MICHIGAN DEPARTMENT OF CONSERVATION
Research and Development Report No. 20 *

December 4, 1964

Feeding behavior of the Common Merganser in captivity

By William C. Latta and Reginald F. Sharkey

Introduction

To evaluate the role of the Common Merganser (Mergus merganser americanus) as a predator on trout populations, detailed knowledge of their feeding behavior is needed. Analyses of the stomach contents of the Common Merganser from trout and salmon streams have indicated a selectivity for the larger salmonids even though there were other more abundant species of fish present in the streams to act as buffers (Salyer and Lagler, 1940; Lindroth, 1955; White, 1957). This apparent selectivity has been attributed to availability as determined by behavior of the prey species, of the buffer species, and of the predator (Lindroth and Bergström, 1959; Elson, 1962; Mills, 1962). Our observations on the feeding of Common Mergansers in captivity tend to confirm the premise of availability. In addition, some information was gathered on the daily ration needed by mergansers to maintain body weight.

---

* Institute for Fisheries Research Report No. 1700.

We wish to thank H. L. Thompson for providing facilities for holding the mergansers at the Oden Hatchery. G. P. Cooper critically read the manuscript. P. M. Earl prepared the graphs.

Methods

At the State Fish Hatchery, Oden, Michigan, regular patrols of the raceways are made to drive off bird predators. In late February, 1962, two female Common Mergansers were captured after being slightly wounded. At capture they weighed 48 and 50 ounces respectively (Table 1). They were placed in a cement fish tank, 12 feet long, 3 feet wide and 30 inches deep, located inside the hatchery building. The birds were separated by a vertical screen placed in the center of the tank. The bottom of the tank was covered with 3 inches of sand and fine gravel. The water level was kept at about 9 inches above the sand and gravel with enough flow to maintain live trout in good condition. The trout could not swim through the mesh of the screen divider. Each compartment was covered with a screen and partially covered with a canvas to provide some seclusion. Temperature of the water in the tank was 45° F. Temperature of the air above the water in the tank, at the height of a merganser, was 52° F. Temperature of the room was about 65° F.

In February, 1963, six mergansers were captured, three after being wounded and three in "suitcase" type beaver traps. Weights at capture are given in Table 1. Colored leg bands were used to identify

each bird. The birds were placed in cement fish tanks, with a few differences in tank conditions as compared to 1962. In 1963 the water level in the tanks for mergansers III, IV, V and VI was 11 inches, and for VII and VIII it was 6 inches; about one inch of sand and gravel covered the bottom of the tanks holding mergansers III, IV, VII and VIII, and later in captivity a pan of sand and gravel was provided for mergansers V and VI.

In 1962, during the course of the feeding, it was found that the mergansers would readily eat live trout and fresh dead trout, but they would not eat partially decomposed trout nor strips of trout flesh. Merganser I was fed for 25 days on live trout, 14 days on dead trout, and 7 days on a combination of live and dead trout. Merganser II was fed for 16 days on live trout, 44 days on dead trout, and 4 days on a combination of the two. On 4 days neither bird received any food. The birds were fed mostly brook trout (Salvelinus fontinalis), but a few rainbow trout (Salmo gairdneri), and one lake trout (Salvelinus namaycush). Merganser I died April 20, presumably as a result of an injury to her leg caused 21 days earlier when an attempt was made to photograph her. Despite the injury her appetite seemed normal during the 21 days.

In 1963, the birds were fed only live fish--brook trout, rainbow trout, creek chubs (Semotilus atromaculatus) and mottled sculpins (Cottus bairdi).

Weight in captivity

Weight gain or loss of the mergansers in captivity and weight of fish consumed are summarized in Figure 1 A-C and Table 1 respectively. From weights of the mergansers at capture compared to average weights given by White (1957), it is judged that mergansers VI, VII and VIII were immature and the others were adult.

In the 1962 study, one objective was to determine the amount of trout which mergansers must eat each day to maintain their body weight. For the first 10 days each bird received about 4 ounces of trout per day. On this ration merganser I lost 17 ounces during the 10 days and merganser II lost 18 ounces. When the average daily ration was increased to about 9 ounces per day, merganser I gained 8 ounces in 6 days and merganser II gained 6 ounces. When the daily ration was lowered to 6.5 ounces, merganser I lost 7 ounces in 6 days and merganser II lost 4 ounces. Increasing the daily ration to 11 ounces resulted in gains of 5 and 6 ounces in 9 days. At 9 or 10 ounces of trout per day, the two captive mergansers maintained a body weight of about 33 ounces for 12 and 21 days but this was considerably below their original body weight (Figure 1A).

In 1963, there were always live fish available to the mergansers, but even then, mergansers III, IV and V continually lost weight in captivity (Figure 1B); in contrast, mergansers VI, VII and VIII maintained, or very nearly maintained, their body weight (Figure 1C). Mergansers III, IV and

V were adult birds that were wounded in capture while the other three mergansers were immature birds that were captured in traps without injury. Whether it was age of the birds or injury from capture that caused the difference in weight loss is not known. Superficially, the wounds did not appear to be serious.

In both years and for all birds, the percentage of original body weight represented by food consumed per day varied only from 15.3 to 19.5 (Table 1). In 1963, the immature mergansers that were captured in traps (VI, VII and VIII) maintained their body weight for 49 to 51 days on a daily ration of 6.02 to 6.62 ounces of fish or 17.1 to 19.5 percent of original body weight (Table 1).

White (1957) held three immature Common Mergansers in captivity for 219 days during which time they consumed an average of 10.93 ounces of fish per day (or about 25 percent of their body weight). White's mergansers lost weight during the 219 days of captivity. He suggests that the weight loss may have been caused by increased activity due to start of flying plus the observed development of a heavy infestation of nematode worms. His mergansers were held as a group in an outdoor pen while ours were confined individually indoors, so that air temperature and perhaps behavior factors may explain the difference in the daily ration. White, earlier, had held a tame, immature male Common Merganser in captivity for 19 days. Its daily consumption averaged 15.8 ounces or 38.5 percent of its body weight (41 ounces).

Salyer and Lagler (1940) estimated from observations and stomach samples that an adult merganser would consume 1 to 1 1/2 pounds of fish daily or "one-third to one-half its body weight."

Size selectivity

Feeding tests were conducted to explore two questions: (1) does the merganser, to a considerable extent, select trout by size in feeding? and (2) what is the upper size limit of trout that the birds can swallow? Three different series of tests on size selectivity were run--one in 1962 and two in 1963.

Five times during the course of the feeding in 1962, live trout 4-8 inches long were placed in the tanks to determine whether the mergansers would select trout for size. At the end of 2 hours, and again at the end of 24 hours, the number and size of trout that had been eaten were noted (Table 2). It appeared that the two mergansers showed a preference for the smaller (4- to 5-inch) trout over the larger ones.

In 1963, two series of tests were run using each of the six mergansers and trout 4-8 inches long. The limits of the size groups of trout were only 0.4 inch in 1963 instead of 1.0 inch as in 1962, e.g., 3.9-4.2 inches instead of 4.0-4.9 inches. The 8-inch trout were not too large for the mergansers to consume. Each size group contained five trout. The number of trout of each size group consumed was tabulated at the end of 24 hours for each merganser (Table 3). These six mergansers also selected the smaller trout first as did the two in 1962. In contradiction,

White (1957), in feeding his captive Common Mergansers, found "that when there was a choice of sizes at any particular time, the ducks tended to take the larger fish up to the limit of a size which they could readily swallow."

Two series of tests on the upper limit in size of trout that a merganser can eat were run--one in 1962 and one in 1963.

In 1962, two live and five dead trout, 8-10 inches long, were presented to merganser I to determine the largest size trout she was able to consume (Table 4). Girth rather than length of the fish seemed critical. She was able to eat trout up to 5 inches in girth but was unable to consume two trout of 5.5-inch and 6.0-inch girths.

In 1963, each merganser was presented in two or three tests with four live trout of progressively larger girths to determine the maximum size it could consume (Table 5). Each trout was given a different fin clip so that the order in which they were consumed or killed could be noted. The fin clips used varied in each series. The larger the merganser, the larger the girth of the trout it was able to consume. Number III, the largest merganser, was able to consume a trout with a girth of 6.2 inches while VIII, the smallest merganser, could swallow a trout with a girth of only 4.9 inches (Table 5). Size of the merganser and girth of the fish are the two factors which limit the size of fish eaten.

Size selection was noted in the order in which the trout were consumed or killed. The probability that a merganser would by chance

consume or kill the four trout in sequence, smallest girth through largest girth, is 1/24. Of the 14 tests run, the order in which the four trout were consumed or killed was recorded for 12. In 5 of the 12 tests the sequence of consuming or killing followed precisely the girth size from smallest to largest. This ratio, 5/12 or 0.42, is considerably higher than would occur often by chance (99 percent confidence interval for 1/24 is 0-0.28). Apparently the mergansers were able, somewhat, to distinguish the size of the trout.

Species selectivity

Ten each of mottled sculpins, creek chubs and brook trout of approximately the same size were presented to four mergansers in two series of tests to determine if there was selection of a particular species for consumption. At the end of 24 hours, the number of each species consumed was recorded (Table 6). The mergansers consumed about equal numbers of creek chubs and brook trout, but a few less of mottled sculpins. Partial avoidance of the mottled sculpin perhaps can be attributed to a difference in availability between the more secretive, bottom-dwelling sculpin and the more mobile minnows and trout. The peculiar feeding technique of sighting and probing which mergansers use (Lindroth and Bergström, 1959) leaves no doubt about their ability to capture bottom-dwelling sculpins.

Literature cited

Elson, P. F. 1962. Predator-prey relationships between fish-eating birds and Atlantic salmon (with a supplement on fundamentals of merganser control). Bull. Fisheries Research Board Canada No. 133, 87 pp.

Lindroth, Arne. 1955. Mergansers as salmon and trout predators in the River Indalsälven. Fishery Board Sweden, Inst. Freshwater Research, Drottningholm, Rept. No. 36: 126-132.

_____, and Eva Bergström. 1959. Notes on the feeding technique of the goosander in streams. Fishery Board Sweden, Inst. Freshwater Research, Drottningholm, Rept. No. 40: 165-175.

Mills, D. H. 1962. The goosander and redbreasted merganser as predators of salmon in Scottish waters. Fishery Board Scotland, Freshwater and Salmon Research Ser. No. 29, 10 pp.

Salyer, J. Clark, II, and Karl F. Lagler. 1940. The food and habits of the American merganser during winter in Michigan, considered in relation to fish management. Jour. Wildlife Management, 4(2): 186-219.

White, H. C. 1957. Food and natural history of mergansers on salmon waters in the Maritime Provinces of Canada. Bull. Fisheries Research Board Canada, No. 116, 63 pp.

Table 1.--Summary of feeding of six captive Common Mergansers, 1962 and 1963

[Weights in ounces]

	Year and merganser number							
	1962		1963					
	I	II	III	IV	V	VI	VII	VIII
Date of capture	Feb. 24	Feb. 27	Feb. 4	Feb. 5	Feb. 6	Feb. 20	Feb. 27	Feb. 26
Sex of bird	Female	Female	Male	Female	Female	Female	Female	Female
Method of capture	Shotgun	Shotgun	Shotgun	Shotgun	Shotgun	Trap	Trap	Trap
Weight of merganser at capture	50.00	48.00	60.00	51.50	43.00	37.50	34.00	33.00
Mean weight of merganser (Number of weighing in parentheses)	34.03 (8)	32.00 (8)	53.62 (14)	43.77 (14)	35.23 (14)	32.78 (10)	33.80 (10)	32.95 (10)
Number of days of feeding	49	58	69	69	69	51	49	50
Weight of fish consumed	427.90	498.30	661.90	598.15	452.95	326.50	324.25	301.25
Weight of fish consumed per day	8.73	8.59	9.59	8.67	6.56	6.40	6.62	6.02
Percent of original body weight consumed per day	17.5	17.9	16.0	16.8	15.3	17.1	19.5	18.2

Table 2.--Number of each size of trout consumed by two captive Common Mergansers, 1962

Merganser number	Date (1962)	Time (hours)		Size (inches)				
				4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9
I	Mar. 19	24	Available	37	...	11	...	...
			Consumed	20	...	5	...	...
			Percent	54.2	...	45.5	...	...
I	Mar. 24	24	Available	17	...	5	...	...
			Consumed	17	...	3	...	...
			Percent	100.0	...	60.0	...	...
I	Mar. 26	2	Available	6	...	6	...	6
			Consumed	4	...	1	...	0
			Percent	66.7	...	16.7	...	00.0
II	Mar. 26	2	Available	6	...	6	...	6
			Consumed	5	...	1	...	0
			Percent	83.3	...	16.7	...	00.0
I	April 15	2	Available	4	4	4	4	...
			Consumed	3	3	2	1	...
			Percent	75.0	75.0	50.0	25.0	...

Table 3.--Number of each size of trout consumed by six captive Common Mergansers from 25 trout (five of each size) available for each merganser for 24 hours, 1963

Merganser number	Size (inches)				
	3.9-4.2	4.9-5.2	5.9-6.2	6.9-7.2	7.9-8.2
			Series No. 1 (March 13)		
III	3	5	5	4	0
IV	5	5	1	1	0
V	3	3	1	1	0
VI	0	1	3	2	1
VII	5	4	3	0	0
VIII	4	2	3	1	0
Total	20	20	16	9	1
Percent consumed	66.7	66.7	53.3	30.0	3.3
			Series No. 2 (March 19)		
III	0	0	0	1	3
IV	3	3	4	3	0
V	1	3	3	1	0
VI	3	1	1	2	2
VII	5	5	5	3	0
VIII	4	5	2	1	0
Total	16	17	15	11	5
Percent consumed	53.3	56.7	50.0	36.7	16.7
			Series No. 1 and 2 combined		
Total	36	37	31	20	6
Percent consumed	60.0	61.7	51.7	33.3	10.0

Table 4.--Largest size of trout which Common Merganser I was able to consume in captivity, 1962

Date	Size of trout (inches)		Species and condition of trout	Able to consume	Remarks
	Length	Girth			
Mar. 12	8.5	3.5	Brook, dead	Yes	Consumed immediately
	9.5	4.5	Brook, dead	Yes	Consumed one hour after smaller fish above
Mar. 15	9.0	5.0	Brook, dead	Yes	Consumed immediately
Mar. 16	9.4	4.8	Brook, live	Yes	Three hours to reduce fish to helplessness then consumed
April 17	10.0	4.2	Lake, dead	Yes	Three attempts to swallow fish; after swallowed caudal fin visible for ten minutes
Mar. 14	9.6	5.5	Brook, dead	No	Unable to consume in 24 hours
Mar. 27	10.8	6.0	Brook, live	No	Unable to consume in 24 hours

Table 5.--Largest size of trout which six captive Common Mergansers were able to consume, 1963

Merganser Number	Merganser Weight at capture (ounces)	Date of test	Species of trout		Size of trout (inches) 1	2	3	4	Order consumed or killed[1]
III	60.0	Mar. 18-20	Rainbow	Length	8.5	9.2	9.8	10.0	3, 2, 1, 4
				Girth	4.5	5.1	5.2	5.3	
		Mar. 20-21	Rainbow	Length	8.5	9.5	9.2	9.9	1, 2, 3, 4
				Girth	4.5	4.8	4.9	5.6	
		Mar. 25-28	Brook	Length	10.3	10.7	10.7	11.0	1, 2, 3, 4*
				Girth	5.6	5.7	6.2	6.5	
IV	51.5	Mar. 19-21	Rainbow	Length	8.9	9.0	9.2	9.2	1, 2, ...,*...*
				Girth	4.5	4.9	5.0	5.0	
		Mar. 25-27	Brook	Length	8.7	8.6	7.3	10.0	1, 2, ...,*...*
				Girth	4.5	4.6	5.1	5.5	
V	44.0	Mar. 27-31	Rainbow	Length	9.0	8.5	9.7	9.8	2, 3, 1, 4*
				Girth	4.1	4.5	4.8	5.3	
		April 4-7	Rainbow	Length	8.9	9.0	9.9	10.0	2, 1, 3, 4*
				Girth	4.8	4.9	5.2	5.4	
VI	37.5	Mar. 29-31	Rainbow	Length	8.5	8.9	9.8	9.6	1, 2, 3*, 4*
				Girth	4.7	4.9	5.2	5.5	
		April 11-12	Rainbow	Length	9.7	9.4	9.3	10.0	1, 3*, 2*, 4*
				Girth	5.0	5.1	5.2	5.4	
VII	34.0	April 1-3	Rainbow	Length	8.6	8.5	9.0	8.0	1*, 2*, 3*, 4*
				Girth	4.2	4.5	4.7	5.0	
		April 3-5	Rainbow	Length	7.3	7.9	8.8	8.8	1, 2, 3, 4*
				Girth	3.6	4.4	4.6	4.8	
		April 8-10	Rainbow	Length	9.0	9.1	9.6	9.8	1*, 3*, 2*, 4*
				Girth	4.6	4.7	4.9	5.1	

(continued next page)

Table 5.--continued

Merganser Number	Merganser Weight at capture (ounces)	Date of test	Species of trout		Size of trout (inches) 1	2	3	4	Order consumed or killed[1]
VIII	33.0	April 1-4	Rainbow	Length	8.4	9.2	8.8	10.0	1, 3*, 2, 4*
				Girth	4.3	4.5	4.7	5.0	
		April 8-11	Rainbow	Length	9.0	8.7	9.7	9.4	1*, 2*, 4, 3*
				Girth	4.5	4.6	4.9	5.0	

[1] Trout killed but not consumed are marked with an asterisk.

Table 6.--Number of each species of fish consumed by captive Common Mergansers from 30 fish (ten of each species) available for each merganser for 24 hours, 1963

Merganser number	Mottled sculpin		Creek chub		Brook trout	
	Size available (inches)	Number consumed	Size available (inches)	Number consumed	Size available (inches)	Number consumed
			Series No. 1 (March 3)			
III	3.8-4.0	4	3.8-4.0	10	4.2-4.5	9
IV	3.5-3.7	2	3.8-4.0	3[1]	4.0-4.2	9
V	3.2-3.5	3	3.7-3.9	7	3.9-4.0	3
Total consumed		9		20		21
Percent consumed		30.0		66.7		70.0
			Series No. 2 (March 9-11)			
III	3.8-4.0	0	4.0-4.2	10	4.0-4.2	9
V	3.5-3.7	9	3.7-3.9	8	3.8-4.0	5
VII	3.8-4.0	10	3.8-4.0	10	4.0-4.2	10
Total consumed		19		28		24
Percent consumed		63.3		93.3		80.0
			Series No. 1 and 2 combined			
Total consumed		28		48		45
Percent consumed		46.7		80.0		75.0

[1] Seven killed but not eaten.

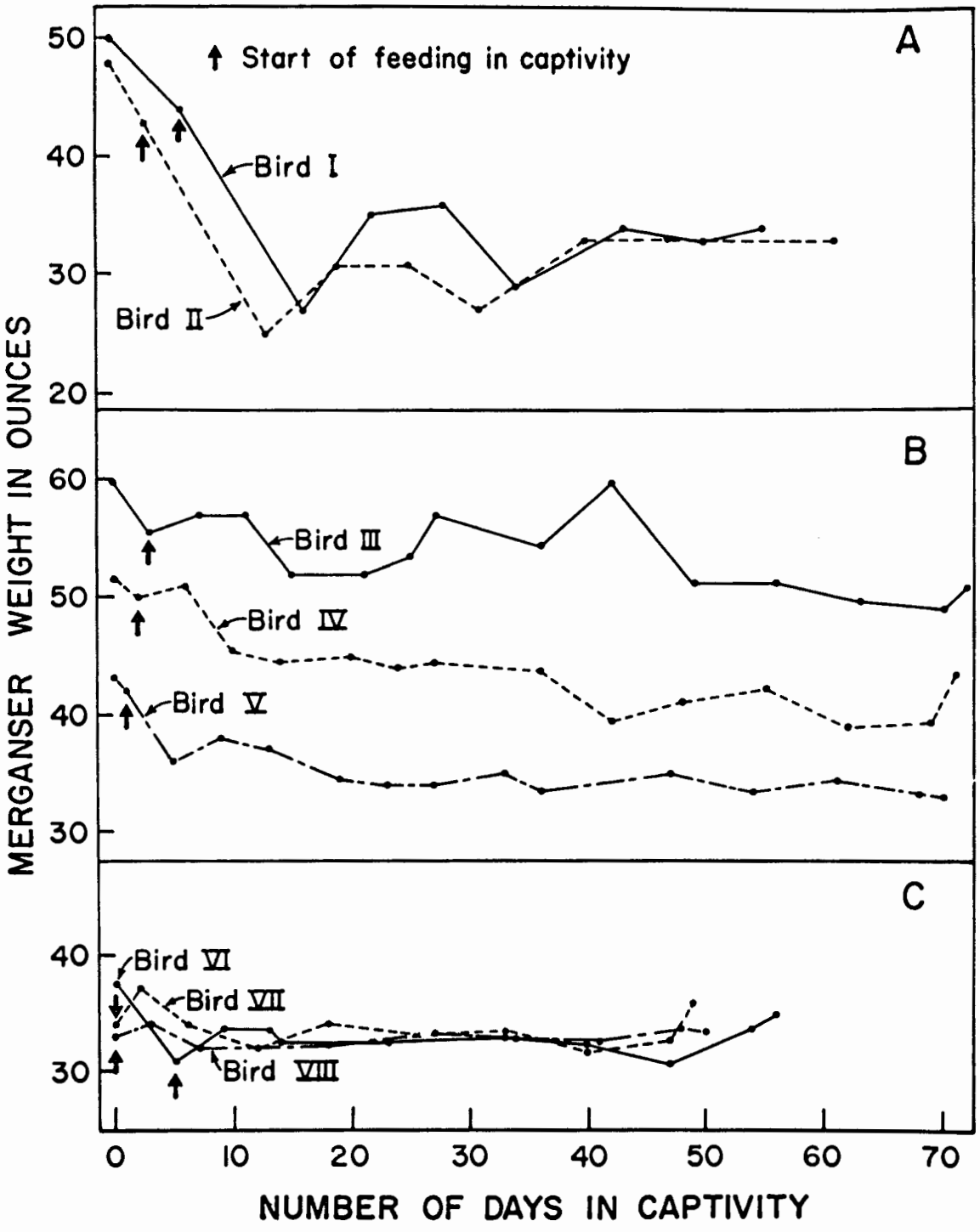

Figure 1. --Weight gain or loss of Common Mergansers which were fed while held in captivity. A (upper) -- two adults held in 1962; B (middle) -- three adults held in 1963; C (lower) -- three immature birds held in 1963.