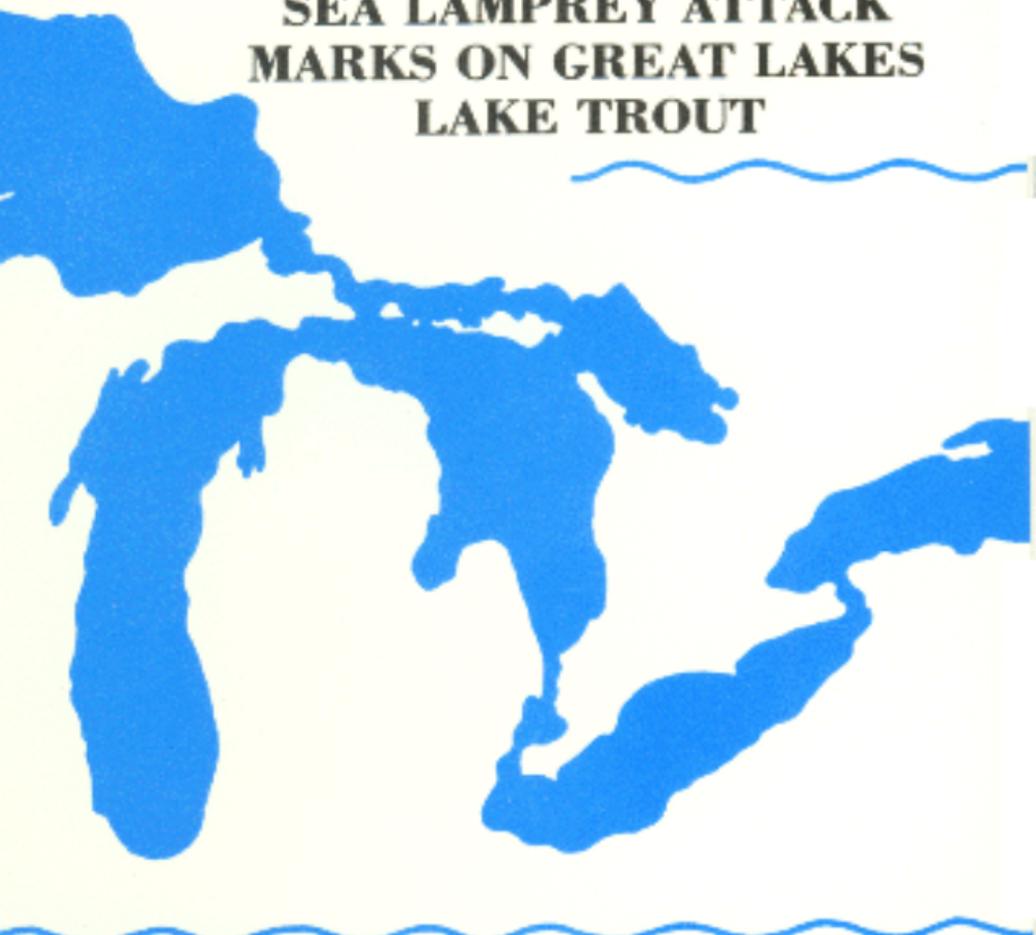


**ILLUSTRATED FIELD
GUIDE FOR THE
CLASSIFICATION OF
SEA LAMPREY ATTACK
MARKS ON GREAT LAKES
LAKE TROUT**



Great Lakes Fishery Commission

SPECIAL PUBLICATION 79-1

The Great Lakes Fishery Commission was established by the Convention on Great Lakes Fisheries, between Canada and the United States, ratified on October 11, 1955. It was organized on April 1956 and assumed its duties as set forth in the Convention on July 1, 1956. The Commission has two major responsibilities: the first, to develop coordinated programs of research in the Great Lakes and, on the basis of the findings, recommend measures which will permit the maximum sustained productivity of stocks of fish of common concern; the second, to formulate and implement a program to eradicate or minimize sea lamprey populations in the Great Lakes. The Commission is also required to publish or authorize the publication of scientific or other information obtained in the performance of its duties.

Great Lakes Fishery Commission
1451 Green Road
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LAKE TROUT

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INTRODUCTION

This field guide was produced in response to requests from representatives of various Great Lakes fishery agencies for a pocket-sized booklet that provides standardized criteria for classifying the sea lamprey attack marks observed on lake trout under field conditions. Standardized attack mark data are needed to (1) develop more refined indices of the intensity of sea lamprey predation on lake trout stocks throughout the Great Lakes and (2) facilitate the estimation of sea lamprey-induced mortality in those stocks.

DEVELOPMENT AND APPLICATION OF CRITERIA

The criteria presented in this field guide were developed from the examinations of sea lamprey attack marks produced on more than 300 lake trout during closely controlled studies conducted at the Hammond Bay Biologi-

cal Station in 1976-78. We photographed and prepared written descriptions of attack marks present on lake trout from which sea lampreys had spontaneously detached. Each attack mark was first observed within 8 or 16 hours after the lamprey detached; later records were made at various intervals until the trout died or the mark healed sufficiently to be no longer readily visible to an experienced observer. The criteria developed from these laboratory observations are based on attack mark characteristics that can be discerned under field (conditions by touching and examining the mark and the surrounding body surface of the trout.

These criteria are intended for use only with live lake trout or those freshly killed that retain the coloration typical of the live state. Although the criteria may also be valid for classifying attack marks on lake trout that have undergone postmortem color changes, we have not yet attempted to develop the data needed to verify that application.

ATTACK MARK CLASSIFICATION

Basic Marks

Our observations disclosed two basic types of sea lamprey attack marks, here termed Type A and Type B. Each of these two types of marks had four stages (I-IV) of healing that should be identifiable on lake trout under field conditions. Classification criteria for these attack marks follow.

Type *A*, Stage I-The lamprey has very recently detached. The skin at the attachment site is broken exposing the underlying musculature; the site is rough to the touch and scales (if normally present on the site) have been removed; a pit can be seen and felt in the exposed musculature; the skin surrounding the exposed musculature is white, necrotic, ragged, and hemorrhaged, but probably not bleeding (see Figs. 1a and 2a). [Note: Bleeding from fresh., lamprey-inflicted attack marks on lake trout has been reported by some ob-

servers in the field; we did not see blood flowing from an attack mark on any of the lake trout in our study, perhaps because we did not examine most attack marks immediately after the lamprey detached.]

Stage II - The entire attachment site is covered with a transparent, membrane-like material and is smooth to the touch; the exposed musculature is usually pink; a pit can be seen and felt in the exposed musculature; semi-opaque, mucus-like material partly fills the pit; unsloughed, white, necrotic skin and hemorrhaged tissue are usually visible (Figs. 1b and 2b).

Stage III - The attachment site is generally similar to that described for Stage II, but masses of new, dark pigment cells partly cover the exposed musculature; these pigment cell masses are usually first visible at the edge of the descaled skin, surrounding the exposed musculature; a pit can be felt and sometimes seen at the attachment site (Figs. 1c and 2c).

Stage IV - The attachment site appears similar to the adjacent, unaffected body sur-

face of the trout; repigmentation is essentially complete; scale regeneration (if the site normally supports scales) has not begun; a slight pit or indentation can be felt at the site (Figs. 1d and 2d).

Type B, Stage I-The lamprey has very recently left the host. The attachment site is rough to the touch and scales (if normally present on the site) have been removed; the skin is basically intact and hemorrhaged, but probably not bleeding; the underlying musculature is not exposed; the site is firm to the touch, little or no swelling can be seen, and a pit cannot be felt in the underlying musculature (Fig. 3a). This attack mark heals to produce a Type B, Stage II mark. (See also Type B, Stage I, Sloughing attack mark described below.)

Stage II - The attachment site is generally as described for Stage I, except that a transparent, membrane-like material covering the entire site makes it smooth to the touch; hemorrhaged skin tissue is usually confined to the central portion of the site (Fig. 3b).

Stage III - The attachment site is smooth

to the touch and appears as a lightly pigmented or slightly blanched area; no hemorrhaged tissue is visible; scale regeneration (if the site normally supports scales) has not begun (Fig. 3c).

Stage N--The attachment site is' closely similar in appearance to the adjacent, unaffected body surface; repigmentation is complete; if the site normally supports scales, it will be partly or fully covered with irregularly arranged, regenerated scales that may reflect light differently than the body surface immediately surrounding the site. (Fig. 3d).

Type B, Stage I, Sloughing--The characteristics of this mark are generally similar to those described above for the Type B, Stage I mark except that the site is swollen, a pit can be felt beneath the skin in the musculature (Figs. 4a and 4b), and the skin covering the pit will probably slough exposing the musculature and producing a Type A, Stage I mark.

Complex Marks

Although a sea lamprey may remain in one place while it is attached to a trout and produce an attack mark that is relatively simple to classify (Figs. 1-4), another lamprey may change its location (Figs. 5 and 6), often producing both Type A and Type B marks, as well as marks in different stages of healing. These complex marks can be classified on the basis of the characteristics of the portion of the mark that is in the earliest stage of healing. For example, when both Stage I and Stage II marks of the same type are present on a fish, the earlier (Stage I) classification should be assigned to the attack mark as a whole; similarly, if one portion of the mark displays the characteristics of Type A, Stage II, and another portion shows those of Type B, Stage I, the Type B, Stage I designation should be applied to the entire mark.

Large and Small Marks

If attack marks observed on lake trout during the early winter to late spring are to be classified according to the particular feeding year class of sea lampreys that caused them, the size of the mark (as it reflects the diameter of the lamprey's oral disc and the size of the lamprey) should also be recorded. Generally, "small" attack marks observed in early winter to late spring can be attributed to the feeding year class of lampreys with oral disc diameters of 20 mm or less which enters the lakes during that period. "Large" attack marks observed at that time are produced by the feeding year class of lampreys with oral disc diameters of 30 mm or more that entered the lakes 1 year earlier.

Figure 1. Attack Mark on 485-mm Lake Trout.

Location: Middle of back between head and dorsal fin (see diagram for photograph location). Figures 1a to 1d show successive stages in the healing of this mark.

Figure 1a.

Classification: Type A, Stage I.

Description: Broken skin exposes musculature; attachment site rough to the touch and descaled; pit 3-mm deep can be seen and felt in musculature; pit surrounded by ragged, white necrotic tissue; hemorrhaged tissue present at margins of site.



Figure 1b.

Classification: Type A, Stage II.

Description: Entire attachment site smooth to the touch, pit partly filled with semi-opaque, mucus-like material; pit can be seen and felt as an indentation; necrotic tissue has sloughed, exposing more musculature; site no longer appears ragged.



Figure 1c.

Classification: Type A, Stage III.

Description: Repigmentation of site under way; new dark pigment, most visible at the edge of exposed musculature, covers the previously exposed musculature in lower left portion of site; pit filling with new tissue, but can still be felt as an indentation.

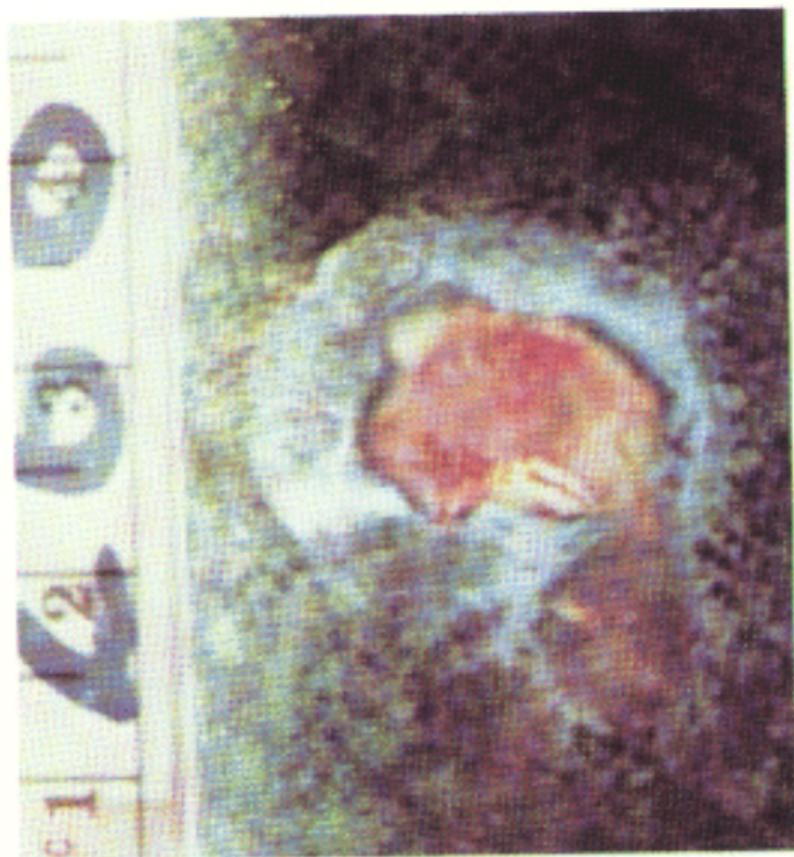


Figure 1d.

Classification: Type A, Stage IV.

Description: Repigmentation complete; an indentation can still be felt at site; scale regeneration not evident.

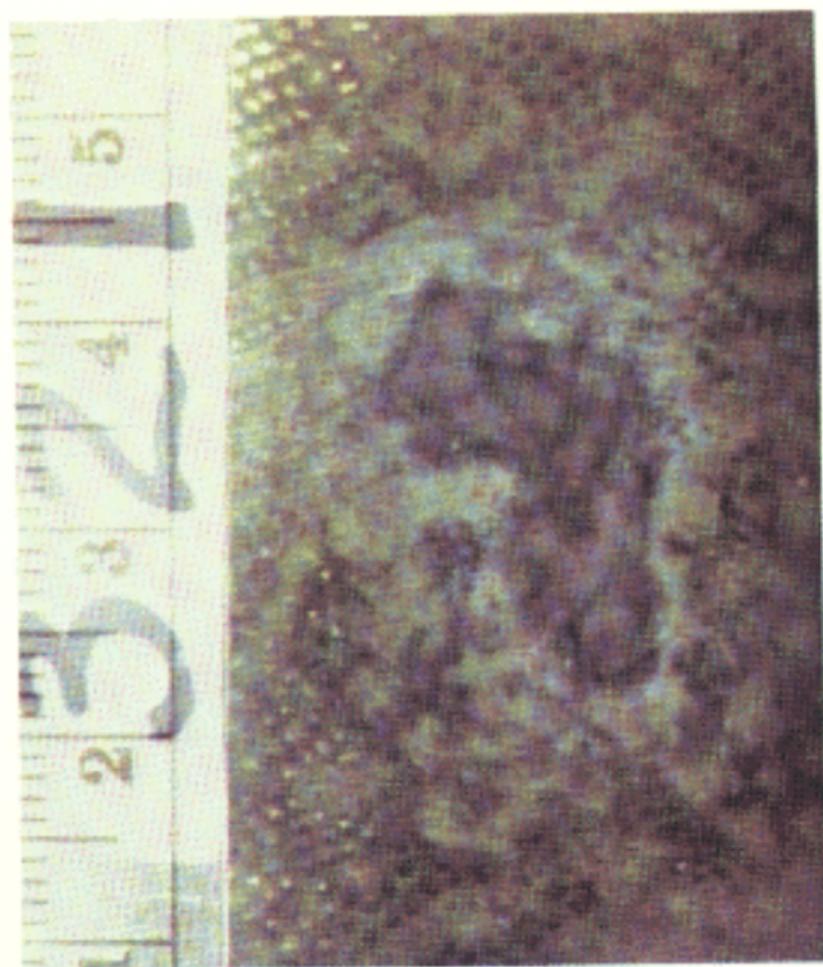


Figure 2. Attack Mark on 631-mm Lake Trout.

Location: Right cheek behind eye (see diagram for photograph location).

Figure 2a.

Classification: Type A, Stage I.

Description: Skin broken exposing musculature; attachment site (about 30 mm in diameter) rough to touch; pit 8-mm deep can be seen and felt in musculature; pit surrounded by white necrotic tissue.



Figure 2b.

Classification: Type A, Stage II.

Description: Site as in Figure 2a, but now smooth to the touch; pit partly filled with semi-opaque, mucus-like material; pit can be seen and felt as an indentation.



Figure 2c.

Classification: Type A, Stage III.

Description: Repigmentation under way; new dark pigment visible at the margins of the pit; pit can be felt as an indentation.



Figure 2d.

Classification: Type A, Stage IV.

Description: Repigmentation essentially complete; pit barely detectable to the touch.



Figure 3. Attack Mark on 623-mm Lake Trout.

Location: Immediately below lateral line, about 50 mm behind head (see diagram for photograph location). Figures 3a to 3d show successive stages of healing of this mark.

Figure 3a.

Classification: Type B, Stage I.

Description: No break in skin that exposes musculature; attachment site rough to the touch, descaled and hemorrhaged.

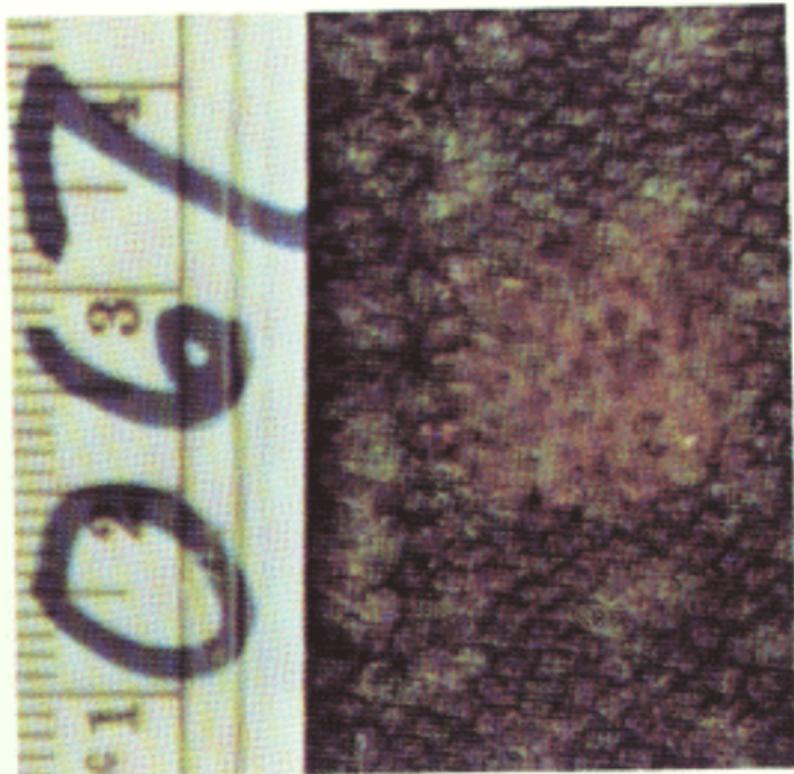


Figure 3b.

Classification: Type B, Stage II.

Description: Site as in Figure 3a, but smooth to the touch.

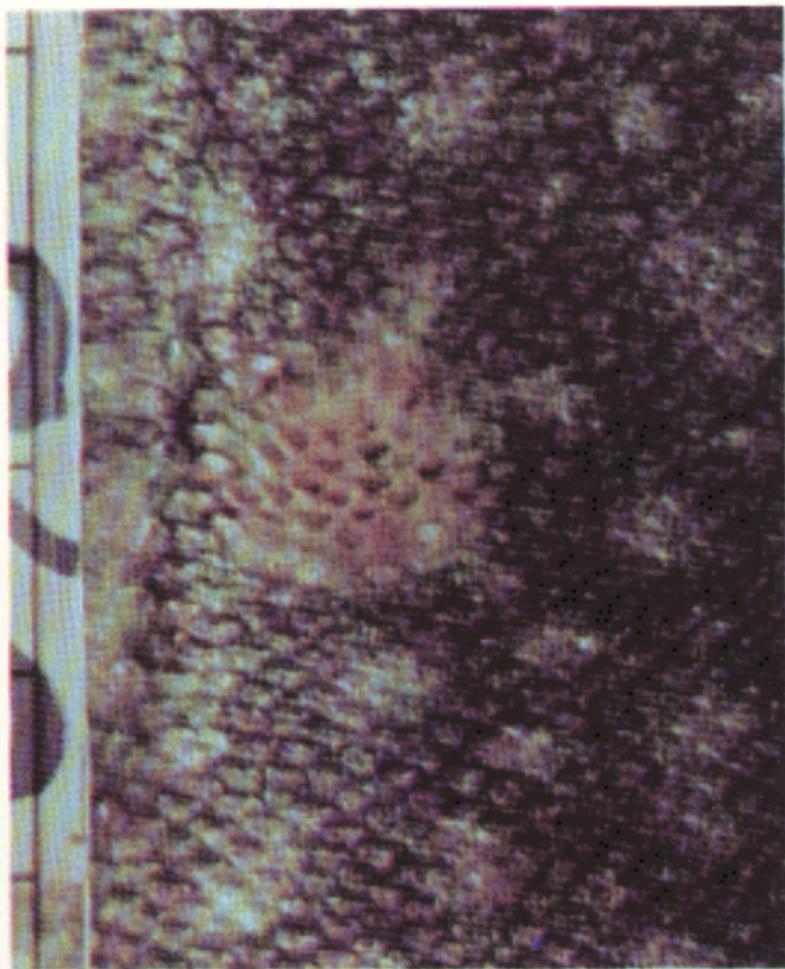


Figure 3c.

Classification: Type B, Stage III.

Description: Site as in Figure 3b, but no hemorrhaged tissue visible; new, dark pigment visible at margins of descaled area.

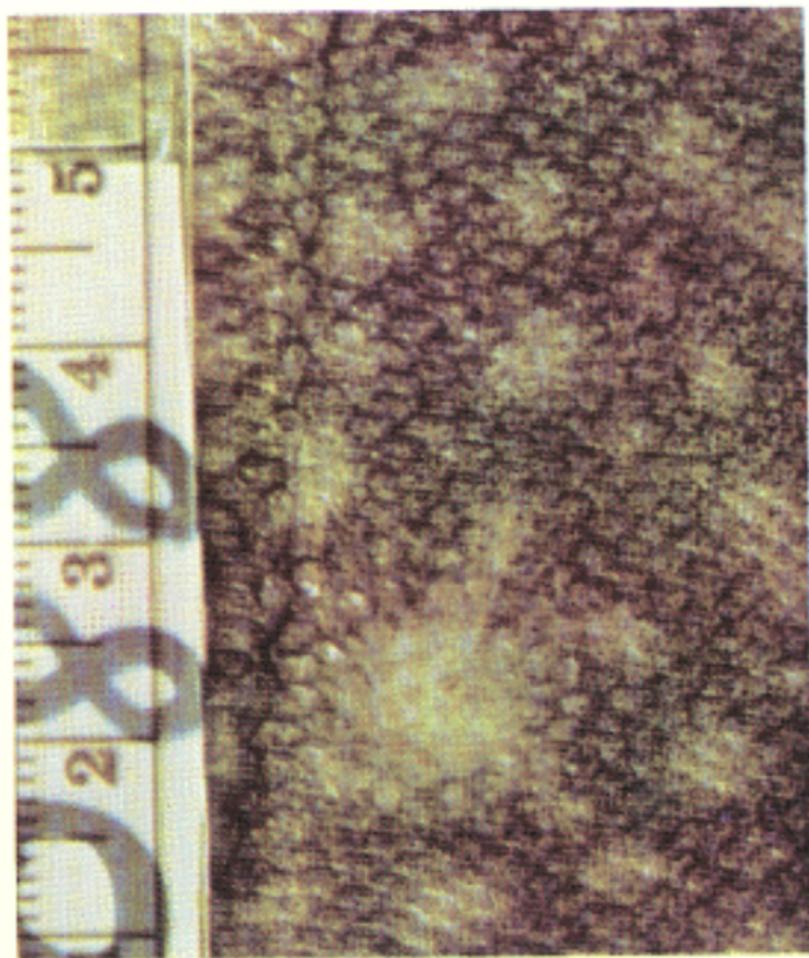


Figure 3d.

Classification: Type B, Stage IV.

Description: Site as in Figure 3c, but repigmentation appears to be complete; irregularly arranged, regenerated scales forming at margins of descaled area.

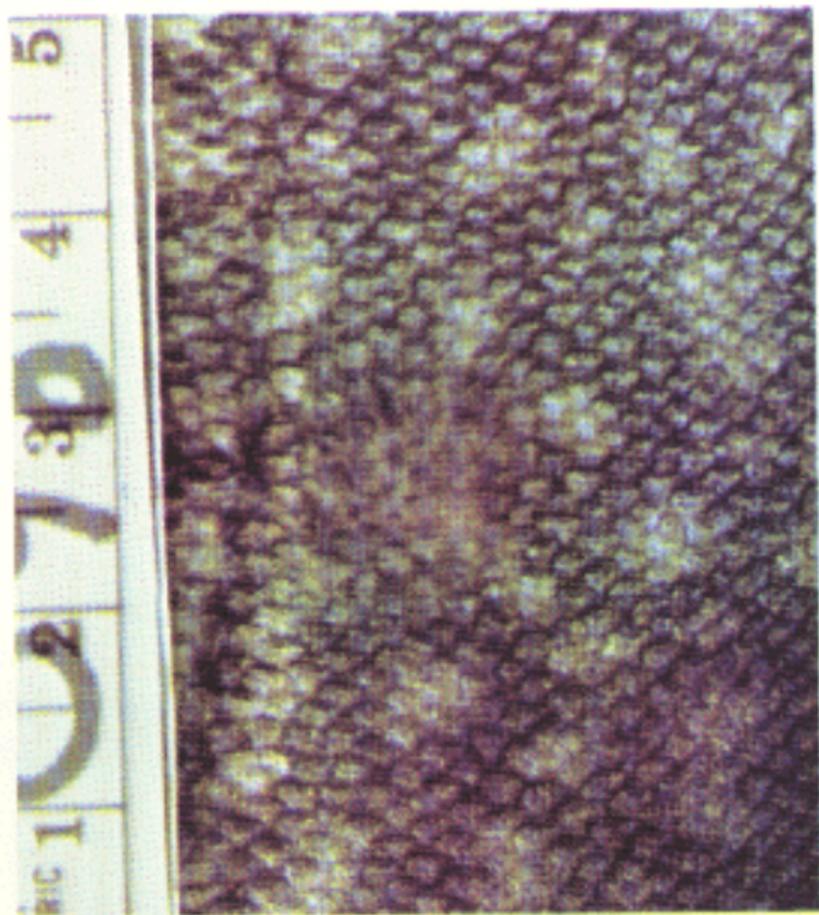


Figure 4. Attack Mark on 642-mm Lake Trout.

Location: Base of dorsal fin (see diagram for photograph location). Figures 4a and 4b are successive stages in the healing of this mark.

Figure 4a.

Classification: Type B, Stage I.

Description: No break in skin that exposes musculature; attachment site rough to the touch, pit can be felt in musculature beneath skin.

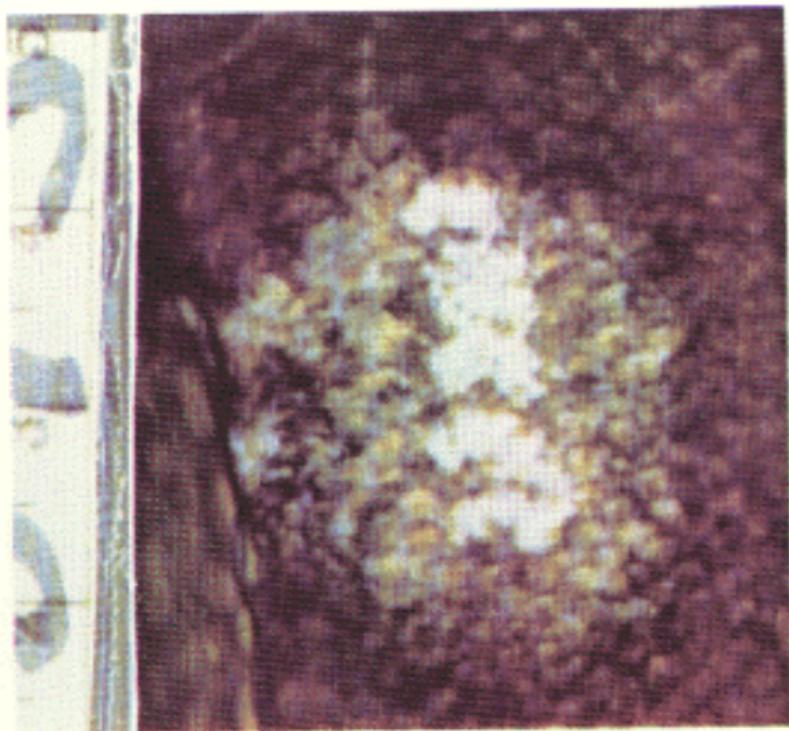


Figure 4b.

Classification: Type B, Stage I.

Description: Site as in Figure 4a, but covered with whitish-yellow necrotic tissue.

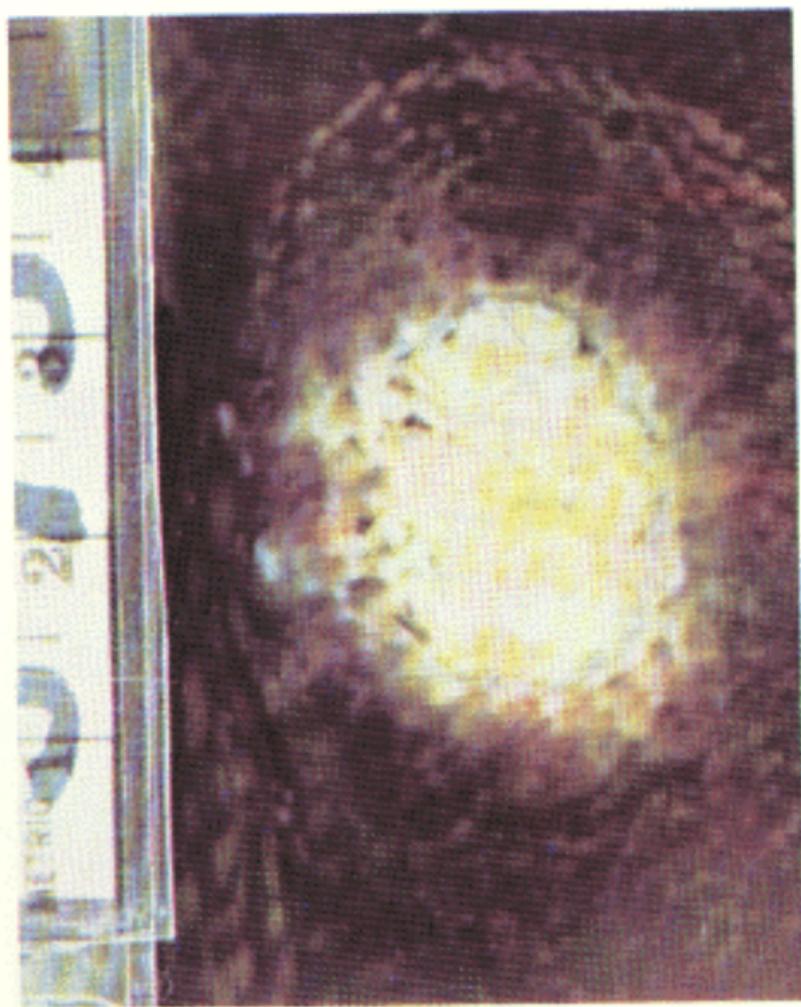


Figure 5. Attack Mark on 610-mm Lake Trout.

Location: Diagonally across right side from lateral line above pectoral fin, to belly (see diagram for photograph location).

Figure 5a.

Classification: Type B, Stage I. (Classification based on major attachment site in earliest stage of healing.)

Description: Elongate attack mark with multiple major attachment sites; major attachment site in lower right portion of figure has typical Type B, Stage I characteristics.

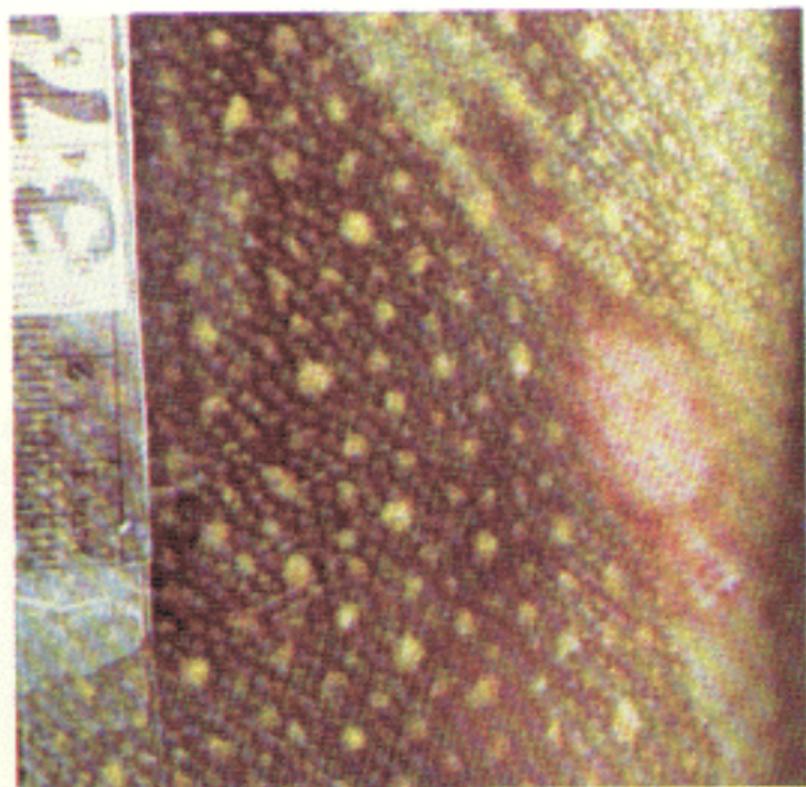


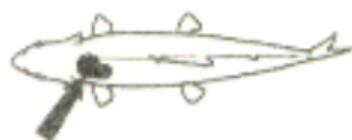
Figure 6. Attack Mark on 627-mm Lake Trout.

Location: Dorsal surface left of midline, immediately behind head (see diagram for photograph location).

Figure 6a.

Classification: Type A, Stage I. (Classification based on major attachment site in earliest stage of healing.)

Description: Multiple major attachment sites. Site in upper right portion of figure has typical Type A, Stage II characteristics; site at center has typical Type A, Stage I characteristics.



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