Ann. Zool. Fennici 33: 617–620
Helsinki 28 November 1996
ISSN 0003-455X

Use of hot branding in marking juvenile pikeperch (*Stizostedion lucioperca*)

Ari Saura

Saura, A., Finnish Game and Fisheries Research Institute, P.O. Box 202, FIN-00151 Helsinki, Finland

Received 17 October 1995, accepted 12 December 1995

Hot branding methods used for adult fish are generally considered harmful to juveniles. Use of a very thin electrically heated metal (nichrome) wire to impress a mark on the scales of the fish is a fairly gentle procedure compared with the traditional method of branding. The thin metal filament can easily be shaped to form code symbols. About 200 000 one-summer-old pikeperch (*Stizostedion lucioperca*) juveniles (mean weight 2.5–5.5 g) were branded with this method during 1986–1995 and stocked in two lakes in southern Finland. No mortality or physiological responses caused by the branding were observed and the marks were readily identified on adult fish several years after application. This method is very economical. Branding instruments cost about FIM 600 and one person can mark up to 500–1 000 fish per hour. The method is suitable for pikeperch and other species with fairly small and firmly attached scales.

1. Introduction

Three branding methods are commonly used for fish: hot branding, cold branding and chemical branding. In hot branding, the filament can be heated by a gas flame or electricity (Hargraeves 1992), while laser light has also been used (Brock & Farrell 1977). In cold branding, the marking rod is usually cooled by liquid nitrogen (Bouvet & Quost-Cristau 1985, Busack 1985), although Fujihara and Nakatani (1967) used an ethanol-dry ice slurry, while Buss (1953) and Everest and Edmudson (1967) an acetone-dry ice mixture for this purpose. In chemical branding a caustic chemical, e.g. silver nitrate, is used. All methods have a similar physiological effect, i.e. the scales and the tissue forming them are damaged and a scar develops. Branding has usually been used for marking commercially important fish species such as Atlantic salmon (*Salmo salar*) (Bourgeois *et al*. 1987, Herbinger *et al*. 1990), Pacific salmonids (*Oncorhynchus sp*.) (McCutheon & Giorgi 1989, 1990), cod (*Gadus morhua*) (Svasand 1990), Atlantic halibut (*Hippoglossus hippoglossus*) (Berge 1990), American eel (*Anguilla rostrata*) (Sorensen *et al*. 1983), channel catfish (*Ictalurus punctatus*) (Moore 1986), tilapia (*Tilapia nilotica*) (Myers & Iwamoto 1986), arctic char (*Salvelinus alpinus*) (Laurent 1982) and walleye (*Stizostedion vitreum*) (LaJeone & Bergerhouse 1991).

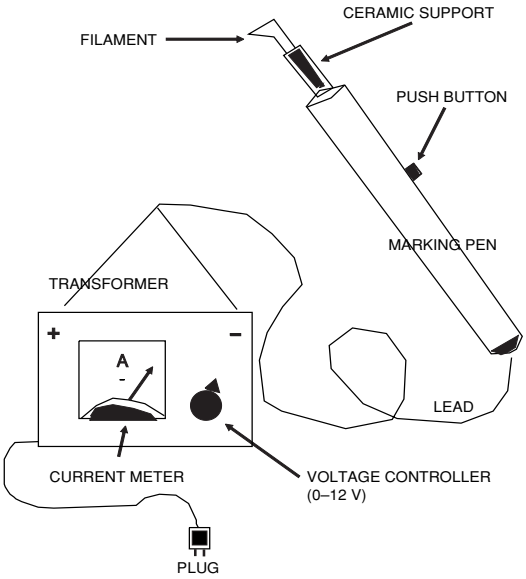

Fig. 1. Simple hot branding equipment with an energy source from a 12 volt transformer.

2. Materials and methods

2.1. Equipment

The hot branding equipment consists of a transformer and marking pen with branding filament (Fig. 1). A filament of known specific resistance is used. A great variety of filaments is available, but the thicker the filament, the smaller is its specific resistance and the greater the energy needed to heat it. Filaments with specific resistance ranging 10–15 ohm/m and diameters of 0.10–0.25 mm are easily heated with a direct current of 12 V.

It is recommended that the energy source allows voltage to be adjusted, as the length of the filament is then not as important. The filament is normally attached directly to a marking pen (Fig. 1), however, I have found it useful to attach the filament to a ceramic support, such that it protrudes further from the marking pen and is not obscured by the pen during use.

The marking pen has a press switch, which allows the filament to be heated at the appropriate moment. The electric lead to the marking pen should be sufficiently long and flexible to allow free handling of the pen (Fig. 1).

2.2. Field testing

Experiments were performed at Lohja fish hatchery, southern Finland. In 1986, 100 one-summer-old pikeperch juveniles (mean size 94 mm) were hot-branded with s-shaped marks below the dorsal fin (Fig. 2a) and put in a 1-m^2 plastic

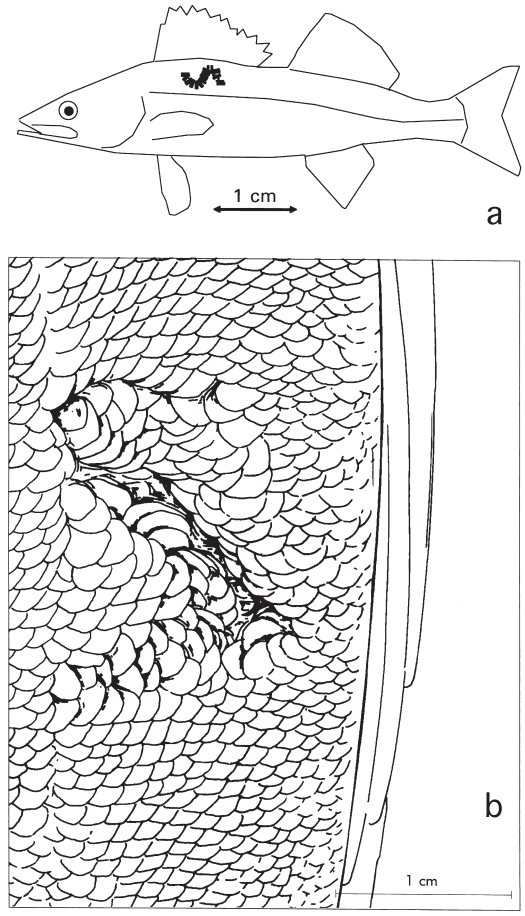

Fig. 2. — a: The site of s-shaped brand in control fish. — b: Four years after branding, the mark is still clearly visible.

tank. One week later the marked fish were checked and thereafter released into an 800-m^2 earthen pond containing asps (*Aspius aspius*) and tenches (*Tinca tinca*), both of which were larger than pikeperch juveniles. Retention of brands was verified two and four years later (Fig. 2b).

During 1987–1991, 38 300 one-summer-old pikeperch juveniles were branded and released into Lake Högbensjö, southern Finland. In 1987, 500 branded and 500 unbranded fish were monitored in 1-m^2 plastic tanks for one week to determine possible mortality caused by marking. Significance of the difference between the groups was estimated with chi-square test. The physiological condition of 30 fish from each group was examined.

During 1991–1995, 160 300 one-summer-old pikeperch juveniles, 7–9 cm in length, were branded and released into Lake Lohjanjärvi, southern Finland. The first catch samples were taken in 1995. During 1993–1995, 200 marked and 200 unmarked fish were kept for two weeks in plastic tanks to

determine possible marking mortality. The groups were compared using the chi-square test.

2.3. Codes and marking

The filament can easily be shaped into a code symbol with pointed pliers. The easiest symbols are simple letters or numbers (e.g. U, I, S, J, L, Z, V, N, 1, 2, 3, etc.). The filament is heated and the symbol pressed lightly onto the fish scales and held there sufficiently long to damage the scales and the tissue forming them (about one second), which causes a scar to develop. If the filament is pressed too hard or for too long, the muscle will be damaged and a dangerous inflammation can result. The exact location of the mark can be varied, but it is advisable to avoid the lateral line, abdomen, fins and the region of anal aperture. It is essential to anaesthetize the fish during marking. A suitable concentration of tricaine methanesulphonate (MS 222), water-soluble anaesthetic for pikeperch juveniles is, 1 g/10 l water, with the water temperature about 10°C. A five-person marking group can mark 2 000–4 000 fish per hour (Fig. 3).

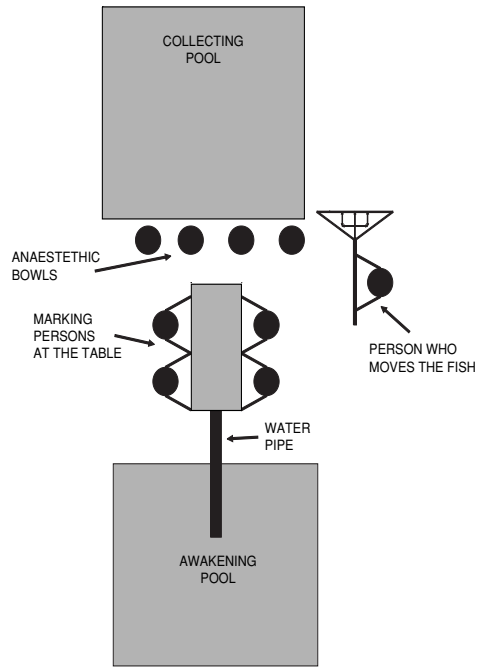

Fig. 3. A five-person marking team. Best results attained with water temperature below 10°C and well-oxygenized anaesthetic.

3. Results and discussion

3.1. Legibility of the marks and mortality

In 1986, no mortality caused by marking was observed among 100 branded fish, during a one-week control period. Two years later, the earthen pond into which they had been released after mortality control was emptied, but of the original 100 fish only 27 (mean length 146 mm ± 1.6 mm (*S.E.*)) were still in the pond; the others had probably been eaten by the asps. In all fish, the s-shaped brands were clearly visible. Four years after branding, 21 fish remained (mean length 300 mm ± 6.9 mm (*S.E.*)) and the marks were still clearly visible (Fig. 2b). The growth rate of pikeperch was very slow due to the lack of prey fish.

One week after branding no significant differences in mortality occurred among 500 marked and 500 unmarked pikeperch released into Lake Högbensjö in 1987 (Table 1). Furthermore, physiological parameters (mean length, mean weight, condition factor, plasma chloride, sodium and po-

Table 1. Comparison of mortality in marked and unmarked fish. Data according to Matti Salminen (unpublished). *NS* = not significant.

Year	1987		1993		1994		1995	
Water temperature (°C)	11.0–12.5		9.5–12.3		11.7–12.3		8.0–12.0	
Control time (days)	7		14		14		14	
	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked
Number in beginning	500	500	200	200	200	200	200	200
Number in the end	463	477	188	196	169	171	163	190
Number of dead fish	37	23	12	4	31	29	37	10
Mortality (%)	7.4	4.6	6	2	15.5	14.5	18.5	5
Difference (χ^2-value)	*NS* (0.11)		*NS* (0.09)		*NS* (0.01)		*NS* (1.1)	

tassium contents, muscle water, whole-fish water, muscle lactate, liver glycogen and whole-fish lipid content) did not differ significantly between marked and unmarked fish (Leena Forsman, unpubl. data). The situation in mortality caused by marking was similar among fish released into Lake Lohjanjärvi during 1993–1995 (Table 1).

3.2. Suitability of hot branding for different species

Apart from pikeperch, similar tests as previously outlined indicate that this method of hot branding is also suitable for trout (*Salmo trutta*) and salmon (*Salmo salar*) parr, whitefish (*Coregonus lavaretus*), grayling (*Thymallus thymallus*) and arctic char (*Salvelinus alpinus*) juveniles, but can probably also be used for marking juveniles of most other fish species (Saura 1993). The method is particularly suitable for species with fairly small, firmly attached scales (e.g. pikeperch and trout). The length of the fish to be branded should preferably be > 6 cm. For small fish the filament should be as thin as possible (Saura 1993).

.

3.3. General evaluation

As any method, the electrical hot branding technique has its limitations. Code legibility depends on healing of the branding wound; e.g. if the wound becomes inflamed, the entire code can disappear. In such cases, however, a scar remains on the scale cover of the fish and the site of the brand can still be seen. In fish < 6 cm in length, the method might increase mortality.

The advantages of hot branding are its low costs and the possibility of marking large numbers of fish within a relatively short period of time as compared to fin clipping or other group marking methods. A branding instrument runs using mains electricity, costs about FIM 600, and allows one person to mark 500–1 000 fish per hour. Since it is very strong, the resistance wire can be heated up to a thousand times. The branding equipment can also be run on energy sources available in the field (e.g. batteries and rechargeable batteries). It is possible to obtain very good marking results with this method, providing that careful handling of fish, adequate oxygenation, good changing of water and it's sufficiently low water temperature occur throughout the entire marking process.

References

Berge, G. M. 1990: Freeze branding of Atlantic halibut. — Aquaculture 89: 383–386.

Bourgeois, C. E., O'Connell, M. F. & Scott, D. C. 1987: Cold-branding and fin-clipping Atlantic salmon smolts on the Exploits River, Newfoundland. — N. Am. J. Fish. Manage 7: 154–156.

Bouvet, Y. & Quost-Cristau, I. 1985: The use of cold branding in freshwater fish study. — Bull. Mens. Soc. Linn. Lyon 54: 170–192.

Brock, J. A. & Farrell, R. K. 1977: Freeze and laser marking of channel catfish. — Prog. Fish-Cult. 39: 138.

Busack, C. 1985: A simplified cold-branding apparatus. — Prog. Fish-Cult. 47: 127–128.

Buss, K. 1953: A method for markin trout by branding. — Pa. Fish. Comm. Prog. Rep. Harrisburg, Pa.: 4.

Everest, F. H. & Edmundson, E. H. 1967: Cold branding for field use in marking juvenile salmonids. — Prog. Fish-Cult. 29: 175–176.

Fujihara, M. P. & Nagatani, R. E. 1967: Cold and mild heat marking of fish. — Prog. Fish-Cult. 29: 172–174.

Hargreaves, N. B. 1992: An electronic Hot-branding device for marking fish. — Prog. Fish-Cult. 54: 99–104.

Herbinger, C. M., Newkirk, G. F. & Lanes, S. T. 1990: Individual marking of Atlantic salmon: Evaluation of cold branding and jet injection of Alcian Blue in several fin locations. — J. Fish Biol. 36: 99–101.

LaJeone, L. J. & Bergerhouse, D. L. 1991: A liquid nitrogen freeze-branding apparatus for marking fingerling Walleyes. — Prog. Fish-Cult. 53: 130–133.

Laurent, P. J. 1982: Results obtained after release of tagged chars in Leman Lake. — Bull. Fr. Piscic. 285: 210–220.

McCutcheon, C. S. & Giorgi, A. E. 1989: Assessment of freeze brand and PIT tag recovery data at McNary Dam. — Annual report, 1987. Rep. U. S. Dep. Energy: 1–64.

— 1990: Assessment of freeze brand and PIT tag recovery data for juvenile salmonids at McNary Dam. — Annual report, 1990. Rep. U. S. Dep. Energy: 1–28.

Moore, A. 1986: Branding – an improvement in catfish stock. — Farm. Pond. Harvest. 20: 1–16.

Myers, J. M. & Iwamoto, R. N. 1986: Evaluation of thermal and chemical marking techniques for tilapia. — Prog. Fish-Cult. 48: 288–289.

Saura, A. 1993: The use of hot branding in the marking of one-summer-old juvenile fish. — Finnish Game and Fisheries Research Institute. Kalatutkimuksia-Fiskundersökningar 63: 1–38.

Sorensen, P. W., Bianchini, M. & Winn, H. E. 1983: Individually marking American eels by freeze branding. — Prog. Fish-Cult. 45: 62–63.

Svasand, T. 1990: Cod enhancement experiments in Norway. Proceedings of Canada-Norway Finfish Aquaculture Workshop, Septemper 11–14, 1989. — Can. Tech. Rep. Fish. Aquat. Sci. 1761: 143–151.