *Clarias gariepinus* (Clariidae: Pisces). *Water SA* 8 (2) 101-107

KLOTSCH, H., SIEBER, C.H. and UNVERFÄRTH, J. (1977) Versuchsergebnisse bei der Anwendung von Milch zur Entfernung der Klebrichkeit bei Karpfeneiern in der Künstlichen Erbrütung.

Dobra, VEB. Binnenfischerei Dresden. Zeit. *Binnenfisch, DDR.* **24**(8) 253-254.
ROTHBARD, S. (1981) Induced reproduction in cultivated cyprinids – the common carp and the group of Chinese carps: I. The technique of induction, spawning and hatching. *Bamidgeh* **33** (4) 103-121.
SCHOONBEE, H.J., HECHT, T., POLLING, L. and SAAYMAN, J.E. (1980) Induced spawning of and hatchery procedures with the sharptooth catfish *Clarias gariepinus* (Pisces: Clariidae) *S. Afr. J. Sci.* **76** 364-367.
SCHOONBEE, H.J. and BRAND, F. de W. (1982) Observations on some techniques employed for the removal of egg adhesiveness of the common carp, *Cyprinus carpio*, during induced spawning. *Water SA* **8** (3) 145-148.
SCHOONBEE, H.J. and PRINSLOO, J.F. (1984) Techniques and hatchery procedures in induced spawning of the European common carp *Cyprinus carpio* and the Chinese carps, *Ctenopharyngodon idella, Hypophthalmichthys molitrix* and *Aristychthys nobilis* in Transkei. *Water SA* **10** (1) 36-39.
SCHOONBEE, H.J. and PRINSLOO, J.F. (1986) Use of the pituitary glands of the sharptooth catfish *Clarias gariepinus* in the induced spawning of the European common carp *Cyprinus carpio* and the Chinese grass carp *Ctenopharyngodon idella. Water SA* **12** (4) 235-237.
SOIN, S.G. (1977) Some features of the development of the carp, *Cyprinus carpio*, under hatchery conditions. *J. Ichthyol* **17** 759-768.
WOYNAROVICH, E. (1962) Hatching of carp eggs in "Zuger" glasses and breeding of carp larvae until an age of ten days. *Bamidgeh* **14** (2) 38-46.
WOYNAROVICH, E. and HORVÁTH, L. (1980) The artificial propagation of warm-water finfishes – a manual for extension. *FAO Fish. Tech. Pap.* **201** 183.
WOYNAROVICH, E., and WOYNAROVICH, A. (1980) Modified technology for elimination of stickiness of common carp, *Cyprinus carpio* eggs. *Aquacultura Hungarica.* **2** 19-21.