Report 310

August 31, 1935

WHEN DO PIKE SHED THEIR TEETH?

By Milton B. Trautman and Carl L. Hubbs,

Institute for Fisheries Research,
Michigan Department of Conservation and University of Michigan

From the days of Gesner downwards, more lies—to put it in very plain language—have been told about the pike than any other fish in the world; and the greater the improbability of the store, the more particularly is it sure to be quoted.—Frank Buckland, 1880

The pike which reached the venerable age of 260 odd years; the one that grew to the amazing length of 19 feet and weight of 350 pounds (something must be wrong about those figures, for according to the normal length-weight relation a 19-foot pike should weigh about a ton and a half); the pike which was found to "have an infant child in its stomach": the one that nearly severed a hand from an unsuspecting boy swimming in a stream; another one that, going to the other extremity, "was known to have seized the foot of a young woman while she held it naked in a pond": such pike, referred to by the famous British fish conservationist "in very plain language", fortunately have died, or been forgotten; or have failed to swim from their European haunts across the ocean to America.

The pike on our side of the Atlantic, although usually classed in the same species, are seldom thought to attain such age or appetite. In fact our pike are claimed to lose their appetite in the head of summer, at just the season when they should be feeding most heavily and growing fast. At least that is the theory on which most pike fishermen

rely, to explain why they fail to catch pike in late summer. We suspect that guides, finding it an excellent alibi to satisfy their unsuccessful customers, have been to a large degree responsible for keeping this idea alive.

The reason almost always given for the season loss of appetite suffered by our northern pike, and likewise by our muskellunge and chain pickerel, is that the fish after shedding its old teeth in late summer, grows a new set. The pike when cutting teeth, like a human infant in the same predicament, is assumed to develop sore gums, so sore in fact that he refuses to feed.

Referring to the muskellunge, concerning which the tooth-shedding and soregum theory is perhaps even more widely current than for the northern pike, the well-known angling author Dixie Carroll wrote:

> About the middle of August the musky loses his teeth and his mouth is in such shape that it takes something mighty aggravating to arouse enough anger to make him forget his sore molars [sic] and strike.....September tenth of last season I examined three musky caught on that day, and in the mouth of each was a new set of sharp-edged teeth, firmly set, while, hanging loose in the back, were still the remains of the old teeth, which had not entirely parted company with their owners.

To test the idea that members of the pike family shed their teeth at a particular season, and to determine in what manner the teeth are shed and replaced, we have examined and tabulated the teeth of 188 northern pike (Esox lucius), 7 muskellunge (Esox masquinongy masquinongy and E. m. immaculatus) and 6 Chain pickerel (Esox niger). With only 6 exceptions all the specimens used are more than 300 mm. (about 1 foot) in standard length, from tip of snout to base of caudal fin. These fish were collected in every month of the year excepting February and December. Adequate numbers of northern pike were examined for each month from April to September inclusive.

The teeth of the pike that are involved in the sore-gum theory are the huge knife-like, compressed canines which line the hinder two-thirds of the side of each lower jaw. The teeth in the front third of the lower jaw are round in section, hooked, much smaller,

and seldom missing at any time. Those near the symphysis (extreme front) of the lower jaw are semi-depressible, while those farther back grade into the large canines which were counted. In counting the canine teeth, however, it was possible to differentiate between these and the smaller anterior teeth, with little obvious error.

The teeth of the upper jaw, borne only on the premaxillaries, which form the edge of the front third of each jaw, are in one row, relatively minute and seldom missing.

The hinged, depressible teeth, with which the roof of the mouth bristles, become enlarged toward the inner edges of the long palatines and on the broad head of the vomer, are almost shagreen-like on the posterior part of the vomer, as also on the opposing mid-section of the tongue; whether large or small, these teeth on the roof of the mouth and on the tongue are always present in great numbers, showing no very obvious or extensive shedding or renewal at any time.

The canines of the lower jaw, in contrast, are very obviously subject to loss and renewal. Not one of the more than 200 specimens examined had as many as three-fourths of its full complement of these large teeth in service; few had as many as two-thirds in use; but all had a number in use. The method of replacement is somewhat like that of the rattlesnake's fang or the sting-ray's spine, multiplied by about 16 times on each lower jaw. The wide strip of gum covering the hinder two-thirds of each lower jaw is divided internally by walls, of connective tissue, into about 16 sections which extend inward and backward from the outer edge of the jaw. Along the middle of each division one finds on dissection a single, even file of teeth in graded series of development. The innermost of these teeth is often merely a shapr little tip; the outermost is either a tooth in service or one being prepared to take the place of one that has been lost or shed.

If a tooth in service has been broken off, its very widely flaring bony base is resorbed, as is a loose piece of bone in a human gum. This process continues until the base is completely removed, leaving bare a square section of the flat surface of the mandible. The lower end of the replacing tooth then moves into position; a new, flaring, flat-bottomed base is then formed to fit the square space on the jaw bones, as soft

tissue which later ossifies and becomes very firmly attached to the plane surface of the jaw. As the base enlarges it becomes united also with the inner edge of the thin, upturned edge of the mandible, and is separated from the base of the fixed tooth on either side only by connective tissue walls which bound its section of the gum. Filling the entire tooth-supporting section of its compartment, the base thus becomes square. During this final stage in the replacement process, the needle-like tip of the new tooth moves outward until it lies along the outere edge of the gum, almost but not quite vertically over the hardening base. As it moves outward, the extreme tip becomes exposed above the gum, and the whole outer side of the tooth comes to lie against the lower lip. As a result of these simultaneous modifications at the base and tip, the new tooth is brought into service. Its tip is sharp as a needle; its front and rear edges are expanded into knife-like keels.

The replacement of the teeth proceeeds in such a manner, that those in service are usually scattered along the whole portion of the jaw bearing these enlarged teeth. The pike therefore, baring rare accidents, retain at all times an efficient dentary equipment. The first tooth of the series counted is usually small and fixed, that is in service. Then follows another small tooth, or 2 or 3 increasing in size, usually in process of replacement (not fixed to jaw). Behind these are usually 2 very long piercing teeth, corresponding in psotion and function to the canines of a carnivorous mammal; one of these super-canines is almost always in service; one is usually being replaced. Of the 8 to 12 most posterior teeth, which gradually decrease in height so as to form a rather even, gently ascending edge, several are usually being replaced. The last 2 or 3 very small teeth, located behind the corner of the gape and therefore protected, are usually fixed to the jaw.

It is not evident whether old teeth are shed and replaced, except when broken. In any event the replacement process assures an equipment of sharp teeth throughout life. The larger adults examined seem to have more broken teeth than the smaller ones, suggesting a slower rate of replacement as compared with the rate of loss.

We find little or no evidence that the number of canine teeth increases with age. As the jaw grows longer, each tooth section becomes proportionately larger, so that a three-foot pike has no more canine teeth than a five-inch pike. Accurate counts of these teeth, made with the aid of dissection in order to avoid overlooking any teeth in the early stages of replacement or any small ones at the posterior end of the jaw, are listed in Table I. The average number of canines per jaw in 5 specimens 104 to 265 mm. in standard length (roughly 5 to 12 inches long over all), is 15.8; the average number of teeth in 10 pike 315 to 960 mm. long without caudal fin (about 14 to 42 inches over all), is 15.9.

Table I

Accurate counts of canine teeth, including those being replaced on each lower jaw of northern pike of different sizes.

Standard length	Number of canine teeth	
	Left jaw	Right jaw
104	15	12
130	17	15
151	15	16
255	18	17
265	16	17
315	17	18
315	18	15
320	15	15
430	14	15
460	16	16
500	15	13
580	16	15
600	18	16
675	18	16
960	17	17

Counts of the canine teeth in 178 adult pike, made without dissection, likewise show no increase in the larger fish (Table II). These counts are consistently about 4 too low; it was virtually impossible, with dissection, to perceive all the teeth in early stages of replacement or the one or two very small though usually fixed teeth on the edge of the jaw behind the angle of the gape.

Table II

Counts of the canine teeth on each lower jaw in 178 adult northern pike of different sizes

Size group (standard length in mm.)	300 -349	350 -399	400 -449	450 -499	500 -549	5 50 -599	All sizes
Number of fish examined	69	42	30	22	12	4	178
Average number of teeth in service	6.8	6.9	6.8	6.9	6.7	5.9	6.8
Average total number of teeth	11.7	11.8	11.8	12.4	12.4	10.6	11.9

Since the number of teeth in half-grown and adult northern pike does not materially change with age, it is legitimate to include pike of all sizes in the study made to determine whether the teeth are usually shed or replaced at any particular season. The data bearing on this point are given in Table II. The tooth counts for pike in this table, since they were made without dissection, omit on the average about 4 teeth per jaw as explained above. Every indication, including the evidence shown in Table II, points to the conclusion that the counts consistently omitted about 4 teeth.

It is evident from the data summarized in Table III, that the Northern Pike shows no seasonal variation of importance in the number of teeth in service or in the number being replaced. We therfore find no confirmation for the popular idea that the pike shed their teeth exclusively or chiefly in late summer. At all times of the year there is an effective complement of teeth, and at all seasons approximately the same number of teeth are being replaced. Therefore if the rate of replacement is accelerated at any season of the year, the rate of loss must be accelerated to approximately the same degree.

Much less material of the muskellunge and the chain pickerel is available, to determine when these species shed their teeth. The few counts made, however, confirm the conclusions drawn from the study of the northern pike (see Table IV). It is probable that all species of the pike genus Esox agree in the following respects:

1. The number of canine teeth on the lower jaw is constant throughout life, averaging about 16 per jaw.

2. These teeth are confined in sections of the gum.

Table III

Counts of the canine teeth on each lower jaw in 183 adult northern pike 300 to 960 mm. long (standard length) taken in different months.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.D
Number of Fish examined.....	2	..1	1	20	21	17	30	40	45	7	... .
Average number of teeth in service...	(5.75)	...	(9.5)	6.4	6.8	7.0	6.8	7.25	7.0	6.5	... .
Aver. number of teeth being replaced	(3.5)	...	(3.0)	4.9	4.9	4.6	5.6	4.9	4.9	4.9	... .
Average total number of teeth	(9.25)	...	(12.5)	11.3	11.7	11.6	12.3	12.2	11.9	11.4	... .

Table IV

Accurate counts (made with dissection) of the canine teeth on each lower jaw of 5 muskellunge and 4 chain pickerel, of different sizes, taken in different months.

Species	Date of capture	Standard length, mm.	Number of teeth: In service	Being replaced	Total
Muskellunge (Wisc.)	July 10	340	6-6	8-9	14-15
Muskellunge (Wisc.)	July 28	475	6-7	9-9	15-16
Muskellunge (Wisc.)	Sept. 14	310	7-6	11-11	18-17
Muskellunge (L.Erie)	Sept. 23	585	10-9	8-9	18-18
Muskellunge (L.Erie)	Nov. 29	438	6-7	9-10	15-17
Chain Pickerel	Aug. 4-5	380	6-6	9-10	15-16
Chain Pickerel	Aug. 4-5	386	7-7	11-9	18-16
Chain Pickerel	Aug. 20	345	7-8	11-9	18-17
Chain Pickerel	Sept. 12	280	8-5	9-12	17-17

Table V

Catch per hour of northern pike in Houghton Lake, Michigan

	1928	1929	1930	1931	1932
Number of hours of fishing reported:					
May-June	5102.5	7144.25	4895.5	3184.75	3080.5
July-Sept.	4969.0	4373.25	6110.75	1274.5	1805.0
Catch of northern pike per hour:					
May-June	0.22	0.22	0.222	0.15	0.26
July-Sept.	0.10	0.15	0.10	0.04	0.10

3. The canines are much subject to loss and to replacement by accessory teeth being developed in each section of the gum.

4. An effective number of teeth remain in service at all seasons.

5. There is no evident seasonal change of consequence in the number of teeth in service, or being replaced.

Therefore if pike, muskellunge and pickerel can not be caught so readily in the heat of summer as in the cooler seasons, it is presumably not because the fish have just shed their teeth. The Michigan creel census, by such data as that shown in Table V, has confirmed the general opinion that the catch of northern pike per hour does fall off very notably in the summer.

It is not evident why the catch of the northern pike and its relatives falls off in mid-summer. We find no good evidence that these fish "go off their feed" at that season, although Alfred C. Weed in his Field Museum publication, Pike, Pickerel and Muskalonge, states an aquarium muskellunge in Chicago "has been in the habit of fasting for several weeks each summer". We do find evidence, by examining the stomachs of about 100 northern pike, that this species at least partakes freely of food throughout the summer: our specimens caught in July and August contain approximately as much food as those captured in cooler months.

We also fail to confirm the popular supposition that "sore gums" are developed in summer (to explain the loss of appetite and the falling off of the catch), although we have not excluded that possibility. The gums of all preserved pike, muskellunge and pickerel examined appeared normal, showing no evidence of inflammation in life. Four northern pike and two mud pickerel (Esox vermiculatus), taken in late August and early September of this year, when examined immediately after their removal from the water, showing no swelling, reddening or other pathological symptoms of inflamed gums. Soon afterward, however, sections of the gums reddened, on account of the accumulation of blood in the finer blood vessels, some of which ruptured to produce internal and even external hemorrhages. The same congestion and rupturing of the blood vessels, as is generally known, likewise occurs on the vertical fins, which however, have never been

accused of soreness. These hemorrhages on the gums and fins are apparently due to the death struggles of the fish, and are naturally most evident where the parts have been bruised, for instance where the gums have rubbed against a hook, plug or spoon. The gums redden chiefly where a canine tooth is being replaced, because the soft flesh is there unprotected by a fixed, external tooth, and is well supplied with blood vessels which nourish the growing tooth. This is apparently the reason why fishermen believe that the gums are sore about the new teeth, or about the old teeth if they mistake a replacement tooth for an old, broken tooth. Whether the blood vessels rupture as readily as in summer has not been ascertained.

Why pike, muskellunge and pickerel are not caught in large numbers in summer may be due to the especial abundance of avilability of natural food in summer, or to the sluggishness induced by the warm water.