

**MARK RETENTION IN FIN-CLIPPED PACU, *Piaractus mesopotamicus* (HOLMBERG, 1887)**

**Uwe Horst Schulz\***

**ABSTRACT.** Two hundred and twenty pacu of 50.7 g medium weight were subjected to 11 combinations of adipose, ventral and pectoral fin-clipping. Within 130 days 65% of all fish which received a pectoral fin-clip, either in single cut or in combination with others, had regenerated to 100%. In 35% of the specimens which displayed still visible marks the regeneration process was almost complete (93%). In the group which was marked by ventral fin-clipping, 59% of the individuals showed no marks. In 41% marks were still detectable but had already regenerated to 92%. Of all pacu marked with adipose fin-clippings 99% were still detectable.

**Key words:** *Piaractus mesopotamicus*, fin-clipping, batch marking.

**RETENÇÃO DE MARCAS EM NADADEIRAS CORTADAS DE PACU *Piaractus mesopotamicus* (HOLMBERG, 1887)**

**RESUMO.** Duzentos e vinte pacus com peso médio de 50.7 g, foram submetidos a uma combinação de 11 cortes de nadadeiras, que incluíam as nadadeiras adiposas, ventrais e peitorais. Depois de um período de 130 dias, 65% dos peixes que tiveram cortada a nadadeira peitoral, unicamente ou em combinação com outras nadadeiras, apresentaram 100% de regeneração. 35% dos peixes ainda apresentaram marcas visíveis, mas com processo regenerativo em estado avançado (93%). Do grupo que foi marcado com cortes nas nadadeiras ventrais, 59% dos indivíduos não apresentaram marcas detectáveis, nos demais 41%, a regeneração também estava avançada (92%). Dos pacus marcados com cortes de nadadeiras adiposas, em 99% deles as marcas eram visíveis.

**Palavras-chave:** *Piaractus mesopotamicus*, cortes de nadadeiras, marcação de grupos.

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## INTRODUCTION

Marking fish is an important tool for managing fish stocks in the wild and in aquaculture. By marking it is possible to assess stocking efficiency, investigate growth, age and mortality, identify different stocks and observe fish movements, habitat use, etc.

In many cases the individual identification of a marked fish is not necessary. A lot of problems which involve the work of fishery biologists in reservoirs, lakes and rivers can be solved by batch marking techniques. Batch marking means the application of the same mark on many fish. In this way groups of fish can be identified, not individuals. An example of batch marking application is the marking of hatchery released fish to investigate stocking success in a lake (Schulz 1995) or in a salmon outmigrant run (Peven and Hays 1989).

The use of batch marking techniques has several advantages over individual marking which is usually done by attaching or inserting external or internal tags to a fish. Batch marking is less costly and faster than individual marking or tagging.

Of all batch marking methods fin-clipping is most commonly used. Mutilation of fins or other bony parts of the fish body has been practised very early in the science of fishery. In 1902 Calderwood (cited in McFarlane *et al.*, 1990) already "referred to studies conducted in Scotland as early as 1829 in which the adipose fins were cut off young Atlantic salmon." Like these early studies most of the work has been conducted with salmonids. If properly applied marks remain visible for several years (Hansen 1988; Schulz 1995).

Large numbers of salmonids were marked by fin-clipping. Bailey (1965) reports that 3.5 million Canadian lake trout (*Salvelinus namaycush*) were marked in the period 1953-1963 by 2 Michigan hatcheries. The average number of marked fish per hour and worker was 549 for the removal of one fin and 453 for two.

Unfortunately published results of fin-clipping studies on tropical fish are rare. No longterm studies on mortality and mark retention are known to the author. Rinne (1976) reports about a short term experiment conducted with tilapia of which partially clipped dorsal and anal fins regenerated from 50% to 100% within one month.

Due to the wide field of possible applications the feasibility of fin-clipping on a tropical species should be tested. Pacu (*Piaractus*

*mesopotamicus*) were marked with 11 different combinations of pectoral, ventral and adipose fin-clipping. The objective of the experiment was to investigate whether this method had adverse effects on body growth. The regeneration rates of paired fins should also be measured.

### MATERIAL AND METHODS

The experiment was conducted at Camboriú hatchery, Santa Catarina, for a period of 130 days. Each of the eleven groups consisting of 20 pacu each received different cuts of right (r) and left (l) pectoral (P), ventral (V) and adipose (A) fins: Pr, Pl, Vr, Vl, A, PrA, PlA, VrA, VlA, PrVl and PlVr. Marking was carried out with anesthetized fish (benzocaine 0.05 g/l). The fins were cut off completely with curved surgical scissors, avoiding bleeding. The fish were weighed to the nearest gram and total length measured to the nearest mm. A group of 27 pacu served as control group. They received no fin-clippings but anesthetic.

The experimental groups and controls were reared together in a pond with steady water supply for a period of 130 days. They were fed with dry pelleted diet, 3% of total body weight per day.

After this period the pond was fished, all fish were anesthetized, weighed and measured again. The lengths of the paired fins were measured from the base to the tip with an accuracy of 0.5 mm using a calliper square. A fish was considered to have retained a mark on a paired fin if one of them was at least 1 mm shorter than the other. An adipose fin-clipping was positively identified when the adipose fin was absent, distorted or smaller than a normal one.

The degree of regeneration R was calculated for paired fins, applying the formula

$$R [\%] = 100 - (Lu - Lm) \times 100\% / Lu$$

where

Lu = Fin length unmarked,

Lm = Fin length marked.

Furthermore, the mean condition factor of the pacu was calculated at the end of the experiment using the slope of the logarithmic length-weight regression as exponent b for the condition-factor formula

$$C_b = 100 * w / l^b$$

where C = condition factor,

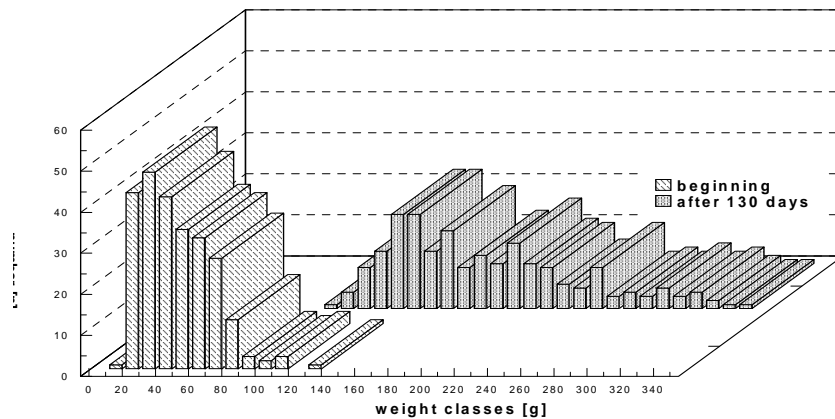
w = weight,

l = total length (Bagenal 1978).

## RESULTS

Of 247 pacu at the beginning of the experiment 233 were recaptured resulting in a survival rate of 94%. The total fish weight increased from 12,511 g to 44,832 g, which means a food-conversion-factor of 1:1.087. Mean fish weight increased from 50.7 g ( $s = 20.8$ ) to 192.4 g ( $s = 65.2$ ). The mean condition factor was calculated to be 2.9 ( $s = 0.26$ ) at the end of the experimental period.

The weight distribution (Figure 1) indicates a normal growth. Mean fish length increased from 14.1 cm ( $s = 5.7$ ) to 21.5 cm ( $s = 5.5$ ).



**Figure 1.** Weight class distribution of pacu at the beginning of the experiment and 130 days after fin-clipping

A comparison of the growth of the marked groups and the control was not possible because of the rapid regeneration of paired fins. The control group was “contaminated” by experimental individuals with total fin regeneration and increased by misidentification from 27 at the beginning to 76 individuals at the end of the experiment (Table 1).

One hundred and twenty pacu had received fin-clippings of pectorals, as a single cut or in combination with ventral or adipose fins. Only in 42 fish (= 35%) these marks were still detectable. In these 42 pacu the degree of regeneration  $R$  of the pectorals ranged between 85% and 98% ( $R_{\text{mean}} 93\%$ ;  $s = 2.4$ ). Of 120 fish which received a ventral fin-clipping 49 (= 41%) could still be identified.

The degree of regeneration  $R$  of the ventral fins ranged between 66% and 98% ( $R_{\text{mean}}$  92%;  $s = 6.9$ ).

**Table 1:** Detected fin-clippings after 130 days (P = Pectoral; V = Ventral; A = Adipose; r = right; l = left)

Combination	Pr	Pl	PrVl	PlVr	PrA	PlA	A	Vr	Vl	VrA	VlA	Control
n [n]	14	12	3	1	8	4	68	9	17	6	13	76
$\Sigma P$ [n]							42					
$\Sigma V$ [n]							49					
$\Sigma A$ [n]							99					

Contrary to paired fins almost all adipose clippings were identified. One hundred pacu received an adipose fin clipping in a single cut or in combination with others and 99 were recovered. Most of them were clearly visible, 11 fish showed no sign of regeneration at all.

## DISCUSSION

Due to the fast regeneration of the paired fins the control group could not be identified at the end of the experiment, making the statistical comparison of growth rates between marked and unmarked fish impossible. The fast overall growth of the whole group however indicates that an adverse effect of the marking procedure is not probable. The high condition factor of 2.9 supports this assumption. Pacu raised in indoor tanks displayed 2.1 in a diet study (Kopp, personal communication), which the author considered to be normal.

Paired fins in pacu regenerated very quickly. Fin-clipping of pectoral and ventral fins for marking purposes cannot be recommended for longterm studies if the method is not improved.

Cutting off the adipose fin resulted in the highest recovery rates. In some cases however mark identification was difficult. Regeneration of the adipose took place but caused smaller fins. As the natural variation of the adipose fin size was unknown it is possible that some unmarked small adipose fins were counted as regenerated ones. In this case the recovery rate of marked adipose fins was overestimated.

Eleven pacu were found without any sign of regeneration of the adipose fin. Probably these fish received particularly deep cuts which removed the regenerative tissue.

A cauterisation technique used by Champigneulle and Escomel (1984) could be applied in addition to fin-clipping. These authors burned the adipose fins of 35 mm whitefish (*Coregonus* sp.), arctic charr (*Salvelinus alpinus*) and brown trout (*Salmo trutta*) using a soldering iron. Up to 600 fish per hour were marked with this method. Ninety-eight per cent did not display any sign of regeneration after 7 months. In pacu fin-clipping and subsequent cauterization could be tested to prevent adipose regeneration totally. Probably the application of this method would as well improve the mark retention of paired fins. Clipping and cauterization of adipose fins in combination with other batch marking techniques, such as the application of dyes, hot or cold brands, could increase the number of possible combinations for a higher number of batches.

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