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A Device for Holding Objects in the Stomachs of Fish

Studies were initiated in 1962 which involved holding objects in the stomachs of fish for extended periods of time. To accomplish this, it was necessary to construct a device which would withstand regurgitating actions without inflicting injury, and would not disrupt the normal behavior of the fish. This device consisted of a plastic rod that was attached to the isthmus of the fish and extended down the gullet into the stomach.

The method required the shaping of a Halon¹ resin rod 0.0625 inch in diameter into a loop to fit around the isthmus of the fish. Halon was used because of its apparent lack of toxicity, its plasticity after moderate heating and its flexibility. The proper fit of the loop around the isthmus was important to prevent irritation and wearing away of the isthmus tissues. The proper size and shape of the har-

¹Manufactured by Allied Chemical Corporation, Plastics Division, 1 River Road, Edgewater, New Jersey.

ness was determined as follows. A fish of the desired species and body length was dissected and a balsa wood model was carved so that its cross section matched that of the isthmus between the first and second gill arches. One end of the Halon rod was then heated and a loop having a plane perpendicular to the long axis of the rod was formed around the appropriate model. The opposite end of the rod was trimmed to extend the desired distance into the stomach and the object to be implanted in the stomach was attached. The apparatus was easily installed in the anesthetized fish by inserting the rod down the gullet and manipulating the loop around the isthmus between the first and second gill arches. Tolerance by the fish to this harness is indicated by the following observations.

The effects of these devices on feeding activity of northern pike, *Esox lucius*, was studied over a 51-day period. Twenty northern pike, 406 to 616 mm total length, were selected; 15 were fitted with harnesses to which various metals were attached, five fish were used as controls.

The experimental fish fitted with harnesses and metals attempted to expel the harnesses within a few hours after attachment. They were observed to open their mouths widely and to shake their heads rapidly from side to side. This behavior was observed infrequently after the first day. The control fish did not behave in this manner although they also had been anesthetized.

The fish were held individually in concrete and glass tanks of approximately 175-gallon capacity containing creek chubs, *Semotilus atromaculatus*, which were replaced as rapidly as the northern pike ingested them. There was no difference in the mean rate of feeding between fish in the control group and the experimentals, both of which consumed about one creek chub per northern pike each 5 days. Throughout the study there was some regurgitation of partially digested fish remains by northern pike in the three experimental groups; however, control fish regurgitated at the same rate.

Upon completion of the feeding study, four northern pike fitted with harnesses and metals were placed in a 0.1-acre pond with suitable

forage fish. Three northern pike were subsequently recovered from the pond. The first test fish was removed and examined 87 days after it had been fitted with a harness. This fish was in poor physical condition and showed extensive erosion of tissue where the harness was attached. A second northern pike was removed from the pond and examined after carrying the harness for 164 days. This fish appeared to be in good physical condition except that the isthmus showed wearing away of the tissues on the ventral surface. A third northern pike was recaptured 226 days after the harness was attached. This fish also appeared to be in good physical condition. Although initially there had been wearing away of the tissues on the ventral portion of the isthmus, this had healed and no further wear had taken place. Apparently there had also been some irritation where the rod entered the gullet as the tissue of the ventral portion of the gullet had grown around the rod for a length of 20 mm. No inflammation of the isthmus, gullet, or the stomach was apparent at the time of recapture.

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