USE OF VIRGINIA'S TRIBUTARIES OF THE POTOMAC RIVER BY ANADROMOUS FISHES

by

Michael C. Odom

Richard J. Neves

John J. Ney

USE OF VIRGINIA'S TRIBUTARIES OF THE POTOMAC RIVER BY ANADROMOUS FISHES

Final Report

for Phase Four of an Analysis of the Impediments to Spawning Migrations of Anadromous Fish in Virginia Rivers

Prepared by:

Michael C. Odom
Richard J. Neves
John J. Ney

Department of Fisheries and Wildlife Sciences
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Sponsored by:

Virginia Transportation Research Council
Virginia Department of Transportation

October 1988

Abstract

The use of Virginia's tributaries of the lower Potomac River (downstream of Great Falls) by striped bass, American shad, hickory shad, and river herring (a collective term for alewife and blueback herring) was determined by reviewing literature, consulting knowledgeable agency personnel, and interviewing local fishermen and landowners. Barriers to upstream movement were identified for each tributary, and all highway crossings were evaluated for their impact on spawning migrations.

A total of 148 tributaries in the lower Potomac River downstream of Great Falls were identified from topographic maps as potential spawning streams. Of these, 40 are confirmed as spawning streams, 83 are deemed probable spawning streams, and 25 are unlikely candidates. Identified barriers to upstream movement on these 148 streams are as follows: 10 are open their entire length, 116 have natural impediments, 6 have highway crossing barriers, and 16 have other anthropogenic structures. Descriptions of the six highway crossings are presented in the text.

Table of Contents

List of Illustrations

List of Tables

INTRODUCTION

Striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), alewife (*A. pseudoharengus*), and blueback herring (*A. aestivalis*) are anadromous fishes that ascend Virginia's rivers each spring to spawn in freshwater. These five species have historically provided a rich resource to Virginia's sport and commercial fishermen (Figure 1); however, the harvest of each has declined to record low levels in recent years (Atran et al. 1983, Hart 1987). Probable causes of this decline include habitat degradation, overfishing, and reduced access to historical spawning sites. Concern for these species has prompted efforts to reduce harvest, improve water quality, and restore access to ancestral spawning areas.

Anadromous fishes historically ascended the Potomac River as far upstream as Great Falls, approximately 16 miles upstream of Washington, D.C. Presently, the upper limit of anadromous fish spawning migrations in the Potomac River is Little Falls Dam, approximately 8.5 miles downstream of their historic limit. An existing fishway at this dam has failed to provide upstream passage for anadromous species, and recent modifications to the dam face have provided only limited (if any) passage for fish. Capture of a striped bass at Great Falls within the last two years may indicate limited upstream fish passage at Little Falls (or possible downstream movement of a landlocked individual from an upstream impoundment). Anadromous fish restoration efforts in the Potomac River basin include providing fish passage facilities at barriers to upstream migrations, and giving fish access to historic spawning grounds. Currently, a more efficient fishway is being considered for Little Falls Dam.

Highway crossings have the potential to obstruct upstream movements of anadromous fish by altering stream width, depth, velocity, and gradient, especially on smaller tributaries where culverts are typically used instead of bridges. This multiphase study was designed to provide an evaluation of the occurrence and significance of highway impediments to the migration of

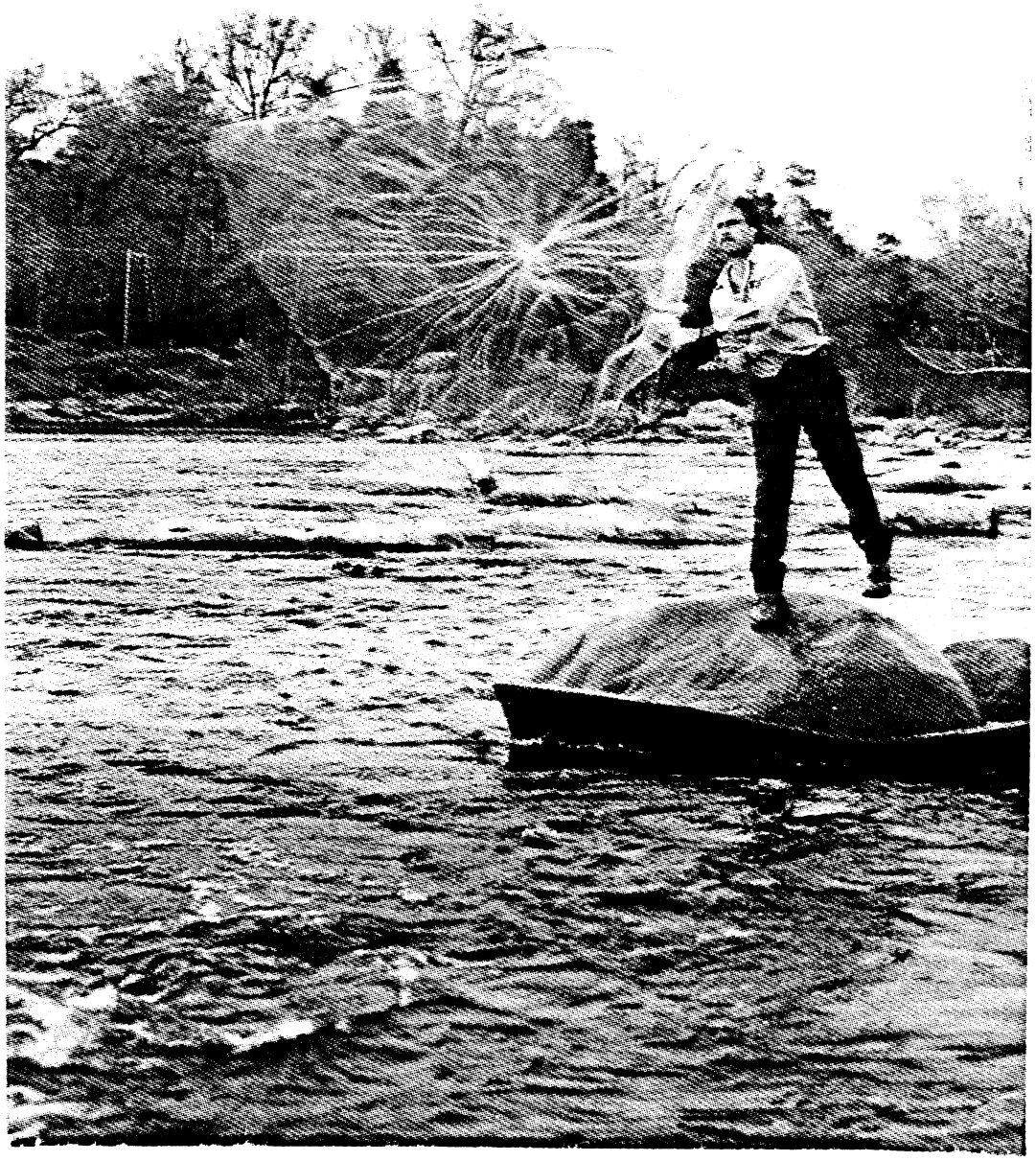


Figure 1. Fishing for hickory shad and blueback herring with a cast net on the Rappahannock River, Fredericksburg, Virginia.

anadromous fish in Virginia's streams, now and in the future. Phase I of this study developed an overview of the issue (Mudre et al. 1985). Phase II examined the use of tributaries of the lower James River (downstream of Richmond) by anadromous fishes, identified barriers to spawning migrations, and evaluated highway crossings with respect to their impact on spawning migrations (Odom et al. 1986). Phase III estimated the potential range of anadromous fishes on tributaries of the James River between Richmond and Lynchburg by identifying natural and man-made barriers to upstream migrations, and evaluated highway crossings with respect to their potential to impede upstream migrations (Odom et al. 1988). The James River upstream of Richmond is currently inaccessible to migrating anadromous fish due to a series of impassable dams. However, breaching and/or construction of fish passage facilities at these dams is possible in the near future, providing fish access to historical spawning grounds blocked since colonial days. The objectives of Phase IV are: 1) to determine the present and potential extent of upstream migrations of striped bass and the four alosine species (American shad, hickory shad, alewife, and blueback herring) in Virginia's tributaries of the lower Potomac River, downstream of Great Falls (the historic upstream limit of anadromous fish runs in the Potomac River); 2) to identify natural barriers and dams which restrict spawning migrations on these streams; 3) to inspect highway crossing sites on these tributaries downstream of the barriers and evaluate their potential to impede upstream movement; and 4) to update the Phase I state-of-knowledge synthesis of factors which limit instream migrations of striped bass and the four alosine species.

METHODS

A literature search was conducted to locate references to historic and present distributions of anadromous fishes in Virginia's tributaries of the lower Potomac River. Various agencies responsible for the anadromous fish resource were contacted to determine whether relevant data on anadromous fish usage of lower Potomac River tributaries were available. In addition, fishermen (both sport and commercial), residents, and agency personnel were consulted

regarding their personal knowledge of anadromous fish runs in the streams of interest. The following agencies were consulted: District of Columbia Fisheries Management (within the Department of Consumer and Regulatory Affairs), Maryland Department of Natural Resources (MDNR), National Marine Fisheries Service (NMFS), Potomac River Fisheries Commission (PRFC), Soil Conservation Service (SCS), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Institute of Marine Science (VIMS), Virginia Polytechnic Institute and State University (VPI&SU), and Virginia Water Control Board (VWCB). Tributaries were categorized as 1) confirmed, 2) probable, or 3) unlikely spawning streams for anadromous fish. Confirmed spawning streams are those in which 1) anadromous fish spawning has been documented in the reviewed literature, or 2) knowledgeable agency personnel, residents, and/or fishermen identified as having spawning runs. In addition, those tributaries that did not meet the above criteria, but through which anadromous fish swim in order to reach known spawning tributaries, were also designated as confirmed spawning streams. Probable spawning streams are those not confirmed, but 1) are upstream of, or a tributary of, a confirmed tributary (therefore within the freshwater spawning range of anadromous fish), 2) are accessible to anadromous fish, and 3) have adequate depth for at least river herring (a collective term for alewife and blueback herring) to ascend. Unlikely spawning tributaries are those that 1) appear to be too shallow for even river herring to ascend, 2) have a stream gradient barrier near their mouth (impassable falls), or 3) are too brackish for anadromous fish spawning.

Impediments to spawning migrations of anadromous fish were identified by interviews with knowledgeable agency personnel, residents, and fishermen; inspection of U.S. Geological Survey (USGS) 7.5 minute topographic maps; and field observations. Beaver dams may be effective barriers to anadromous fish migrations, but for the purposes of this report, we did not consider them to be permanent structures. Our estimates of the upstream limits of anadromous fish runs are based on the scenario of no beaver-related obstructions. On many of the streams, there is no well-defined natural barrier, but rather a gradual shallowing of the

stream that eventually stops anadromous fish. In addition, the upstream limits of spawning migrations on these streams may vary between years as a result of variable stream discharge. For many of these streams, we made a subjective estimate of the upstream limit of spawning migrations, based on interviews with knowledgeable residents and fishermen, and assessments of stream gradient and drainage area. Our bias was to err in favor of an overestimate, rather than an underestimate, of the lengths of stream used.

Highway crossings on the sections of all (confirmed, probable, and unlikely) tributaries of the Potomac River that are open to anadromous fish were identified. Each crossing was visited and evaluated for its impact on stream flow, and this information was related to the known swimming abilities and limitations of the anadromous species that use, or may use, the tributary. Parameters of particular relevance included depth, velocity, gradient, and turbulence. Each highway crossing was categorized as 1) passable, 2) impassable, or 3) questionably passable. Sites were visited more than once, as needed. When possible, we consulted with local residents on the success of anadromous fish in negotiating given crossings.

All stream and place names in this text are based on those printed on the USGS 7.5 minute topographic maps. Anastomoses, oxbows, tidal tributaries with little or no free-flowing headwaters, and unnamed freshwater tributaries with small drainage areas (therefore, little discharge) are not addressed in this study. The Potomac River Miles listed in this text were derived by measuring along the center of the main channel printed on USGS 1:250,000 scale topographical maps. Stream mileages for tributaries were taken from USGS 7.5 minute topographical maps, following the main channel as printed. On the few tributaries where no defined stream channel was indicated, stream mileage was measured by following the center of the floodplain.

A literature review of anadromous fish studies on the East Coast since 1984 was conducted by computer searches through the library services at Virginia Tech. Information relevant to upstream migrations of striped bass, American shad, hickory shad, blueback herring and alewives was surveyed, with special attention to fish passage facilities and problems. Relevant publications from the computerized search were obtained and read to supplement the literature synthesis included in Mudre et al. (1985).

RESULTS AND DISCUSSION

Only three publications were located addressing anadromous fish usage of Virginia's tributaries of the Potomac River. Davis et al. (1970) identified the larger tributaries used by spawning alosine species, but failed to address the upstream limits of their migrations. Loesch (1981) provides limited information regarding anadromous fish spawning in Dogue and Pohick Creeks, Fairfax County. The text in Lippson et al. (1979) does not address anadromous fish distributions in Virginia's tributaries of the Potomac River, but this publication includes a map (Folio 8) which displays the range of anadromous fish spawning runs in some of Virginia's larger tributaries. However, none of the references listed for this map provide data to substantiate the displayed ranges of anadromous fish in Virginia's tributaries. Of the agency personnel consulted, few had personal knowledge of the upstream limits of anadromous fish runs in the tributaries of interest. Therefore, knowledgeable residents and fishermen provided the bulk of information on use of tributaries by anadromous fishes and the upstream limits of migrations.

None of the fishermen and local residents that were interviewed knew of anadromous fish spawning runs in tributaries downstream of Potomac Creek (confluence with Potomac River at River Mile 68.9). While densities of spawning adults may not be sufficient to gain the attention of residents and fishermen, tributaries as far downstream as Popes Creek (confluence with Potomac River at River Mile 37.9) had enough spawning activity to be

detected in scientific collections (Davis et al. 1970). All available data indicate that anadromous fish do not utilize any tributaries downstream of Popes Creek for spawning (Davis et al. 1970; William Kriete, VIMS, personal communication). Due to their location near the Chesapeake Bay, and their small drainage areas, tributaries downstream of Popes Creek appear to have salinity levels unsuitable for the spawning of anadromous fishes. Therefore, tributaries downstream of Popes Creek are not discussed further in this report.

A total of 148 tributaries of the Potomac River, between Great Falls and Popes Creek (inclusive), were identified from USGS 7.5 minute topographic maps as being potential spawning streams for anadromous fishes (Table 1). Of these, 40 have been confirmed as spawning streams, 83 were deemed probable spawning streams, and 25 appear to be unlikely candidates for spawning runs. We identified the barriers to upstream movement on these 148 tributaries and the breakdown is as follows: 10 streams were open their entire length, stream morphology formed the impediments on 116 tributaries, highway crossing structures were barriers on five streams, and 17 streams had other miscellaneous anthropogenic barriers (i.e. dams, drop structures, pipeline crossings, etc.). Descriptions of the five problem highway crossings are presented in descending sequence (from upstream to downstream) in the following text.

Giles Run

We were unable to confirm that river herring ascended to the I-95 crossing because of beaver dam blockages downstream. Numerous riffles downstream of this site may prevent fish from reaching this culvert, at least during low water years. However, our estimate of the natural upstream limit (during wet years) for river herring is 0.2 miles upstream of this structure. The three-cell box culvert at this crossing would be impassable to river herring because of the following vertical drops at the outlets (Figure 2): 13 cm for left cell, 17 cm for

Table 1. Virginia's tributaries of the Potomac River Basin that are or may be utilized by spawning anadromous fishes (striped bass, American shad, hickory shad, alewife, and blueback herring), and stream miles available for use. Tributaries are listed in descending order, from upstream to downstream. Tributary: 1 = first order, 2 = second order, 3 = third order, 4 = fourth order. The numbers indicate the distance in miles from the mouth of the tributary to the mouth of the receiving stream. Use: C = usage confirmed, P = usage probable, U = usage unlikely.

#	Stream	Tributary				Use	Upstream obstruction	Length open	Highway crossings
		1	2	3	4				
1	Mine Run Branch	128.1	.	.	.	U	stream morphology	0.0	0
2	Difficult Run	126.5	.	.	.	P	stream morphology	0.3	0
3	Bullneck Run	124.9	.	.	.	U	stream morphology	0.1	0
4	Scott Run	124.3	.	.	.	U	stream morphology	< 0.1	0
5	Dead Run	122.7	.	.	.	U	stream morphology	< 0.1	0
6	Turkey Run	121.8	.	.	.	U	stream morphology	0.1	0
7	Pimmit Run	118.2	.	.	.	C	stream morphology	0.1	0
8	Gulf Branch	117.9	.	.	.	U	stream morphology	0.0	0
9	Donaldson Run	117.5	.	.	.	C (?)	stream morphology	< 0.1	0
10	Windy Run	116.2	.	.	.	U	stream morphology	0.0	0
11	Spout Run	115.6	.	.	.	P	stream morphology	< 0.1	1
12	Roaches Run	111.4	.	.	.	P	none	0.4	1
13	Fourmile Run	109.2	.	.	.	C	drop structure	2.9	5
14	Long Branch	.	2.1	.	.	U	pipeline crossing	0.0	0
15	Hunting Creek	105.7	.	.	.	P	none	1.2	2
16	Cameron Run	.	1.2	.	.	P	drop structure	1.6	2
17	Pike Branch	.	.	1.1	.	U	drop structure	< 0.1	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
18	Taylor Run	.	.	0.8	.	U	drop structure	0.0	0
19	Hooff Run	.	1.2	.	.	U	stream morphology	0.4	1
20	Unnamed tributary	.	0.8	.	.	P	stream morphology	0.4	1
21	Unnamed tributary	104.6	.	.	.	P	concrete channel	1.0	1
22	Unnamed tributary	.	0.5	.	.	P	stream morphology	0.4	0
23	Little Hunting Creek	98.3	.	.	.	C	stream morphology	2.7	2
24	North Branch	.	1.7	.	.	P	stream morphology	1.3	1
25	Unnamed tributary	.	.	0.9	.	P	stream morphology	0.2	1
26	Unnamed tributary	.	0.4	.	.	P	stream morphology	0.3	1
27	Dogue Creek	96.5	.	.	.	C	stream morphology	5.4	3
28	Unnamed tributary	.	3.6	.	.	P	stream morphology	0.6	0
29	Unnamed tributary	.	3.0	.	.	U	stream morphology	< 0.1	0
30	Unnamed tributary	.	2.0	.	.	C	stream morphology	1.0	2
31	Unnamed tributary	.	.	0.7	.	C	stream morphology	0.3	0
32	Gunston Cove	94.5	.	.	.	C	none	2.0	0
33	Accotink Bay	.	2.0	.	.	C	none	1.1	0
34	Accotink Creek	.	.	1.1	.	C	Lake Accotink Dam	11.6	7
35	Unnamed tributary	.	.	.	10.2	U	stream morphology	< 0.1	0
36	Calamo Branch	.	.	.	9.0	U	stream morphology	< 0.1	0
37	Unnamed tributary	.	.	.	8.7	U	stream morphology	< 0.1	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
38	Field Lark Branch	.	.	.	6.2	U	stream morphology	0.0	0
39	Long Branch	.	.	.	3.4	P	stream morphology	0.6	2
40	Unnamed tributary	.	.	.	2.8	U	stream morphology	< 0.1	0
41	Mason Run	.	.	.	1.0	P	pipeline crossing	< 0.1	0
42	Pohick Bay	.	2.0	.	.	C	none	1.5	0
43	Pohick Creek	.	.	1.5	.	C	stream morphology	4.8	5
44	South Run	.	.	.	3.7	P	stream morphology	0.3	0
45	Unnamed tributary	.	.	.	1.6	P	stream morphology	0.1	0
46	Unnamed tributary	90.0	.	.	.	P	stream morphology	0.8	0
47	Occoquan Bay	87.0	.	.	.	C	none	2.3	0
48	Belmont Bay	.	2.3	.	.	C	none	2.5	0
49	Occoquan River	.	.	2.5	.	C	Occoquan Pumping Dam	2.8	3
50	Little Occoquan Run	.	.	.	2.5	U	stream morphology	< 0.1	0
51	Unnamed tributary	.	.	.	1.7	P	stream morphology	0.2	0
52	Unnamed tributary	.	.	.	1.0	P	stream morphology	0.2	0
53	Unnamed tributary	.	.	.	0.9	P	stream morphology	0.3	0
54	Massey Creek	.	.	2.2	.	C	none	1.1	0
55	South Branch	.	.	.	1.1	P	stream morphology	0.1	0
56	Giles Run	.	.	.	1.1	C	highway culvert	2.0	3
57	Unnamed tributary	.	.	1.0	.	P	stream morphology	0.7	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
58	Kanes Creek	.	.	1.0	.	C	stream morphology	1.5	0
59	Unnamed tributary	.	.	.	1.3	P	stream morphology	0.1	0
60	Unnamed tributary	.	.	.	0.8	P	stream morphology	0.6	0
61	Unnamed tributary	.	1.9	.	.	C	stream morphology	1.1	0
62	Marumsco Creek	.	1.7	.	.	C	stream morphology	1.6	0
63	Unnamed tributary	.	.	0.6	.	P	stream morphology	0.2	0
64	Farm Creek	.	0.6	.	.	P	stream morphology	1.0	0
65	Neabsco Creek	.	0.0	.	.	C	stream morphology	6.2	2
66	Unnamed tribuary	.	.	4.5	.	P	stream morphology	0.1	0
67	Unnamed tribuary	.	.	4.2	.	P	stream morphology	0.1	0
68	Unnamed tribuary	.	.	1.2	.	P	pipeline crossing	0.7	2
69	Powells Creek	84.6	.	.	.	C	unnamed dam	6.9	4
70	Unnamed tributary	.	1.4	.	.	P	stream morphology	0.2	0
71	Quantico Creek	81.2	.	.	.	C	stream morphology	5.6	4
72	Unnamed tributary	.	5.3	.	.	U	stream morphology	< 0.1	0
73	Unnamed tributary	.	3.7	.	.	P	stream morphology	0.1	0
74	Unnamed tributary	.	3.5	.	.	C	highway culvert	0.2	1
75	Unnamed tributary	.	2.5	.	.	P	stream morphology	< 0.1	1
76	Unnamed tributary	.	1.9	.	.	P	stream morphology	0.2	1
77	Little Creek	.	0.4	.	.	P	stream morphology	0.7	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
78	Chopawamsic Creek	78.5	.	.	.	C	U.S. Marine Corps ford	4.6	2
79	Unnamed tributary	.	3.6	.	.	P	stream morphology	0.1	0
80	Unnamed tributary	.	2.9	.	.	P	stream morphology	0.1	0
81	Unnamed tributary	.	2.6	.	.	P	stream morphology	0.5	0
82	Unnamed tributary	.	2.5	.	.	P	stream morphology	0.3	0
83	Unnamed tributary	.	2.2	.	.	P	stream morphology	< 0.1	0
84	Unnamed tributary	.	1.9	.	.	P	stream morphology	< 0.1	0
85	Unnamed tributary	.	0.3	.	.	P	stream morphology	0.3	0
86	Tank Creek	77.3	.	.	.	P	stream morphology	0.2	0
87	Unnamed tributary	76.3	.	.	.	C	stream morphology	0.7	1
88	Aquia Creek	71.8	.	.	.	C	Aquia Creek Dam	11.7	2
89	Austin Run	.	6.9	.	.	C	stream morphology	1.7	2
90	Unnamed tributary	.	.	1.5	.	P	stream morphology	0.2	0
91	Unnamed tributary	.	.	1.5	.	U	stream morphology	< 0.1	0
92	Unnamed tributary	.	4.8	.	.	P	stream morphology	0.2	0
93	Unnamed tributary	.	3.7	.	.	P	stream morphology	0.6	0
94	Boars Creek	.	3.4	.	.	P	stream morphology	0.8	0
95	Potomac Creek	68.9	.	.	.	C	Abel Lake Dam	13.2	5
96	Unnamed tributary	.	11.7	.	.	P	stream morphology	0.2	0
97	Unnamed tributary	.	10.1	.	.	P	stream morphology	0.2	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
98	Unnamed tributary	.	9.7	.	.	P	stream morphology	0.1	0
99	Unnamed tributary	.	8.4	.	.	U	stream morphology	< 0.1	0
100	Unnamed tributary	.	7.9	.	.	P	stream morphology	0.2	0
101	Unnamed tributary	.	7.7	.	.	U	stream morphology	< 0.1	0
102	Unnamed tributary	.	7.2	.	.	P	stream morphology	0.4	0
103	Unnamed tributary	.	6.6	.	.	P	stream morphology	0.3	0
104	Unnamed tributary	.	5.8	.	.	C	stream morphology	0.7	0
105	Unnamed tributary	.	5.0	.	.	P	stream morphology	0.6	0
106	Unnamed tributary	.	4.9	.	.	P	stream morphology	0.2	0
107	Beaverdam Run	.	2.3	.	.	P	stream morphology	1.2	0
108	Black Swamp Branch	.	2.1	.	.	C	stream morphology	0.9	0
109	Accokeek Creek	.	1.0	.	.	C	stream morphology	8.0	2
110	Unnamed tributary	.	.	7.9	.	U	stream morphology	< 0.1	0
111	Unnamed tributary	68.6	.	.	.	P	stream morphology	0.2	0
112	Passapatanzy Creek	68.2	.	.	.	P	stream morphology	2.2	0
113	Dirt Bridge Run	.	0.5	.	.	P	stream morphology	1.2	0
114	Unnamed tributary	67.5	.	.	.	U	stream morphology	0.1	0
115	Unnamed tributary	66.5	.	.	.	U	stream morphology	0.1	0
116	Unnamed tributary	63.9	.	.	.	P	stream morphology	0.7	0
117	Unnamed tributary	.	0.4	.	.	P	stream morphology	0.2	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
118	Chotank Creek	58.8	.	.	.	C	stream morphology	3.7	0
119	Unnamed tributary	.	2.0	.	.	P	stream morphology	0.6	0
120	Unnamed tributary	.	1.3	.	.	P	stream morphology	0.4	0
121	Gambo Creek	48.0	.	.	.	C	highway culvert	3.5	1
122	Unnamed tributary	.	0.9	.	.	P	stream morphology	1.0	0
123	Upper Machodoc Creek	47.3	.	.	.	C	stream morphology	15.4	4
124	Pepper Mill Creek	.	11.3	.	.	P	stream morphology	6.3	2
125	Unnamed tributary	.	.	5.6	.	P	stream morphology	0.1	0
126	Unnamed tributary	.	.	3.9	.	P	stream morphology	0.2	0
127	Unnamed tributary	.	10.6	.	.	P	stream morphology	0.2	0
128	Poplar Neck Creek	.	6.8	.	.	P	highway culvert	0.8	1
129	Deep Creek	.	2.0	.	.	P	stream morphology	0.6	1
130	Williams Creek	.	1.6	.	.	P	stream morphology	2.8	2
131	Unnamed tributary	.	.	1.4	.	P	stream morphology	0.6	0
132	Black Marsh	46.6	.	.	.	P	stream morphology	0.8	0
133	Rosier Creek	44.7	.	.	.	C	none	3.2	0
134	Pine Hill Creek	.	3.2	.	.	P	unnamed dam	2.4	1
135	Unnamed tributary	.	3.2	.	.	P	stream morphology	0.4	1
136	Goldman Creek	44.7	.	.	.	P	stream morphology	1.0	1
137	Monroe Bay	41.6	.	.	.	C	none	1.6	0

Table 1. (Continued)

#	Stream	Tributary 1	Tributary 2	Tributary 3	Tributary 4	Use	Upstream obstruction	Length open	Highway crossings
138	Monroe Creek	.	1.6	.	.	C	highway culvert	3.0	2
139	Mattox Creek	40.5	.	.	.	C	stream morphology	9.6	3
140	Kings Mill Creek	.	9.0	.	.	P	stream morphology	0.5	0
141	Unnamed tributary	.	7.4	.	.	P	stream morphology	0.5	0
142	Unnamed tributary	.	5.3	.	.	P	stream morphology	0.3	0
143	Unnamed tributary	.	4.4	.	.	P	stream morphology	1.5	0
144	Unnamed tributary	.	3.4	.	.	P	stream morphology	0.2	0
145	Bridges Creek	39.5	.	.	.	P	unnamed dam	1.3	0
146	Popes Creek	37.9	.	.	.	C	unnamed dam	3.5	0
147	Morris Run	.	2.9	.	.	P	stream morphology	0.1	0
148	Canal Swamp	.	1.7	.	.	P	stream morphology	1.2	1

Figure 2. Outlet of I-95 culvert on Giles Run showing vertical drop into settling basin.

center cell, and 20 cm for right cell (measured 22 March 1988). In addition, water depths (3-4 cm) in all 3 cells were inadequate for river herring to swim through on the date of evaluation. Water velocities in the cells ranged from 30 to 40 cm/s and was relatively uniform throughout the 150 m length of each cell. Because of the uncertainty of river herring migration to this site, corrective modifications of this structure are deemed unnecessary at present. If and when river herring re-enter Giles Run, upstream migrations should be monitored to determine whether the I-95 culvert is reached and serves as a barrier to their upstream migration.

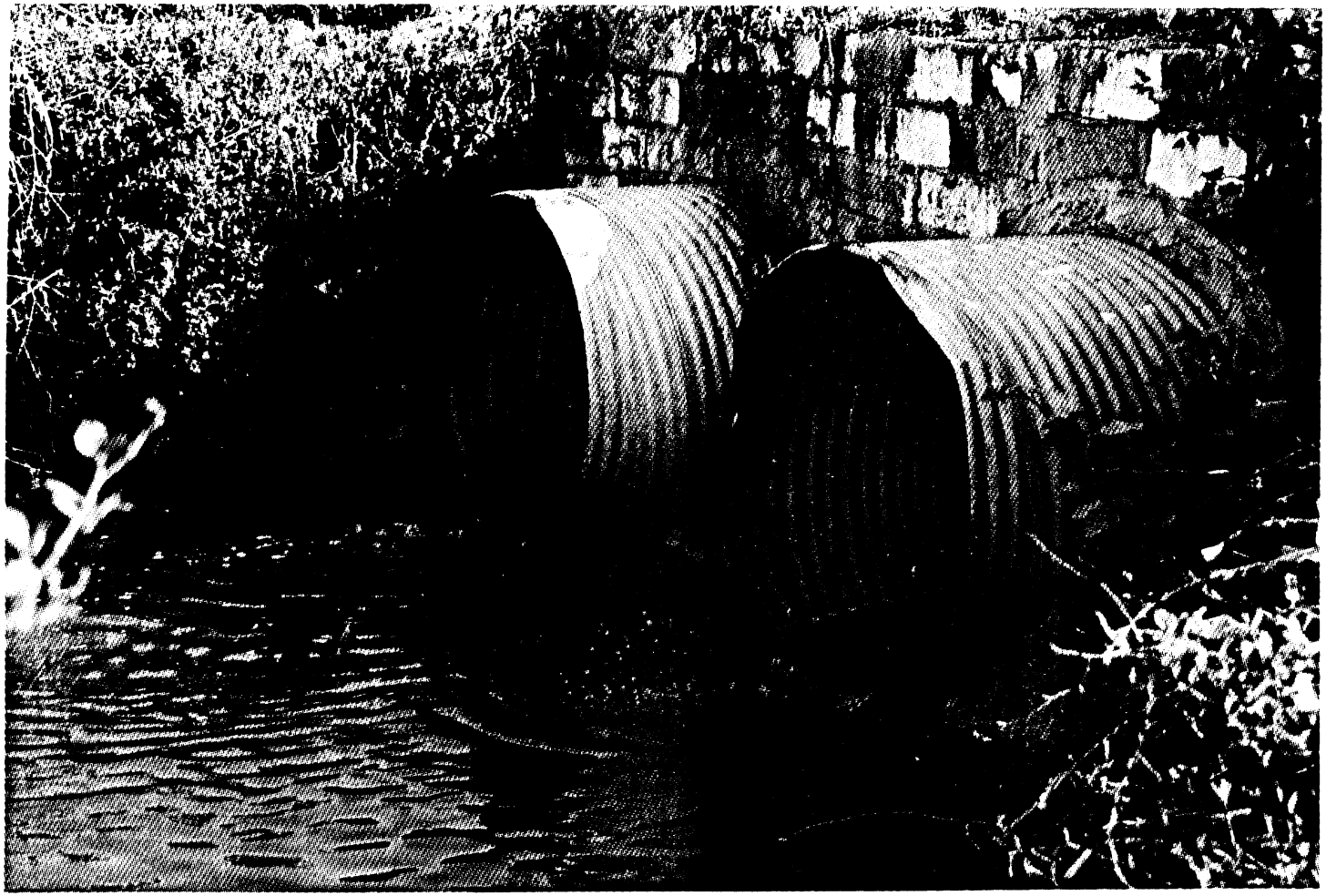
Powells Creek

The maximum distance upstream that river herring could travel was postulated to be an unnamed dam approximately 50 m above the Route 1451 crossing, at stream mile 6.9. If river herring could reach the three-cell box culvert at this crossing, they may be unable to proceed through this structure because of shallow water depths. On the date of evaluation, discharge was low and insufficient to allow passage. Most of the discharge passed through the right descending cell; upper 65 m had a water depth of 4-6 cm, and lower 20 m had a maximum depth of 16 cm at the outlet. Because stream discharge passes through all three cells, high discharge would be required to provide adequate depth for river herring to negotiate the right cell. This structure is therefore considered questionably passable, although a re-evaluation during higher base flows is needed.

Unnamed Tributary of Quantico Creek

The Route 633 crossing over this tributary to Quantico Creek consists of two corrugated metal pipes that are impassable to river herring because of vertical drops at the outlets and shallow water within the pipes (Figure 3). When evaluated on 25 April 1988, a beaver dam

Figure 3. Outlet of Route 633 culvert on an unnamed tributary of Quantico Creek with a 5 cm vertical drop into settling basin.



downstream was impounding water immediately below the outlet of this culvert. Subsequent visits at several tidal stages indicated that high tide does not elevate water level enough to inundate the outlet of this culvert. If the beaver dam below this crossing was removed, the vertical drop at the outlets would be greater than that recorded. Because of this culvert impediment, river herring previously concentrated below the outlet prior to beaver dam construction downstream. This location was a productive spot for dip netters of river herring in previous years.

Gambo Creek

Davis et al. (1970) reported that alosids spawn in Gambo Creek, but none of the local residents and fishermen that we interviewed were aware of anadromous fish spawning runs in this stream. The U.S. 301 crossing over this creek consists of a two-cell box culvert, immediately upstream of normal tidal influence. River herring could ascend the U.S. Navy culvert immediately downstream of this crossing during high tide only; the Navy culvert is impassable at other tidal stages because of shallow water. At high tide on 12 April 1988, water depth in the U.S. 301 culvert was roughly 5 cm at the inlet, gradually increasing to a depth of about 25 cm at the outlet. It appears that normal high tides do not increase water depths sufficiently to permit river herring to pass through the upstream end of the culvert. Unusually high tides may increase water depth throughout the culvert and allow fish to negotiate this crossing. To adequately assess this site, river herring usage of this tributary should be monitored to determine whether this culvert is definitely a blockage to upstream migrations. Any modification of the existing structure should await such an assessment. On the date of evaluation, a beaver dam was present at the inlet to the culvert, further impeding migratory fish.

Poplar Neck Creek

The Route 617 crossing over this creek is a one-cell box culvert about 3 m in diameter (Figure 4). It appears that river herring should be able to ascend up to this culvert (although none of the local residents and fishermen that we interviewed have observed river herring at this location). When visited on 21 April 1988, this culvert had inadequate water depth for the passage of fish. In addition, there was an impassable beaver dam (roughly 2 m in height) at the culvert inlet. If this culvert were modified to provide suitable depth, and in the absence of beaver dams, river herring could ascend an additional 0.3 mile upstream to stream mile 1.1, the estimated upstream limit for river herring. Riffles and shallow shoals would prevent fish from ascending beyond this point under most flow conditions.

Monroe Creek

Alosids were reported to use this creek for spawning, although local residents were unaware of recent spawning runs. The Route 658 crossing over this creek consists of five corrugated metal pipes (Figure 5). When evaluated on 21 April 1988, stream discharge was low. It appears that river herring could ascend as far upstream as this crossing with adequate discharge. When visited, four of the five pipes in this new culvert had flow through them. The three right descending pipes had small vertical drops at their outlets. The two left descending pipes had no vertical drops at their outlets, but water depths within them were too shallow for fish passage. Inlets of the left pipes had water depths of 19 cm and velocities of roughly 30 cm/s; however, depth decreased to 6 cm and velocities increased to about 1.5 m/s at the outlets of these inclined pipes. It appears unlikely that most fish would negotiate this crossing at higher flows because of gradient and pipe locations. If this structure was modified for upstream passage, river herring may ascend an additional 0.6 mile upstream. Monitoring of

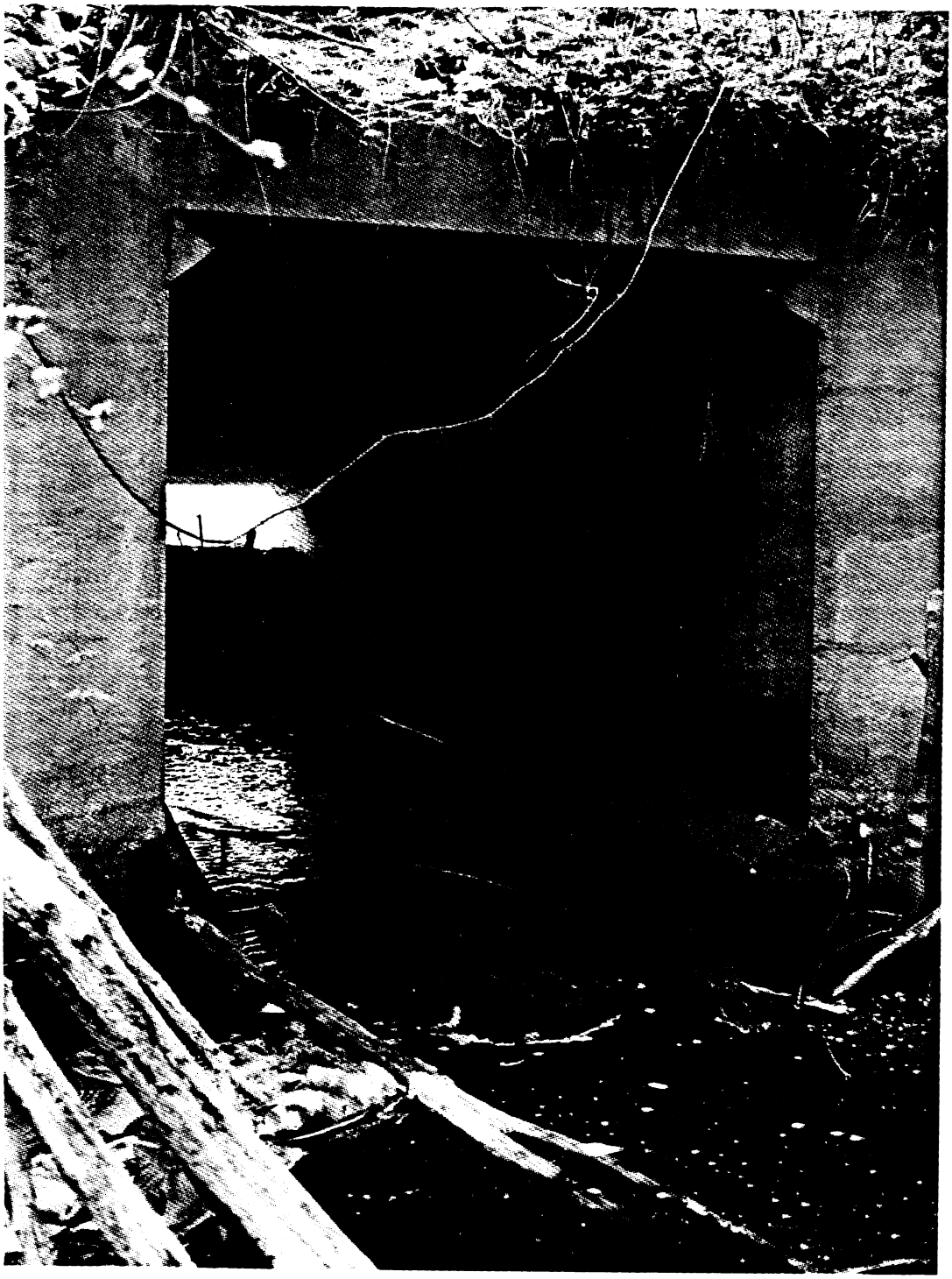


Figure 4. Outlet of Route 617 culvert on Poplar Neck Creek. Shallow water in cell and beaver dam effectively block fish movements.

Figure 5. Outlet of Route 658 culvert on Monroe Creek showing shallow water and vertical drops in pipes.

this stream is required to determine whether alosids presently use this stream before any modifications are warranted.

SUMMARY

Any spawning of striped bass and American shad appears to occur in the mainstem Potomac River in Virginia. Hickory shad appear to spawn in the Occoquan River, as well as in the mainstem Potomac River. All spawning by river herring reportedly occurs upstream of Pope Creek at Potomac River Mile 37.9. Lack of sufficient attractant freshwater flow and salinity levels probably account for the unsuitability of downstream tributaries. Of the 148 tributaries of the Potomac River between Great Falls (upstream barrier) and Pope Creek, 40 were confirmed spawning streams, 83 were probable spawning streams, and 25 were unlikely spawning streams.

Highway structures do not impede striped bass, American shad or hickory shad spawning runs because these species spawn in large tributaries which are usually crossed by bridges. However, river herring ascend smaller tributaries, and 5 of the 90 road crossings evaluated appear to be impassable to river herring. All but one (Monroe Creek) of these impassable crossings approach the natural upstream limit for spawning migrations, and corrective modifications would result in limited additional spawning habitat because of beaver dams and other obstructions. Modification of the Route 658 crossing on Monroe Creek could add 0.6 mile of spawning habitat, but we did not confirm the existence of alosid runs reported by Davis et al. (1970). Monitoring of this and other potential problem sites during the spawning season is required to resolve perceived impacts.

LITERATURE REVIEW

The literature search for studies of migration of striped bass and *Alosa* spp. yielded few recent studies pertinent to this project. As in the previous computerized search, studies relating to salmonids were most common (Tilsworth and Travis 1987), followed by those on American shad (Provost et al. 1984, Slatick and Basham 1985, Barry and Kynard 1986, Witherell 1987). Only one study on striped bass presented data relating migration of subadults to river temperatures, but these movements were unrelated to spawning runs (Kynard and Warner 1987). A synopsis of relevant information on alosids is presented below.

American shad migrate up the Columbia River past many hydroelectric dams and are capable of negotiating Denil fishways constructed for salmonids. Shad can pass through these fishways that are up to 20 m in length, inclined at slopes of up to 28% (Slatick and Basham 1985). In the Ottawa River, Canada, navigation locks are advantageous to shad because they are readily used by upstream migrants to bypass major obstructions such as Carillon Dam (Provost et al. 1984). Problems of shad passage at dams typically result from insufficient attractant discharge and turbulence (Barry and Kynard 1986). Because American shad orient to current and are attracted to strong stream flow, their upstream movements occur in larger systems with sufficient discharge. Witherell (1987) showed that they typically travel in the lower half of the water column, with no diel, seasonal, or yearly changes in depth distribution in the Connecticut River, Massachusetts. Conversely, blueback herring were caught in midwater during their riverine migration (Witherell 1987). It appears, therefore, that both shad and bluebacks orient in the water column with respect to surface and bottom and not to specific current velocities. Velocities of 2 m/s will not inhibit upstream movement of American shad (Kynard and Warner 1986), which can swim against flows of up to 3.3 m/s for short distances (Weaver 1965).

Alewives, observed a few hundred meters below a pool-weir fishway in New Brunswick in late May, did not enter the fishway until mid-June when the spring freshet subsided (Martin 1987). Water temperatures at the start of the run (18.5°C) were considerably higher than upstream migrations in other Canadian rivers. On the downstream migration, a bypass sluice worked well to allow alewives to proceed over the dam. It appears that water flow is extremely important in stimulating both upstream and downstream movements of this species (Martin 1984, 1987).

The only other publication worthy of inclusion in this literature review was provided by the Province of Nova Scotia in Canada. The staffs of the Canada Department of Fisheries and Oceans, Nova Scotia Department of the Environment, and Nova Scotia Department of Transportation prepared a readable brochure to describe environmentally sound construction practices in that Province. Recommendations for the proper installment of culverts were extracted and are included in Table 2. These guidelines appear to be appropriate on all culvert projects in streams with anadromous fish in eastern North America.

During the last 3 years, information on the migration and behavior of *Alosa* spp. has been gathered from personal communications with experienced field biologists in various agencies. Because some of these observations are pertinent to this study, they are summarized in the following paragraphs.

Due to the abundance of headwater lakes and ponds in Maine, alewives typically run farther upstream than bluebacks to reach natal spawning grounds (Clem Walton, Maine Department of Marine Resources, personal communication). Consequently, alewives may pass through very shallow areas that discourage bluebacks. Bluebacks spawn in fast water, to include fishways. Mr. Walton has seen bluebacks negotiate shallow areas provided the stream had a sufficient discharge. They will use small tributaries, provided that adequate depth is available.

Table 2. Environmental construction practices for culverts in Nova Scotia.

1. All work shall be conducted in a manner to cause a minimum of siltation and disturbance to the adjacent and downstream area.
2. Install culverts parallel to, and as close as possible, to the original watercourse. Where culverts cannot be installed parallel, downstream banks shall be armoured with material approved by the project engineer.
3. The following uniformly graded stone riprap material shall be used for stream bank revetment unless alternate materials have been approved in writing by the project engineer:

Class 1	
Local velocity up to 10 feet per second	Use 8-18 inch material
Class 2	
Local velocity up to 13 feet per second	Use 12-30 inch material
Class 3	
Local velocity up to 15 feet per second	Use 20-48 inch material

4. Culverts carrying stream flow shall be installed on a uniform slope, with the inlet and outlet positioned 6 to 12 inches below the natural stream bed.
5. Excavation of diversionary channels shall be carried out in the dry from the downstream end.
6. Diversionary channels constructed in erodible or silt forming materials shall be stabilized with protective rock, plastic sheeting or other approved materials before any flow is diverted.
7. The maximum desirable culvert slope is 6 inches per 100 linear feet (0.5%). In cases where this requirement cannot be met, such as when the pipe is laid on the stream gradient; approved pipe arches, arches, interior baffling, or stilling basins shall be installed to maintain adequate depth in flow (minimum 6 inches) and velocity, to ensure proper conditions for fish passage. In no case shall a drop be permitted at the outlet of a culvert.

8. In the case of installations involving multiple culverts, it is recommended that the floor of the fish passage culvert be located 6 to 12 inches lower than the adjacent structures.
9. When more than one culvert is provided at crossing site, fish passage criteria need only be applied to one of the culverts.
10. The angle of culvert approach should be kept to a minimum and it is recommended that 15° be used and a maximum of 25° unless approved additional channel protection is constructed.
11. Inlets and outlets of all culverts shall be stabilized with riprap or other approved materials to the top of the pipe and a minimum of one pipe diameter on each side of the pipe, or pipes in the case of multiple pipe installations.
12. Unless otherwise instructed, rock aprons shall be constructed downstream of the outlets of all culverts to prevent scour of the streambed. Guidelines for the length of apron measured downstream from the end of the culvert and minimum riprap size should be as follows:

Culvert diameter	Length of apron	Average stone size	Apron thickness
Up to 4′	6 pipe dia.	6 inches	12 inches
4′ to 7′	8 pipe dia.	12 inches	18 inches
7′ to 10′	10 pipe dia.	24 inches	30 inches

Waterfalls and shallow water stop the upstream migration of bluebacks in Maryland, as we observed in Virginia (Ron Klauda, Johns Hopkins University, personal communication). River herring do not run upstream when the streams are high and muddy, but this may be related to water temperature rather than discharge or turbidity. Dr. Klauda noted that the shallowest riffles bluebacks negotiated had water about 15 cm deep.

Characteristics of most spawning streams for bluebacks in Maryland include the following: water with constant movement of less than 1.2 m/s, stream width of 4.6 m or greater, high organic content (peat-stained water), and reaches that are 2-3 miles above tidal influence (Jim Mowrer, Maryland Tidewater Administration, personal communication). High flows with silt appear to result in bluebacks moving downstream; they return to spawning grounds as discharge decreases and turbidity declines. Mr. Mowrer has observed bluebacks pass through shallows by laying on their sides, requiring 5-8 cm minimum of depth to do this. They require a minimum depth of 15-25 cm to spawn and prefer a gravel bottom. He also stated that bluebacks can negotiate a 20-cm drop if it is fitted with a shallow slope of 30 degrees or less.

In the Delaware River basin, alewives spawn primarily in the tidal freshwater zone, preferring the more lentic areas (Joe Miller, U.S. Fish and Wildlife Service, personal communication). Bluebacks move into the faster water of tidal tributaries to spawn, and also move upstream in the Delaware River to above tidewater influence. Mr. Miller has observed that spawning runs of bluebacks are greater in streams below rather than above the fall line. Bluebacks run up the non-tidal portion of the Delaware River less than half the distance that American shad do, which is similar to our observations on the Nottoway River.

TRIBUTARY DESCRIPTIONS AND ROAD CROSSING EVALUATIONS

Descriptions of individual tributaries of the lower Potomac River downstream of Great Falls, their usage by spawning anadromous fishes, and evaluations of public road structures that cross them, are presented in the following pages. The streams are listed in descending sequence, from upstream to downstream, and their names correspond to those printed on the U.S. Geological Survey 7.5 minute topographic maps. Similarly, the highway crossings that anadromous fish may encounter on each stream are presented in descending sequence, from upstream to downstream. To give anadromous fish runs the benefit of the doubt on our stream use estimates, upstream limits represent the maximum distance that fish would likely migrate (herein "liberal"). The term "river herring" refers to both alewife and blueback herring. The following are definitions of the terminology used in the tributary descriptions and road crossing evaluations.

USGS topographic quadrangle. This is the name of the U.S. Geological Survey 7.5 minute topographic map that contains the mouth of the tributary.

Tributary of. This is the name of the water body into which the tributary flows.

Miles above mouth. This is the distance from the mouth of the tributary to the mouth of the water body into which it flows.

Use category. This indicates the usage of the tributary by spawning anadromous fish. Tributaries that are known to be used by spawning anadromous fish are designated as "confirmed". Confirmed spawning streams listed by Davis et al. (1970) are denoted with a "D". Streams that knowledgeable agency personnel and/or local residents identified as having

spawning runs are denoted with an "L". Tributaries that the local residents and agency personnel were not familiar with, yet appear to be suitable for spawning anadromous fish (freshwater and adequate depth), are designated as "probable". Confirmation of these tributaries would likely require field observation and sampling. Tributaries that do not appear suitable for spawning anadromous fish (brackish water or inadequate depth) are classified as "unlikely".

Mileage open. This is the estimated length (in miles) of stream open to anadromous fish for spawning.

Migration obstruction. Identified migration obstructions are given here. The term "stream morphology" denotes an actual falls or shallowing of the stream that would impede upstream migration of anadromous fish.

Road crossing. This is the name and/or number of the public road that crosses the tributary. These are listed in descending sequence, from upstream to downstream.

Date evaluated. This is the date when the site measurements and evaluation were made.

Passage status. Each road crossing is categorized as "passable", "impassable", or "questionable", based on the swimming ability of the anadromous species that would ascend the tributary, and the morphometric and hydrologic characteristics of the stream in the immediate vicinity of the highway structure.

Structure type. The type of structure that supports the road as it crosses the tributary is described here. "CMP" denotes corrugated metal pipe. The term "cell" refers to an individual rectangular opening in a box culvert.

Size. This is the approximate size of each pipe or cell in a culvert. The inside diameter is given for pipes, the maximum width for arches, and the height and width are listed for cells.

The cells of most examined box culverts appeared to be square; only one value is given for these.

Vertical drop. This identifies a vertical falls (laminar water flow descending over a ledge) associated with the highway structure that anadromous fish would have to negotiate under the observed flow conditions. The measurement given is the vertical distance between the surface of the water below the falls, and the lip of the structure from where the water falls.

Depth in culvert. This is the minimum water depth of the thalweg (deepest part of the stream channel) in the culvert (or under the bridge) at the time the evaluation was made.

Velocity in culvert. This is the maximum surface water velocity measured in the culvert (or under the bridge) at the time the evaluation was made.

Notes. These are relevant notes about the site, including descriptions of any possible impediments in the stream resulting from the installation of the road crossing. References to left and right are from the standpoint of a descending view (facing downstream).

MINE RUN BRANCH

USGS topographic quadrangle: Vienna, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 128.1

Use category: unlikely **Mileage open:** 0.0

Migration obstruction: stream morphology

Narrative: Due to its small drainage area and the very steep gradient where it cascades into the Potomac River, this small stream was not visited during field work. The gradient at the mouth, as indicated on the USGS topographic map, would prohibit even river herring from ascending this small stream. Therefore, this stream was classified as an unlikely spawning tributary for anadromous fishes.

DIFFICULT RUN

USGS topographic quadrangle: Falls Church, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 126.5

Use category: probable **Mileage open:** 0.3

Migration obstruction: stream morphology

Narrative: It is probable that the lower 0.1 mile of this tributary was once used by river herring for spawning (prior to the installation of Little Falls Dam). At stream mile 0.1, the stream channel splits around an island, and ascending river herring would encounter a series of shallow rapids. It is unlikely that river herring would have migrated much beyond stream mile 0.1 unless the Potomac River was high (impounding water over the shallow rapids) or stream discharge was elevated. In either case, the first of a series of impassable vertical falls would prevent fish from ascending beyond stream mile 0.3. No roads cross the portion of stream that river herring would use.

BULLNECK RUN

USGS topographic quadrangle: Falls Church, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 124.9

Use category: unlikely **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring utilized the lower portion of this small stream for spawning prior to the installation of Little Falls Dam. In the unlikely event that river herring did ascend this tributary, the stream gradient would restrict their usage to the lower 0.1 mile

or less. Due to its small drainage area and the steep gradient not far above its mouth (where it cascades into the Potomac Gorge), this small stream was not visited during field work. No roads cross the portion of stream that river herring would use.

SCOTT RUN

USGS topographic quadrangle: Falls Church, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 124.3

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring utilized the lower portion of this small stream for spawning prior to the installation of Little Falls Dam. In the unlikely event that river herring did ascend this tributary, the stream gradient would restrict their usage to the lower 100 m or less. Due to the steep gradient not far above its mouth (where it cascades into the Potomac Gorge), this stream was not visited during field work. No roads cross the portion of stream that river herring would use.

DEAD RUN

USGS topographic quadrangle: Falls Church, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 122.7

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring utilized the lower portion of this small stream for spawning prior to the installation of Little Falls Dam. In the unlikely event that river herring did ascend this tributary, the stream gradient would restrict their usage to the lower 100 m or less. Due to the steep gradient not far above its mouth (where it cascades into the Potomac Gorge), this stream was not visited during field work. No roads cross the portion of stream that river herring would use.

TURKEY RUN

USGS topographic quadrangle: Falls Church, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 121.8

Use category: unlikely **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring utilized the lower portion of this small stream for spawning prior to the installation of Little Falls Dam. In the unlikely event that river herring did ascend this tributary, the stream gradient would restrict their usage to the lower 0.1 mile or less. Due to its small drainage area and the steep gradient not far above its mouth (where it cascades into the Potomac Gorge), this small stream was not visited during field work. No roads cross the portion of stream that river herring would use.

PIMMIT RUN

USGS topographic quadrangle: Washington West, D.C.-MD.-VA.

Tributary of: Potomac River **Miles above mouth:** 118.2

Use category: confirmed (L) **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: According to Walter Flory (retired from the Law Enforcement Division, VDGIF) and several local fishermen, river herring ascend the lower portion of this tributary to spawn. River herring apparently ascend approximately 100 m or so up to the base of an impassable vertical falls. No roads cross the portion of stream that river herring use.

GULF BRANCH

USGS topographic quadrangle: Washington West, D.C.-MD.-VA.

Tributary of: Potomac River **Miles above mouth:** 117.9

Use category: unlikely **Mileage open:** 0.0

Migration obstruction: stream morphology

Narrative: Due to its small drainage area and the very steep gradient where it cascades into the Potomac River, this small stream was not visited during field work. The gradient at the mouth, as indicated on the USGS topographic map, would likely prohibit even river herring from ascending this small stream. Therefore, this stream was classified as an unlikely spawning tributary for anadromous fishes.

DONALDSON RUN

USGS topographic quadrangle: Washington West, D.C.-MD.-VA.

Tributary of: Potomac River

Miles above mouth: 117.5

Use category: confirmed (?) (L)

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: Two local residents reported observing clupeids ascending the lower 40 meters (or less) of this small tributary. As they failed to capture any specimens, a positive identification was not made; however, they felt certain that the fish they observed were river herring and not gizzard shad (*Dorosoma cepedianum*). The steep gradient not far above the stream mouth prevents fish from ascending farther. No roads cross the portion of stream that river herring would use.

WINDY RUN

USGS topographic quadrangle: Washington West, D.C.-MD.-VA.

Tributary of: Potomac River

Miles above mouth: 116.2

Use category: unlikely

Mileage open: 0.0

Migration obstruction: stream morphology

Narrative: Due to its small drainage area and the very steep gradient where it cascades into the Potomac River, this small stream was not visited during field work. The gradient at the mouth, as indicated on the USGS topographic map, would likely prohibit even river herring from ascending this small stream. Therefore, this stream was classified as an unlikely spawning tributary for anadromous fishes.

SPOUT RUN

USGS topographic quadrangle: Washington West, D.C.-MD.-VA.

Tributary of: Potomac River

Miles above mouth: 115.6

Use category: probable

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the lower 20-30 m of this tributary. The mouth of this stream was visited at mid-tide on 30 April 1988. At that time, it would have been possible for river herring to utilize the lower 20 m of this stream before a natural falls of approximately 50 cm in height would block them from going farther. Given unusually high

tides and high stream discharge, it may be possible for river herring to ascend an additional 10 m before natural barriers associated with the steep gradient would stop them.

Structural Evaluations

Road crossing: George Washington Memorial Parkway (westbound lanes)

Date evaluated: 04/30/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: see below

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: Beneath this bridge is the natural upstream limit for river herring, just above the stream mouth. Underneath the bridge is a natural falls approximately 50 cm in height (as measured at mid-tide) that would normally prevent river herring from ascending farther than 20 m upstream of the mouth. Downstream of this falls, there is adequate depth and suitable water velocities for river herring. Given very high tides or high water levels in the Potomac River, the falls described above may be inundated, allowing river herring to ascend beyond this bridge, but numerous falls upstream would prevent them from getting much farther.

ROACHES RUN

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Potomac River

Miles above mouth: 111.4

Use category: probable

Mileage open: 0.4

Migration obstruction: none

Narrative: This tributary is nothing more than a tidal gut connecting Waterfowl Sanctuary with the Potomac River. It is probable that at least river herring ascend and spawn in this tributary, as its tidal flows are quite strong and would likely attract alosids. This tributary is not obstructed for its entire (and short) length. As a reference point for the above stream mileage, the George Washington Memorial Parkway crossing is at stream mile 0.3.

Structural Evaluations

Road crossing: George Washington Memorial Parkway

Date evaluated: 04/30/88

Passage status: passable

Structure type: one-cell box

Size: 3.0(?) X 4.0 m

Vertical drop: none

Depth in culvert: > 1.0 m

Velocity in culvert: ~ 90 cm/s

Notes: This structure has suitable depth and velocities for the passage of all anadromous species. The evaluation was made at low tide, and a large volume of water was flowing out of this culvert from Waterfowl Sanctuary. The height measurement listed above for this culvert is an estimate, as the depth and flows within this structure were too great to permit an accurate measurement. At high tide, depth within this structure would be greater, and velocities would change in amount and direction as the water flows into Waterfowl Sanctuary. Rocks below the culvert outlet form rapids as tidal flow rushes out of this culvert, but water depth in the rapids exceeds 50 cm, and velocities are acceptable for anadromous fish passage.

FOURMILE RUN

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Potomac River

Miles above mouth: 109.2

Use category: confirmed (D)

Mileage open: 2.9

Migration obstruction: drop structure

Narrative: Davis et al. (1970) found evidence that alosids use this tributary for spawning, but no locals we interviewed were aware of anadromous fish runs up this stream. The majority of the lower end of this tributary has been channelized to accommodate storm flows associated with the urbanized watershed. The lower 1.8 miles or so are influenced by the tide, and there are no notable barriers in that reach. Upstream of stream mile 1.8, river herring could ascend this man-made trapezoidal channel only during periods of adequate discharge due to numerous shallow riffles and a man-made blockage. The first definitive barrier that river herring would encounter in this tributary is a water-control drop structure at stream mile 2.9. This drop structure consists of a gabion weir capped with concrete that the water flows over, dropping vertically approximately 40 cm into an armored stilling basin (boulders held in place by poured concrete). Approximately 20 m below this weir, the stream takes a second steep drop of approximately 50 cm as it flows over the downstream lip of the armored stream channel. This structure appears to be an impassable barrier to river herring at all flows, therefore we regarded it as the upstream limit for anadromous fishes. However, between this drop structure and the head of tide are numerous shallow riffles (depth of < 10 cm) that may block migrations during periods of low discharge. In addition, at stream mile 2.6, there is a small dam made of rock and concrete debris that the stream flows over, dropping approximately 25 cm. This structure would be impassable to river herring at low flows, but passable during periods of high discharge.

Structural Evaluations

Road crossing: I-395

Date evaluated: 04/29/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 10 cm

Velocity in culvert: ~ 1.2 m/s

Notes: This evaluation was made during a period of relatively low stream discharge. If there was adequate discharge to allow herring to negotiate the numerous shallow riffles and the small dam below here, then there would be adequate depth for river herring to ascend the scattered riffles under this bridge.

Road crossing: West Glebe Road

Date evaluated: 04/29/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 50 cm

Velocity in culvert: ~ 40 cm/s

Notes: This evaluation was made during a period of relatively low discharge. The above measurements were made at the inlet. Most of the thalweg under the bridge had depths exceeding 50 cm and velocities of 30 cm/s or less. River herring could negotiate the channel under this bridge with ease. Numerous shallow riffles within the man-made trapezoidal channel above and below this crossing would block river herring during periods of low discharge.

Road crossing: South Arlington Ridge Road

Date evaluated: 04/29/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 20 cm

Velocity in culvert: ~ 30 cm/s

Notes: This evaluation was made during a period of relatively low discharge, and at mid-tide. According to a local resident, the water depth at this bridge during high tide is approximately 50 cm or more, permitting river herring to negotiate with ease the man-made trapezoidal channel under this bridge.

Road crossings: US 1 and George Washington Memorial Parkway

Date evaluated: 04/29/88

Passage status: passable

Structure types: bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: There are no passage problems at these crossings for the alosids that would encounter them.

LONG BRANCH

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Fourmile Run

Miles above mouth: 2.1

Use category: unlikely

Mileage open: 0.0

Migration obstruction: pipeline crossing

Narrative: A sewer pipeline running down the left descending side of the man-made channel of Fourmile Run creates a barrier that would prevent river herring from utilizing Long Branch during most years. As Long Branch enters Fourmile Run, it spreads out into a shallow sheet as it drops 30-35 cm over the exposed sewer pipe. As the mouth of Long Branch appears to be above the normal tidal influence, it would be a rare occurrence that unusually high tides or high discharge in Fourmile Run would inundate the pipeline, giving river herring access to Long Branch. Even if river herring had access to Long Branch, use for spawning is unlikely due to the stream's small discharge and a series of shallow riffles (depth of 6 cm on 29 April 1988) immediately upstream of the pipeline. Therefore, this stream was classified as an unlikely spawning tributary for anadromous fishes.

HUNTING CREEK

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Potomac River

Miles above mouth: 105.7

Use category: confirmed (?) (L)

Mileage open: 1.2

Migration obstruction: none

Narrative: Davis et al. (1970) reported that no spawning occurred in this tributary due to pollution. However, two local fishermen reported that clupeids ascend Hunting Creek and have been observed spawning upstream in Cameron Run (see description of Cameron Run). As they failed to capture any specimens, a positive identification was not made; however, they felt certain that the fish they observed were river herring and not gizzard shad. Hunting Creek is unobstructed its entire length.

Structural Evaluations

Road crossing: US 1 (and associated ramps) and George Washington Memorial Parkway

Date evaluated: 04/28/88

Passage status: passable

Structure types: bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: There are no passage problems at these crossings for the alosids that would encounter them.

CAMERON RUN

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Hunting Creek

Miles above mouth: 1.2

Use category: confirmed (?) (L)

Mileage open: 1.6

Migration obstruction: drop structure

Narrative: This stream has been extensively channelized, but still maintains an abundance of resident fishes, including some game species that local anglers exploit. Two local anglers were interviewed as they fished at the base of a gabion drop structure at stream mile 1.6 on Cameron Run. Both individuals reported that they have seen several species of fish (including clupeids) ascend Cameron Run up to the base of the drop structure at stream mile 1.6 to spawn. This impassable gabion drop structure has a concrete cap which the stream flows over, dropping approximately 1.5 m into a stilling basin below. As they failed to capture any of the numerous clupeids they observed, a positive identification was not made; however, they were certain that the fish they observed were river herring and not gizzard shad.

Structural Evaluations

Road crossing: I-95

Date evaluated: 04/29/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 20 cm

Velocity in culvert: ~ 90 cm/s

Notes: This crossing appears to be upstream of the normal tidal influence. The above measurements were made at the shallowest portion of the thalweg under this bridge. The shallows under this bridge are comparable to shallows downstream of this bridge. The majority of the thalweg under this bridge has depths exceeding 30 cm. There are no passage problems at this bridge for the alosids that would get this far.

Road crossing: Route 241

Date evaluated: 04/29/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: This crossing appears to be upstream of the normal tidal influence. There are no passage problems at this bridge for the alosids that would get this far.

PIKE BRANCH

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Cameron Run **Miles above mouth:** 1.1

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: drop structure

Narrative: It is unlikely that river herring would ascend this tributary to spawn due to a concrete drop structure a few meters above the stream mouth. This structure would prevent herring from going farther upstream during most years. The stream has washed out a channel around the right descending side of this drop structure. On the date of evaluation, all flow was cascading through riprap in the eroded channel, dropping approximately 45 cm. This cascading falls would prevent most river herring from continuing upstream. As this tributary appears to be upstream of the normal tidal influence, it would be a rare event for high tides to inundate this barrier. For these reasons, we assigned the upstream limit for river herring as being at this drop structure. In the rare event that river herring could get above the drop structure, an impassable highway culvert (exit ramp from I-95 northbound) approximately 10 m upstream would then block them. This three-cell box culvert has shallow, fast water within the cells, as well as a 30 cm vertical drop at the outlet.

TAYLOR RUN

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Cameron Run **Miles above mouth:** 0.8

Use category: unlikely **Mileage open:** 0.0

Migration obstruction: drop structure

Narrative: It is unlikely that river herring could ascend and spawn in the lower few meters of this tributary due to a concrete drop structure at the stream mouth. This stream was visited on 29 April 1988 at 1925 hours (five minutes prior to high tide). At the time of evaluation, the tidal influence did not extend up to the mouth of this tributary. The concrete drop structure at the stream mouth creates a vertical falls of approximately 20 cm. This drop structure appears that it would prevent river herring from entering this tributary except when water levels in Cameron Run were elevated (high discharge or very high tides) enough to inundate the structure. For these reasons, we assigned the upstream limit for river herring as being at this drop structure. In the event that high water levels in Cameron Run inundated the drop structure at the mouth of this stream, river herring would not ascend much above the inundated portion of this stream due to natural shallows. Natural riffles in this stream were approximately 4 cm deep on the date of evaluation (too shallow for river herring). At stream mile 0.1 is a three-cell box culvert under I-95. It is doubtful that river herring would ever

ascend as far as this culvert which is impassable due to shallow water in the cells and a vertical drop of 25 cm at the outlet.

HOOFF RUN

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Hunting Creek

Miles above mouth: 1.2

Use category: unlikely

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: This stream has been extensively channelized, and a large sewage treatment plant discharges into this small tributary. On the date this stream was visited (29 April 1988), the water in the vicinity of the I-95 crossing was an unpleasant gray-green color, and the water surface was well covered with mats of algae and duckweed, interspersed with an occasional petroleum slick. Based on these indications of poor water quality, we would be surprised if any anadromous species utilize this tributary for spawning. The tidal influence appears to extend up to stream mile 0.3, approximately 100 m downstream of the sewage treatment plant bridge. Numerous shallows above the tidal influence (and sewage discharge) would prevent any river herring from ascending much beyond the tidal influence. To be liberal, we placed the upstream limit for river herring at stream mile 0.4.

Structural Evaluations

Road crossing: I-95

Date evaluated: 04/29/88

Passage status: passable

Structure type: four-cell box

Size: ~ 3.0 m (?)

Vertical drop: none

Depth in culvert: > 30 cm

Velocity in culvert: < 20 cm/s

Notes: Due to poor water quality, it is unlikely that anadromous fish would utilize this small tributary. This evaluation was made 30 minutes after high tide. Due to the difficult access to the interior of this culvert, and the fact that it was obviously passable to river herring, the dimensions of this structure were not measured. The depth in this culvert was not measured either, except to ascertain that it was in excess of 30 cm.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Hunting Creek

Miles above mouth: 0.8

Use category: probable

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: This small stream has a high sediment load and suffers from urbanization within the watershed. In addition, channelization has altered the stream in the vicinity of the Route 629 crossing. The small drainage area of this stream and channelization result in numerous shallows (~ 5 cm depth on 29 April 1988) that would prevent river herring from ascending much above tidal influence. An employee of a business adjacent to this stream informed us that the tide normally does not extend upstream as far as Route 629, but an unusually high tide will occasionally do so. Based on this testimony, we put the upstream limit for possible river herring runs at stream mile 0.4, 0.1 mile upstream of Route 629. However, we consider this a liberal estimate, and believe that it would be unusual for river herring to ascend beyond stream mile 0.2.

Structural Evaluations

Road crossing: Route 629

Date evaluated: 04/29/88

Passage status: passable

Structure type: four-cell box

Size: 1.8 X 3.1 m

Vertical drop: none

Depth in culvert: 9 cm

Velocity in culvert: < 20 cm/s

Notes: On the date of evaluation, all flow was through the right descending cell. The above measurements were made at the inlet of the right cell. As this culvert has greater water depth (9 cm) than the shallow riffles downstream of here (~ 5 cm), we consider this structure passable to river herring. If conditions permit river herring to ascend as far as this culvert, they could negotiate this structure.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Potomac River

Miles above mouth: 104.6

Use category: probable

Mileage open: 1.0

Migration obstruction: stream morphology

Narrative: This small tributary is essentially a tidal gut with little drainage area. It is probable that river herring use this tributary for spawning, running upstream with the high tide. We put the upstream limit for possible river herring runs at stream mile 1.0. However, we consider this a liberal estimate, and believe that it would be unusual for river herring to ascend beyond stream mile 0.8.

Structural Evaluations

Road crossing: George Washington Memorial Parkway

Date evaluated: 04/29/88

Passage status: passable

Structure type: two-cell box

Size: 2.0 (?) X 3.2 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: This structure was evaluated one hour after low tide. The height measurement listed above for the culvert cells is an estimate; deep water and silt in the culvert bottom prevented an accurate measurement. This culvert has suitable depth and velocities for river herring to pass with ease.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Alexandria, VA.-D.C.-MD.

Tributary of: Unnamed tributary

Miles above mouth: 0.5

Use category: probable

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: It is probable that river herring would use the lower portion of this small tidal gut for spawning, running upstream with the high tide. As a liberal estimate, we put the upstream limit for possible runs at stream mile 0.4. No roads cross the portion of stream that river herring would use.

LITTLE HUNTING CREEK

USGS topographic quadrangle: Mount Vernon, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 98.3

Use category: confirmed (D, L)

Mileage open: 2.5

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids use this tributary for spawning. A local resident informed us that river herring have been captured by herring dippers within the last two years at stream mile 1.9 (0.2 mile upstream of the mouth of North Branch) during spawning runs. Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that river herring used to run upstream to the vicinity of the US 1 crossing (stream mile 2.5) during the late-1960's. However, siltation associated with urbanization of the watershed has altered the

stream in the vicinity of US 1. On 28 April 1988, there were numerous shallow riffles downstream of US 1 that would likely prevent river herring from getting as far as the US 1 bridge anymore. The present upstream limit for river herring is likely at least 100 m downstream of US 1, but to be liberal, we assigned the upstream limit to stream mile 2.7 (approximately 0.2 mile above US 1).

Structural Evaluations

Road crossing: US 1

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 6 cm

Velocity in culvert: ~ 60 cm/s

Notes: It is unlikely that river herring run this far upstream anymore due to numerous shallows downstream; however, this crossing is within the historical range of river herring runs on this tributary. If river herring could negotiate the shallow riffles downstream of this crossing, they could negotiate the shallow riffles under this bridge. The riffles under this bridge are similar in depth and velocity to several downstream riffles.

Road crossing: George Washington Memorial Parkway

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: There are no passage problems at this bridge for the anadromous species that would encounter it.

NORTH BRANCH

USGS topographic quadrangle: Mount Vernon, VA.-MD.

Tributary of: Little Hunting Creek

Miles above mouth: 1.7

Use category: probable

Mileage open: 1.3

Migration obstruction: stream morphology

Narrative: It is probable that river herring use this tributary for spawning, although none of the local residents we interviewed were aware of river herring runs up this tributary. As a liberal

estimate, we put the upstream limit for river herring at stream mile 1.3, 0.4 mile upstream of Route 628 (Collingwood Road).

Structural Evaluations

Road crossing: Route 628

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: The stream is tidal at this crossing, and the evaluation was made with the tide out and water levels low. If river herring were to ascend as far as this crossing, they would have no difficulty negotiating the stream under this bridge.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Mount Vernon, VA.-MD.

Tributary of: North Branch

Miles above mouth: 0.9

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: This stream is little more than a tidal gut, but it is included in this report due to the highway crossing on its lower end. It is probable that river herring ascend this small stream as far as the limit of tidal influence. On the date this stream was visited (28 April 1988), there was evidence that high tides back water up this creek to above the Route 628 (Collingwood Road) crossing. An adult gizzard shad was observed in a pool of water above the Route 628 crossing, having been stranded as the tide receded. As a liberal estimate, we assigned the upstream limit for river herring runs to stream mile 0.2.

Structural Evaluations

Road crossing: Route 628

Date evaluated: 04/28/88

Passage status: passable

Structure type: three CMPs

Size: ~ 2.0 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: This evaluation was made after the tide had receded and water levels were low. The pipes of this culvert have suitable flow characteristics for the passage of river herring.

However, on the date of evaluation, beaver cuttings and debris were blocking the inlets to these pipes. While this debris was not packed tightly enough to impound water, it did serve as a low-water barrier to fish passage. An adult gizzard shad had moved upstream through this culvert with the high tide, but at low tide, the debris had effectively trapped this fish, preventing it from moving back downstream. If the beaver cuttings and debris were absent, fish would have free access through this culvert, instead of just at high tide.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Mount Vernon, VA.-MD.

Tributary of: Little Hunting Creek

Miles above mouth: 0.4

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: This stream is little more than a tidal gut, but it is included in this report due to the highway crossing on it. It is probable that river herring ascend this small stream as far as the limit of tidal influence, although none of the local residents we interviewed were aware of river herring runs up this small stream. On the date this stream was visited (28 April 1988), there was evidence that high tides back water up this creek to above the Route 2052 crossing. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.3, 0.1 mile upstream of Route 2052.

Structural Evaluations

Road crossing: Route 2052

Date evaluated: 04/28/88

Passage status: passable

Structure type: one CMP

Size: ~ 1.7 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: This evaluation was made while the tide was relatively high. At the time of evaluation, the tide was high enough to back water up into this culvert, providing conditions well suited for fish passage. If river herring utilize this stream, it is probable that they would ascend above this crossing with the tide.

DOGUE CREEK

USGS topographic quadrangle: Mount Vernon, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 96.5

Use category: confirmed (D, L)

Mileage open: 5.4

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids use this tributary for spawning. Loesch (1981) reported the capture of river herring at the US 1 crossing (stream mile 2.7) in the spring of 1981. Phil S. Parrish (Law Enforcement Division, VDGIF) informed us that river herring migrate upstream of US 1 to the vicinity of stream mile 3.0, but not much farther than this. In the absence of any beaver-related obstructions, we put the upstream limit for river herring at the confluence of Barnyard Run at stream mile 5.4. However, there are currently several beaver dams between stream mile 5.4 and stream mile 3.0 that would likely obstruct fish passage upstream. Approximately 10 m upstream of the US 1 bridge is a potential barrier to river herring migrations. It consists of a single concrete pipe (~ 2.0 m in diameter and ~ 30 m in length) imbedded in an earthen embankment across the floodplain. The original purpose of this structure is not apparent, but at the inlet of the pipe are the remains of a flashboard water-control device, indicating that the stream above here was impounded for some purpose. No flashboards exist at the inlet and the stream currently flows unobstructed through the pipe. The pipe may be too small in diameter to handle significant storm discharge, despite its gradient. On 28 April 1988, with stream discharge relatively low, the water in the lower end of this pipe had velocities exceeding 3.0 m/s and a depth of 25-30 cm. According to Walter Flory (retired from the Law Enforcement Division, VDGIF), most river herring ascending Dogue Creek stop at the scour hole below this concrete pipe, but some fish manage to negotiate the flows in this pipe and continue upstream. The testimony of Phil S. Parrish concurs that at least some river herring negotiate this structure and are captured upstream by fishermen. However, during spawning seasons with high stream discharge, the velocities in this pipe may become too great for river herring to ascend.

Structural Evaluations

Road crossing: Route 622

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: On the date of evaluation, a downstream beaver dam was impounding water up under this bridge. Without the beaver dam, water depth and velocities under this bridge would likely be suitable for river herring passage.

Road crossing: US 1

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 60 cm/s

Notes: The above measurements were made at the shallowest portion of the thalweg under this bridge. Most of the thalweg under the bridge is deeper. River herring should have no

difficulty negotiating the stream under this bridge, and apparently fishermen have consistently captured them upstream of here.

Road crossing: Route 235

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: The stream under this bridge is well suited for the passage of river herring, as indicated by the dip netting that occurs upstream.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Dogue Creek

Miles above mouth: 3.6

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: In the absence of beaver dams, it is probable that river herring would enter and spawn in the lower portion of this channelized tributary. Shallows would restrict river herring use to the lower 0.6 mile. Beaver dams on Dogue Creek and in the lower end of this tributary likely exclude river herring from this tributary now. There are no highway crossings on the portion of this tributary that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Dogue Creek

Miles above mouth: 3.0

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring ascend this small tributary to spawn. If they did, shallows would prevent river herring from ascending much more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Dogue Creek

Miles above mouth: 2.0

Use category: confirmed (L)

Mileage open: 1.0

Migration obstruction: stream morphology

Narrative: Riparian landowners reported that river herring used to ascend this stream to spawn, occasionally ascending upstream as far as the vicinity of the upper Route 623 crossing at stream mile 0.8, but usually ascending no farther than stream mile 0.7 (confluence with an unnamed tributary). To be liberal, we placed the upstream limit for river herring runs at stream mile 1.0. The individuals we interviewed said that to the best of their knowledge, river herring no longer use this stream for spawning, even down in the lower portion. According to the riparian landowners, declines in the river herring runs up this stream coincided with the installation of a sewer line along this stream and channelization in the vicinity of the upper Route 623 crossing. The deep pools that once existed in this stream are now silted in, and the stream is plagued with an abundance of fine sediments.

Structural Evaluations

Road crossing: Route 623 (upper crossing)

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 20 cm

Velocity in culvert: ~ 35 cm/s

Notes: According to riparian landowners, high tide extends this far upstream only a few times each year. River herring used to occasionally ascend upstream as far as this crossing, but no fish have been observed in this stream for years. Channelization above and below this crossing has widened the stream channel in the vicinity of this bridge, resulting in a shallowing of the stream. If river herring could negotiate the downstream shallows, they could negotiate the similar shallows underneath this bridge.

Structural Evaluations

Road crossing: Route 623 (lower crossing)

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 40 cm

Velocity in culvert: < 20 cm/s

Notes: Water levels at this bridge fluctuate with the tide. The above measurements were made between high tide and mean tide. This bridge would be passable to river herring during most tidal levels.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Unnamed tributary

Miles above mouth: 0.7

Use category: confirmed (L)

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: Local residents testified that river herring used to occasionally ascend this stream to spawn, running upstream no farther than 0.1 mile. Shallows prevented the fish from going beyond 0.1 mile. To be liberal, we placed the upstream limit for river herring at stream mile 0.3. According to the individuals we interviewed, river herring no longer use this tributary (or the one it flows into) for spawning. No roads cross the portion of stream that river herring would use.

GUNSTON COVE

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 94.5

Use category: confirmed (D, L)

Mileage open: 2.0

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids ascended upstream through this cove to spawn in Accotink and Pohick Creeks. Interviews with riparian landowners confirmed that at least river herring utilized Accotink and Pohick Creeks for spawning. There are no obstructions or road crossings on Gunston Cove.

ACCOTINK BAY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Gunston Cove

Miles above mouth: 2.0

Use category: confirmed (D, L)

Mileage open: 1.1

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids ascended upstream through this bay to spawn in Accotink Creek. An interview with a riparian landowner confirmed that at least river herring utilized Accotink Creek for spawning. There are no obstructions or road crossings on Accotink Bay.

ACCOTINK CREEK

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Accotink Bay

Miles above mouth: 1.1

Use category: confirmed (D, L)

Mileage open: 11.6

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids spawned in this tributary. Phil S. Parrish (Law Enforcement Division, VDGIF) informed us that fishermen dip for river herring at the US 1 crossing (stream mile 1.6), but the fish are not abundant in this stream. A landowner that lives adjacent to this stream at the Route 790 crossing (stream mile 5.1) told us that in the 1960's, fishermen used to dip for river herring in the stream adjacent to her house. She said that the river herring continued upstream beyond the Route 790 crossing, but she was unaware of how much farther they went. She recalled that the river herring were abundant in this stream when she first moved to her current residence in the early 1960's, but the runs diminished to the point where she has not observed river herring in this stream for years. As we could not locate any individuals familiar with the historical river herring runs upstream of Route 790, we attempted to locate any definitive barriers upstream of the Route 790 bridge. The reach of stream between stream miles 5.6 and 6.9 was walked to identify anthropogenic barriers and natural gradient obstructions. At stream mile 5.9 is a concrete ford crossing that may have once been a definitive barrier for river herring runs, and presently would block upstream migrations during low flows. This abandoned private structure has a vertical drop of approximately 40 cm on its downstream side, which would be impassable for river herring. On 28 April 1988, the stream discharge was slightly elevated due to a thunderstorm the night before. On this date, nearly all discharge was flowing over the concrete structure and its impassable vertical drop. However, the stream has washed out a shallow channel on the right descending side of this structure, and with the discharge elevated, river herring could have ascended up this side channel around the structure. During low flows, this side channel may not have adequate depth for river herring passage. The next potential barrier located is a rock ledge waterfall approximately 50 m upstream of the Route 4600 bridge (stream mile 6.2). This natural falls is approximately 60 cm in height and vertical except on the right descending side, where the stream cascades down through rocks. This falls could be a possible barrier to river herring, especially during periods of low discharge. Based on this natural falls and the existence of the old ford at stream mile 5.9, we feel that river herring usage of Accotink Creek above stream mile 6.2 is unlikely. However, the only definitive barrier we identified on Accotink Creek was the Lake Accotink Dam at stream mile 11.6. Until additional information proves otherwise, the Lake Accotink Dam should be considered the liberal upstream limit of river herring runs, although we feel that it is unlikely that river herring would ascend beyond stream mile 6.2.

Structural Evaluations

Road crossing: Route 644

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: ~ 50 cm/s

Notes: It is unlikely that river herring run this far upstream, but if they did, they would have no difficulty negotiating the stream under this bridge.

Road crossing: Route 636

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 1.0 m/s

Notes: It is unlikely that river herring run this far upstream, but if they did, they would have no difficulty negotiating the stream under this bridge. The above measurements apply to a 1.0 m reach of the thalweg (a rocky riffle) on the downstream side of the bridge. The water depth in the majority of the thalweg under this bridge exceeds 40 cm.

Road crossing: Route 4600

Date evaluated: 04/28/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 50 cm

Velocity in culvert: ~ 1.2 m/s

Notes: The rapids under this bridge have sufficient depth and suitable velocities for the passage of river herring.

Road crossing: Route 790

Date evaluated: 04/27/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 11 cm

Velocity in culvert: ~ 40 cm/s

Notes: On the date of evaluation, stream discharge was low. The stream under this bridge forms a broad and shallow riffle as it flows over a gravel bar. The above measurements were made at the shallowest portion of the thalweg in this riffle, on the left descending side. Water depth in most of the thalweg under this bridge exceeded 20 cm on the date of evaluation.

Downstream of here are several shallow riffles that river herring would have to ascend to get to this bridge. According to a riparian landowner, the shallow riffle under this bridge has been there at least since the early 1960's (when the landowner first moved into the residence adjacent to this road crossing). The landowner said the shallows under this bridge made a popular dipping spot for fishermen in the 1960's (before the runs declined). She remarked that when discharge was adequate to permit river herring to ascend up to this crossing, the fish had no difficulty negotiating the shallows under this bridge and continuing upstream. Therefore, we have designated the riffle under this bridge as passable to river herring.

Road crossing: I-95

Date evaluated: 04/28/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to have ascended upstream of this crossing, and they would have no difficulty negotiating the stream under these bridges.

Road crossing: Route 611

Date evaluated: 04/27/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to have ascended upstream of this crossing, and they would have no difficulty negotiating the stream under this old bridge.

Road crossing: US 1

Date evaluated: 04/27/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to ascend upstream of this crossing, and they would have no difficulty negotiating the stream under this bridge.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Annandale, VA.

Tributary of: Accotink Creek

Miles above mouth: 10.2

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend Accotink Creek up to the mouth of this tributary due to potential barriers (see description of Accotink Creek). In the event that river herring ascended beyond the barriers and continued up Accotink Creek to spawn, it is unlikely that they would utilize this small tributary. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

CALAMO BRANCH

USGS topographic quadrangle: Annandale, VA.

Tributary of: Accotink Creek **Miles above mouth:** 9.0

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend Accotink Creek up to the mouth of this tributary due to potential barriers (see description of Accotink Creek). In the event that river herring ascended beyond the barriers and continued up Accotink Creek to spawn, it is unlikely that they would utilize this small tributary. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Annandale, VA.

Tributary of: Accotink Creek **Miles above mouth:** 8.7

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend Accotink Creek up to the mouth of this tributary due to potential barriers (see description of Accotink Creek). In the event that river herring ascended beyond the barriers and continued up Accotink Creek to spawn, it is unlikely that they would utilize this small tributary. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

FIELD LARK BRANCH

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Accotink Creek

Miles above mouth: 6.2

Use category: unlikely

Mileage open: 0.0

Migration obstruction: stream morphology

Narrative: River herring could not use this tributary due to cascading falls (several meters in height) at the stream mouth.

LONG BRANCH

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Accotink Creek

Miles above mouth: 3.4

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: It is probable that river herring would ascend and spawn in the lower portion of this tributary. Use of this tributary above stream mile 0.1 would depend upon adequate discharge to provide sufficient depth in the shallow riffles that characterize this stream, but we consider use of the stream above mile 0.4 as unlikely. As there are no definitive barriers in the lower portion of this stream, we put the upstream limit for river herring at stream mile 0.6, where increased gradient results in a continuous shallow riffle.

Structural Evaluations

Road crossing: Route 617

Date evaluated: 04/27/88

Passage status: passable

Structure type: two-cell box

Size: ~1.9 X 2.8 m

Vertical drop: none

Depth in culvert: 15 cm

Velocity in culvert: ~ 30 cm/s

Notes: It is unlikely that river herring would ever ascend this far upstream due to numerous downstream shallows. If river herring could negotiate the shallows below, they would have no difficulty ascending through this culvert. On the date of evaluation, stream discharge was low, and all flow was through the left descending cell. Boulders dumped at the outlet of the culvert impounded water in the lower portion of the left cell (water level at outlet elevated by ~ 10 cm), making the shallowest depth at the inlet (see measurements above). Gaps between the boulders at the culvert outlet provide passable chutes for fish to enter the outlet of the left cell. If the stream had adequate discharge to permit river herring to negotiate the

downstream shallows, then the inlet of this culvert would have adequate depth for their upstream passage.

Road crossing: Route 611

Date evaluated: 04/27/88

Passage status: passable

Structure type: three-cell box

Size: ~ 2.5 X 3.1 m

Vertical drop: none

Depth in culvert: ~ 12 cm

Velocity in culvert: < 20 cm/s

Notes: Given adequate discharge, it is probable that river herring would ascend to this crossing. As several riffles downstream of this crossing have shallower depths than what occur in this culvert, we consider this structure passable to all fishes that can ascend up to it. On the date of evaluation, stream discharge was low, and all flow was through the center and right descending cells. The center cell had the best flow characteristics for fish passage: the inlet had a depth of 20 cm with velocities less than 20 cm/s, and the outlet had a depth of 14 cm with velocities of approximately 80 cm/s. The shallowest point in the center cell was approximately midway through the culvert (see measurements above). Shallow riffles downstream of this culvert had depths of about 7 cm, considerably less than what occurs in the center cell of this structure.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Accotink Creek

Miles above mouth: 2.8

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend this small tributary to spawn. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

MASON RUN

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Accotink Creek

Miles above mouth: 1.0

Use category: probable

Mileage open: < 0.1

Migration obstruction: pipeline crossing

Narrative: It is probable that river herring would ascend and spawn in the lower portion of this tributary. A steel pipeline crosses this tributary approximately 40 m downstream of the US 1 crossing. This pipeline creates a low-head dam, forcing the stream to flow over it and drop approximately 40 cm in height (measured on 27 April 1988). This vertical falls would prevent river herring from getting upstream of this pipeline crossing. No roads cross the portion of stream that river herring would use.

POHICK BAY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Gunston Cove

Miles above mouth: 2.0

Use category: confirmed (D, L)

Mileage open: 1.5

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids ascended upstream through this bay to spawn in Pohick Creek. Collections by USFWS personnel and interviews with a riparian landowner and VDGIF personnel confirm that at least river herring utilize Pohick Creek for spawning. There are no obstructions or road crossings on Pohick Bay.

POHICK CREEK

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Pohick Bay

Miles above mouth: 1.5

Use category: confirmed (D, L)

Mileage open: 4.8

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids spawned in this tributary. Phil S. Parrish (Law Enforcement Division, VDGIF) said that historically, Pohick Creek had tremendous river herring runs that would attract numerous fishermen to dip in the stream between Routes 611 and 642 (stream miles 1.5-2.5). A landowner that lives adjacent to Pohick Creek at the Route 642 crossing informed us that river herring used to negotiate the rock ledge waterfalls in the vicinity of stream mile 2.4, and continue upstream beyond the Route 642 bridge. As we could not locate any individuals familiar with the river herring runs upstream of Route 642, we must assume that river herring migrated up as far as Pohick Falls, an impassable vertical falls (approximately 1.0 m in height) at stream mile 4.8. There are no definitive barriers downstream of Pohick Falls. River herring runs in Pohick Creek have all but disappeared in recent years. Researchers failed to capture any river herring in this tributary during sampling in the spring of 1981, and suggested that chlorine in the discharge of the large Fairfax County sewage treatment plant at stream mile 1.5 may deter fish from utilizing this tributary (Loesch 1981). During periods of low stream flows, the sewage effluent can be a significant contributor to the overall stream discharge below the sewage outfall. In the spawning season of 1982, USFWS personnel from Annapolis, Maryland sampled and collected 12 river herring adults between the US 1 crossing and the stream mouth (Paul Angermeier, VPI&SU, personal

communication). The discrepancy between the two years is not readily explained, but may be related to differential stream discharge (greater dilution of sewage effluent in 1982 due to higher natural stream discharge) or sampling in 1981 may not have been intense enough or timely to capture the few river herring that may have been utilizing the stream. In response to the potential impacts that the sewage effluent may be having on river herring runs in Pohick Creek, Fairfax County has contracted with George Mason University to monitor river herring usage of this stream, beginning in the spring of 1988.

Structural Evaluations

Road crossing: Route 641

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that river herring historically ran upstream beyond this bridge to Pohick Falls (0.4 mile above this crossing). There are no definitive downstream barriers that would prevent river herring from getting to this bridge. If river herring ascended to this crossing, they would have no difficulty negotiating the stream under this bridge.

Road crossing: I-95

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 1.0 m/s

Notes: It is probable that river herring historically ran upstream beyond this bridge to Pohick Falls (1.3 miles above this crossing). There are no definitive downstream barriers that would prevent river herring from getting to this bridge. If river herring ascended to this crossing, they would have no difficulty negotiating the stream under this bridge. The above measurements apply to rapids at the upstream end of the stream under this bridge. Most of the thalweg under this structure has water depths exceeding 50 cm, and velocities less than 20 cm/s.

Road crossing: Route 642

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 40 cm

Velocity in culvert: ~ 30 cm/s

Notes: According to a riparian landowner, river herring used to ascend upstream beyond this crossing. The thalweg under this bridge was a popular dipping spot for fishermen. River herring could negotiate the stream under this bridge with ease.

Road crossing: US 1

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 40 cm

Velocity in culvert: ~ 25 cm/s

Notes: River herring are known to have ascended upstream of this crossing. River herring would have no difficulty negotiating the stream under this bridge.

Road crossing: Route 611

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to have ascended upstream of this crossing. River herring would have no difficulty negotiating the stream under this bridge.

SOUTH RUN

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Pohick Creek

Miles above mouth: 3.7

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: It is probable that river herring once utilized this tributary for spawning (before the runs declined in Pohick Creek). However, the steep gradient in the lower end of this tributary would likely prevent river herring from ascending farther than 0.1 mile up this stream. As a liberal estimate, we placed the upstream limit for river herring at stream mile 0.3 (at the mouth of Rocky Branch). No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Pohick Creek

Miles above mouth: 1.6

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring utilize the lower 0.1 mile of this small tributary for spawning. Shallows would prevent river herring from ascending farther upstream than 0.1 mile. It should be noted that the lower end of this stream differs from what is shown on the USGS 7.5 minute topographic map. This stream does not flow under Route 611 before flowing into Pohick Creek, as shown on the map, but instead joins Pohick Creek approximately 70 m upstream of the Route 611 bridge. Therefore, no roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 90.0

Use category: probable

Mileage open: 0.8

Migration obstruction: stream morphology

Narrative: It is probable that river herring utilize the lower tidal portion of this small tributary for spawning. As a liberal estimate, we placed the upstream limit for river herring at stream mile 0.8 (50 m downstream of private road crossing shown on the USGS 7.5 minute topographic map). To further aid in identifying this tributary, its mouth is located approximately 0.5 mile northeast of Sycamore Point, Fairfax County. This stream drains portions of Mason Neck State Park, Potomac Shoreline Regional Park, and Mason Neck National Wildlife Refuge. No highways cross the portion of stream that river herring would use.

OCCOQUAN BAY

USGS topographic quadrangle: Indian Head, MD.-VA.

Tributary of: Potomac River

Miles above mouth: 87.0

Use category: confirmed (D, L)

Mileage open: 2.3

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids ascended upstream through this bay to spawn in Occoquan River. While Occoquan River is well known for its river herring spawning runs, other anadromous species (hickory shad and striped bass) may also spawn in it (see the narrative for Occoquan River). There are no road crossings or barriers on this tributary.

BELMONT BAY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Occoquan Bay

Miles above mouth: 2.3

Use category: confirmed (D, L)

Mileage open: 2.5

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids ascended upstream through this bay to spawn in Occoquan River. While Occoquan River is well known for its river herring spawning runs, other anadromous species (hickory shad and striped bass) may also spawn in it (see the narrative for Occoquan River). There are no road crossings or barriers on this tributary.

OCCOQUAN RIVER

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Belmont Bay

Miles above mouth: 2.5

Use category: confirmed (D, L)

Mileage open: 2.8

Migration obstruction: Occoquan Pumping Dam

Narrative: Davis et al. (1970) reported that alosids spawned in this tributary. Anglers informed us that hickory shad and striped bass are captured as far upstream as stream mile 2.5 in the spring of the year. Although it is unknown if striped bass spawn in this tributary, anglers and local residents stated that hickory shad do. River herring ascend this tributary to spawn each year and historically have been very abundant. As a liberal estimate, we placed the upstream limit for river herring at the base of the Occoquan Pumping Dam at stream mile 2.8. However, none of the individuals we interviewed had ever seen river herring as far upstream as Occoquan Pumping Dam, stating that the fish failed to ascend the falls downstream of the dam. Walter Flory (retired from the Law Enforcement Division, VDGIF) was familiar with the Occoquan River before the Occoquan Pumping Dam and Occoquan Dam (upstream at stream mile 3.4) were constructed. In his work experience at checking fishing licenses at the base of Ryans Dam (site at stream mile 9.8, and now inundated by Occoquan Reservoir) to the head of tide, he never knew of river herring to ascend Occoquan River beyond stream mile 2.7.

Structural Evaluations

Road crossings: Route 123, I-95, and US 1

Date evaluated: 03/02/88

Passage status: passable

Structure types: bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring, hickory shad, and striped bass are known to ascend beyond these bridges. These structures are passable to all species of anadromous fish.

LITTLE OCCOQUAN RUN

USGS topographic quadrangle: Occoquan, VA.

Tributary of: Occoquan River

Miles above mouth: 2.5

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend this small tributary to spawn. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Occoquan, VA.

Tributary of: Occoquan River

Miles above mouth: 1.7

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary (the lower 0.1 mile or less). It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.2. No highways cross the portion of stream that river herring would use; the road that crosses at stream mile 0.1 belongs to the Northern Virginia Park Authority.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Occoquan River

Miles above mouth: 1.0

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary (the lower 0.1 mile or so). It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Occoquan River

Miles above mouth: 0.9

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary (the lower 0.2 mile). It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.3. No roads cross the portion of stream that river herring would use.

MASSEY CREEK

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Belmont Bay

Miles above mouth: 2.2

Use category: confirmed (D, L)

Mileage open: 1.1

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids spawned in this tributary. Phil S. Parrish (Law Enforcement Division, VDGIF) informed us that river herring ascend this stream up to beaver dams in the vicinity of stream mile 0.9. Before the beaver dams were constructed, river herring used to ascend the entire length of this stream (1.1 miles) and continue up Giles Run (T.H. Peyton, riparian landowner, personal communication). With the exception of the aforementioned beaver dams, this stream has no barriers to anadromous fish migrations. No roads cross this tributary.

SOUTH BRANCH

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Massey Creek

Miles above mouth: 1.1

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring used the lower portion of this small tributary before downstream beaver dams on Massey Creek blocked the fish runs. We estimate that river herring would utilize no more than the lower 0.1 mile of this stream due to shallows. No roads cross the portion of stream that river herring would use.

GILES RUN

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Massey Creek

Miles above mouth: 1.1

Use category: confirmed (L)

Mileage open: 2.0

Migration obstruction: highway culvert

Narrative: Prior to the construction of beaver dams on Massey Creek, river herring used to spawn in this stream, ascending at least as far upstream as the vicinity of the Route 611 crossing (stream mile 1.6) in numbers sufficient to attract fishermen (T.H. Peyton, riparian landowner, personal communication). We could not locate any individuals familiar with historic river herring runs upstream of Route 611, but based on the stream morphology, shallows would form the natural upstream barrier, preventing river herring from ascending farther than stream mile 2.2 (liberal estimate of their upstream limit). However, the I-95 culvert is an impassable structure that would currently prevent river herring from ascending farther than stream mile 2.0.

Structural Evaluations

Road crossing: I-95

Date evaluated: 03/22/88

Passage status: impassable

Structure type: three-cell box

Size: ~ 1.8 X 2.5 m (center and left descending cells); ~ 1.8 X 2.9 m (right descending cell)

Vertical drop: 13-20 cm (see below)

Depth in culvert: 3-4 cm/s

Velocity in culvert: ~ 30-40 cm/s

Notes: It is unknown if river herring ever ascended as far as this crossing; currently, their access to this stream is blocked by beaver dams. Numerous shallows downstream of here may prevent river herring from reaching this culvert, but our liberal estimate of the natural

upstream limit for river herring runs in this stream is 0.2 mile upstream of this structure. This culvert would be impassable to river herring due to the vertical drop at the outlet (vertical drop of 13 cm, 17 cm, and 20 cm for the left, center, and right descending cells, respectively, as measured on 22 March 1988). In addition, the water depth in all three cells was insufficient for river herring to negotiate on the date of evaluation (water depth of 3 cm, 3 cm, and 4 cm for the left, center, and right descending cells, respectively). Water velocities in the cells ranged 30-40 cm/s. Water depths and velocities were relatively uniform the entire length of each cell (~ 150 m in length). Due to the uncertainty that river herring ever ascended upstream as far as this culvert, mitigation of this structure is not presently recommended. If and when river herring begin using Giles Run again, the spawning runs should be monitored to determine if the I-95 culvert is within their range, forming a barrier to their upstream migration.

Road crossing: US 1

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 20 cm

Velocity in culvert: < 20 cm/s

Notes: It is presumed that river herring historically ascended as far as this crossing. They are known to have ascended at least to within 0.1 mile downstream of here in numbers sufficient to attract fishermen. Beaver dams on Massey Creek currently prevent river herring from utilizing this tributary. If river herring could negotiate the shallows downstream of this crossing, they would have no difficulty ascending the stream under this bridge.

Road crossing: Route 611

Date evaluated: 03/22/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 16 cm

Velocity in culvert: ~ 25 cm/s

Notes: River herring historically ascended this tributary to some point upstream of this bridge, in numbers sufficient to attract fishermen. Beaver dams on Massey Creek currently prevent river herring from utilizing this tributary. Most of the thalweg under this bridge has depths exceeding 25 cm (as measured on 22 March 1988, with low stream discharge). The shallowest point of the thalweg at this crossing is in a short riffle on the upstream side of the bridge (see measurements above). This shallow riffle is similar in depth and velocities to numerous natural riffles upstream of here. As river herring are known to have once negotiated the shallows at this bridge and continued upstream (T.H. Peyton, riparian landowner, personal communication), and our evaluation was made during a period of low stream discharge, we feel that river herring would have little difficulty ascending upstream of this bridge.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Belmont Bay

Miles above mouth: 1.0

Use category: probable

Mileage open: 0.7

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower portion of this small tributary for spawning. In the absence of beaver dams, river herring would run upstream no farther than stream mile 0.7 due to shallows. Beaver activity would likely prevent river herring from ascending beyond stream mile 0.4, presently. No roads cross the portion of stream that river herring would use.

KANES CREEK

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Belmont Bay

Miles above mouth: 1.0

Use category: confirmed (D, L)

Mileage open: 1.5

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids utilize this tributary for spawning. Walter Flory (retired from the Law Enforcement Division, VDGIF) recalled checking dip net permits of fishermen as they caught river herring at stream mile 0.8 of Kanes Creek. As a liberal estimate, we put the upstream limit for river herring at stream mile 1.5. Shallows would prevent river herring from ascending any farther up this stream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Kanes Creek

Miles above mouth: 1.3

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower 0.1 mile of this small tributary for spawning. Shallows would prevent river herring from ascending any farther up this stream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Kanes Creek

Miles above mouth: 0.8

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower 0.6 mile of this small tributary for spawning. Shallows would prevent river herring from ascending any farther up this stream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Occoquan Bay

Miles above mouth: 1.9

Use category: confirmed (L)

Mileage open: 1.1

Migration obstruction: stream morphology

Narrative: River herring formerly ascended this small tributary to spawn during high tide, getting upstream as far as stream mile 1.1 (D.A. Martin, security guard at the U.S. Army's Harry Diamond Laboratory, personal communication). Mr. Martin last saw river herring using this tributary in the early 1980's; the runs have disappeared in recent years. According to Mr. Martin, river herring would ascend this small tributary as far as the tide would allow, which was never any farther upstream than 1.1 miles above the mouth. To aid in identifying this tributary, the stream mouth is located approximately 0.15 mile west of Deephole Point, Prince William County. No highways cross the portion of stream that river herring use.

MARUMSCO CREEK

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Occoquan Bay

Miles above mouth: 1.7

Use category: confirmed (D, L)

Mileage open: 1.6

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids used this tributary for spawning. Jesse R. Baldwin (former Prince William County resident and avid fisherman) stated that by the early 1960's, river herring runs in Marumsco Creek had declined to levels too low to attract fishermen. Consequently, information on the upstream migrations of river herring in this stream is lacking. Based on the stream morphology observed, our liberal estimate for the

upstream limit for river herring runs is at stream mile 1.6 (approximately 0.1 mile downstream of the US 1 bridge). Numerous shallow riffles (~ 5 cm deep on 25 April 1988) would prevent river herring from ascending as far as US 1. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fort Belvoir, VA.-MD.

Tributary of: Marumsco Creek

Miles above mouth: 0.6

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring utilize this small tributary for spawning. At stream mile 0.1 is a culvert owned by the Prince William County Park Authority. At low tide, this culvert has a vertical drop that is impassable to river herring. This structure was not visited at high tide, but it appears that the vertical drop at the culvert outlet would be inundated at high tide, making this structure passable then. Shallows would prevent river herring from ascending any farther than stream mile 0.2. No highways cross the portion of stream that river herring would use.

FARM CREEK

USGS topographic quadrangle: Indian Head, MD.-VA.

Tributary of: Occoquan Bay

Miles above mouth: 0.6

Use category: probable

Mileage open: 1.0

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary. River herring could ascend no farther than stream mile 1.0 due to shallows. No highways cross the portion of stream that river herring would use.

NEABSCO CREEK

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Occoquan Bay

Miles above mouth: 0.0

Use category: confirmed (D, L)

Mileage open: 6.2

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. Stuart P. Doggett (Law Enforcement Division, VDGIF) stated that fishermen historically dipped for river herring in the vicinity of the US 1 bridge, but the runs have declined to the point that fishermen are no longer observed at this crossing. The owner of an automobile repair shop adjacent to the US 1 bridge confirmed this, adding that the last year he saw river herring ascend this stream to the US 1 crossing was 1982. Jesse R. Baldwin (former Prince William County resident and avid fisherman) spent his childhood and adolescence as a resident of Garfield Estates, overlooking Neabsco and Powells Creeks. Mr. Baldwin informed us that in the early 1960's, there were outstanding river herring runs up Neabsco Creek. In addition, he told us that sport fishes (centrarchids and esocids) were plentiful enough to provide good fishing opportunities, and nongame fishes (catostomids and cyprinids) were numerous. Mr. Baldwin told us that river herring runs in this stream began to decline in the mid to late 1960's, with decreasing water quality associated with urbanization of the watershed. Mr. Baldwin stated that to his knowledge, river herring no longer utilize this stream for spawning, and resident fishes are extirpated in the free-flowing portions of this tributary downstream of the uppermost sewage treatment plant discharge at stream mile 8.3 (0.2 mile upstream of the Route 640 crossing). The senior author walked portions of this stream, between stream miles 2.9 and 8.8, and did not observe any resident fishes downstream of the sewage outfall at stream mile 8.3. All free-flowing portions of this tributary that were visited between stream miles 2.9 and 8.3 had a strong sewage odor. At the Route 610 crossing at stream mile 8.6 (0.3 mile upstream of the uppermost sewage treatment plant), the sewage odor was not noticed, and small centrarchids were observed in the stream. Mr. Baldwin was very familiar with river herring runs in Neabsco Creek as a youngster and adolescent. He said that to the best of his knowledge, river herring runs did not extend upstream beyond stream mile 5.4. He remarked that our estimate of the upstream limit of river herring runs, at stream mile 6.2 (immediately upstream of of a series of steep rapids, 0.8 mile downstream of the Route 1826 crossing), was quite liberal, insuring the inclusion of all former river herring range.

Structural Evaluations

Road crossing: I-95

Date evaluated: 04/25/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: 22 cm

Velocity in culvert: 65 cm/s

Notes: River herring historically ascended Neabsco Creek to some point well upstream of this crossing. However, river herring are no longer known to use this tributary. The stream at this crossing is noticeably influenced by sewage discharge, giving off a strong odor of sewage effluent. This crossing consists of two separate bridges, both of which are passable to river herring. The shallowest portion of the thalweg under the southbound bridge had a water depth of 38 cm with velocities of approximately 70 cm/s. The shallowest portion of the thalweg under the northbound bridge had a water depth of 22 cm with velocities of approximately 65 cm/s. If river herring were to utilize this stream again and ascend to this crossing, they would have no difficulty negotiating the pools and riffles in the vicinity of these bridges.

Road crossing: US 1

Date evaluated: 04/25/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 25 cm

Velocity in culvert: ~ 90 cm/s

Notes: River herring historically ascended Neabsco Creek to some point well upstream of this crossing. However, river herring are no longer known to use this tributary, having last been seen in the vicinity of this bridge in 1982. If river herring were to utilize this stream again and ascend to this crossing, they would have no difficulty negotiating the riffle in the vicinity of this bridge (measurements at the shallowest portion of the thalweg are listed above).

UNNAMED TRIBUTARY

USGS topographic quadrangle: Occoquan, VA.

Tributary of: Neabsco Creek

Miles above mouth: 4.5

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that at one time, river herring used the lower 0.1 mile of this tributary for spawning. However, river herring are no longer known to ascend Neabsco Creek to the mouth of this tributary, so current usage of this tributary by river herring is doubtful. Shallows would prevent river herring from ascending farther than stream mile 0.1. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Neabsco Creek

Miles above mouth: 4.2

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that at one time, river herring used the lower 0.1 mile of this tributary for spawning. However, river herring are no longer known to ascend Neabsco Creek to the mouth of this tributary, so current usage of this tributary by river herring is doubtful. Shallows would prevent river herring from ascending farther than stream mile 0.1. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Neabsco Creek

Miles above mouth: 1.2

Use category: probable

Mileage open: 0.7

Migration obstruction: pipeline crossing

Narrative: It is probable that river herring use the tidal (lower 0.4 mile) portion of this tributary for spawning. This stream appears to have an unusual amount of bedload material (mostly sand) that results in numerous shallow riffles (~ 5 cm in depth as measured on 25 April 1988) in the free-flowing portion of the stream. Use of this tributary above stream mile 0.4 is unlikely due to these numerous shallows. As a liberal estimate, the upstream limit for river herring migrations was put at an impassable pipeline crossing at stream mile 0.7, immediately upstream of the Route 638 bridge. The stream drops approximately 45 cm as it flows over this pipeline, forming an impassable barrier to upstream movement of fish.

Structural Evaluations

Road crossing: Route 638

Date evaluated: 04/25/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 8 cm

Velocity in culvert: ~ 60 cm/s

Notes: It is unlikely that river herring would ever ascend upstream as far as this crossing due to numerous downstream shallows. If stream discharge was sufficient to permit river herring to negotiate the shallows (~ 5 cm on 25 April 1988) below this crossing, they would have no difficulty negotiating the shallows under this bridge. Immediately upstream of this bridge is a pipeline that the stream flows over, forming an impassable barrier.

Road crossing: Route 1392

Date evaluated: 04/25/88

Passage status: passable

Structure type: four-cell box

Size: ~ 3.0 m

Vertical drop: none

Depth in culvert: 19 cm

Velocity in culvert: ~ 60 cm/s

Notes: It is unlikely that river herring would ascend upstream as far as this crossing due to downstream shallows. If river herring were to ascend to this crossing, they would have no difficulty negotiating this culvert. On the date of evaluation, all discharge was through the left descending cell, the other three were partially obstructed with bedload (sand). All but the upper 10 m of the left cell had a water depth of approximately 30 cm; the upstream 10 m of the cell was shallower, with water depth decreasing to 19 cm at the inlet. The shallowest portion

of the thalweg in this culvert is considerably deeper than the natural shallows downstream of this crossing.

POWELLS CREEK

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 84.6

Use category: confirmed (D, L)

Mileage open: 6.9

Migration obstruction: unnamed dam

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. Walter Flory (retired from the Law Enforcement Division, VDGIF) stated that fishermen used to capture river herring in the vicinity of the power line crossing at stream mile 2.0, 0.8 mile downstream of US 1. Mr. Flory stated that the shallow braided stream channel and beaver dams above the power line crossing prevented fish from ascending farther than stream mile 2.0 during most years. Jesse R. Baldwin (former Prince William County resident and avid fisherman) spent his childhood and adolescence as a resident of Garfield Estates, overlooking Neabsco and Powells Creeks. Mr. Baldwin was very familiar with river herring runs in Powells Creek as a youngster and adolescent. He corroborated Mr. Flory's statement about the beaver dams and shallow braided stream channel preventing river herring from ascending much beyond the power line crossing (at stream mile 2.0) during most years. Mr. Baldwin added that in some years, conditions would permit river herring to ascend beyond the aforementioned barriers. When this happened, river herring ran well upstream of the US 1 crossing. He personally observed river herring upstream of a natural falls at stream mile 4.1 (~ 80 m upstream of the I-95 crossing). He doubted that river herring ascended farther than stream mile 4.8, stating that natural falls and beaver dams would deter them. Based on Mr. Baldwin's statements, we consider the river herring usage of Powells Creek above stream mile 4.8 as unlikely. However, due to the lack of definitive barriers, we put our estimate of the upstream limit for river herring at the base of an unnamed dam at stream mile 6.9 (~ 50 m upstream of the Route 1451 crossing). Water quality in this stream is good, and the stream contains numerous resident fishes (cyprinids, centrarchids, and darters).

Structural Evaluations

Road crossing: Route 1451

Date evaluated: 04/25/88

Passage status: questionably passable

Structure type: three-cell box

Size: ~ 3.0 m

Vertical drop: none

Depth in culvert: 4 cm

Velocity in culvert: ~ 120 cm/s

Notes: Due to the lack of a definitive downstream barrier, the upstream limit for river herring migrations in Powells Creek was estimated to be at the base of an unnamed dam located approximately 50 m upstream of this crossing. However, it is unlikely that river herring have ever ascended upstream as far as this crossing due to numerous downstream shallows, falls, and beaver dams. On the date of evaluation, stream discharge was low, and this culvert had

inadequate depth for river herring to negotiate (see measurements above). All three cells of this culvert had water flowing through them, with most of the discharge in the right descending cell. As a result, the right cell had the greatest water depth. The upper 65 m of the right cell had a water depth of 4-6 cm. The depth in the lower 20 m of the right cell increased to a maximum of 16 cm at the outlet (with velocities reduced to 40 cm/s). High discharge would be required for river herring to negotiate the downstream falls and shallows, and ascend to this culvert. As stream discharge is distributed in all three cells of this culvert, it is questionable if the right cell would have adequate depth and/or suitable velocities for river herring passage at higher flows. For this reason, we have classified this structure as questionably passable to river herring. It is recommended that this structure be re-evaluated during a period of relatively high base flows.

Road crossing: Route 1461

Date evaluated: 04/25/88

Passage status: passable

Structure type: three-cell box

Size: 3.4 X 3.0 m

Vertical drop: none

Depth in culvert: ~ 30 cm

Velocity in culvert: ~ 30 cm/s

Notes: Due to the lack of a definitive downstream barrier, the upstream limit for river herring migrations in Powells Creek was estimated to be at the base of an unnamed dam located approximately 1.1 mile upstream of this crossing. However, it is unlikely that river herring have ever ascended upstream as far as this crossing due to numerous downstream shallows, falls, and beaver dams. On the date of evaluation, stream discharge was low, and this culvert had adequate depth and suitable velocities for river herring to negotiate this structure with ease. However, a debris dam composed of logs and beaver cuttings was obstructing the inlet on the date of evaluation, forming a 30-cm high barrier to upstream migrations. In the absence of the debris dam, river herring could negotiate this structure, even at the low flows observed on 25 April 1988. The center cell was partially filled with sand, and all stream discharge was through the two outer cells, both of which were passable to river herring. The right descending cell had the greatest depth throughout its length, with the shallowest point being near the inlet (~ 30 cm).

Road crossing: I-95

Date evaluated: 04/25/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 40 cm/s

Notes: Given adequate discharge, river herring are known to ascend Powells Creek to some point upstream of this crossing. However, during most years, river herring migrations are blocked by shallows and beaver dams in the vicinity of stream mile 2.0, approximately 2.0 miles downstream of this crossing. On the date of evaluation, stream discharge was low, but the thalweg under these two bridges had adequate depth and suitable velocities for river herring passage. The above measurements were made at the shallowest part of the thalweg, under the southbound bridge.

Road crossing: US 1

Date evaluated: 04/25/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: Given adequate discharge, river herring are known to ascend Powells Creek to some point upstream of this crossing. However, during most years, river herring migrations are blocked by shallows and beaver dams in the vicinity of stream mile 2.0, approximately 0.8 mile downstream of this crossing. On the date of evaluation, stream discharge was low, but the thalweg under this bridge had adequate depth and suitable velocities for river herring passage.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Powells Creek

Miles above mouth: 1.4

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary (the lower 0.1 mile or so). It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

QUANTICO CREEK

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 81.2

Use category: confirmed (D, L)

Mileage open: 5.6

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. Stuart P. Doggett (Law Enforcement Division, VDGIF) stated that fishermen capture river herring in the vicinity of the US 1 crossing (stream mile 4.3-4.5). A local fisherman was interviewed as he stopped to check on the river herring runs at the Route 627 crossing (stream mile 4.9). He said that his favorite location to dip for river herring in Quantico Creek is at the base of the rocky rapids 20 m upstream of the Route 627 bridge. He explained that river herring have a difficult time ascending the rapids due to shallow water, resulting in a concentration of fish that are easily netted. He added that some of the river herring are successful at getting upstream of the rapids, but he was uncertain how much farther they went. Therefore, the senior author

walked from this point upstream to identify natural barriers to upstream migrations. A rock ledge falls at stream mile 5.4 would be passable to river herring if a large log presently wedged in place was absent. The log has blocked the passable chute on the left descending side, forcing the water to flow over it and drop vertically into the pool below. This log appears to have been in place for several years, and will likely remain so for many additional spawning seasons. In the event that this log was displaced, providing access to the stream above, river herring could only migrate upstream an additional 0.2 mile before encountering an impassable rock ledge falls at stream mile 5.6.

Structural Evaluations

Road crossing: Route 627

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 45 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to ascend Quantico Creek to some point upstream of this crossing. River herring would have no difficulty negotiating the stream under this bridge.

Road crossing: I-95

Date evaluated: 04/20/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: ~ 20 cm

Velocity in culvert: ~ 60 cm/s

Notes: River herring are known to ascend Quantico Creek to some point upstream of this crossing. On the date of evaluation, stream discharge was low. The above measurements are from the shallowest portion of the thalweg (a riffle) under the northbound bridge. The riffles under these bridges have sufficient depth and suitable velocities for river herring passage, as evidenced by river herring being observed upstream of here.

Road crossing: US 1 (southbound)

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 80 cm/s

Notes: River herring are known to ascend Quantico Creek to some point upstream of this crossing. On the date of evaluation, stream discharge was low. The above measurements are from the shallowest portion of the thalweg (a riffle) under this bridge. The riffle under this bridge has sufficient depth and suitable velocities for river herring passage, as evidenced by river herring being observed upstream of here. A pipeline crossing just upstream of this

bridge has the potential to impede river herring. On the date of evaluation, debris was trapped against the upstream end of the pipe, and bedload had shifted, filling in behind the debris blockage. Water was flowing under this pipe at just a few locations, and only one of these openings was large enough for river herring to swim through. Should these openings under the pipe become sealed, the water would flow over the pipe, forming a low falls that may impede upstream migrations.

Road crossing: US 1 (northbound)

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 30 cm

Velocity in culvert: ~ 50 cm/s

Notes: River herring are known to ascend Quantico Creek to some point upstream of this crossing. On the date of evaluation, stream discharge was low. The stream at this crossing may be influenced by the tide, but at the time of this evaluation, it was free flowing (no tidal influence). The stream under this bridge has sufficient depth and suitable velocities for river herring passage, as evidenced by river herring being observed upstream of here.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 5.3

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would use this small tributary for spawning due to shallows associated with steep gradient in the vicinity of the stream mouth. If river herring did enter this tributary they could ascend no farther than 10 m above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 3.7

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower tidal portion of this small tributary for spawning. It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.1. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 3.5

Use category: confirmed (L)

Mileage open: 0.2

Migration obstruction: highway culvert

Narrative: According to David L. Dodson (Law Enforcement Division, VDGIF), river herring ascend this tributary, and fishermen dip for them in the vicinity of the Route 633 culvert. Presently, a beaver dam would prevent most river herring from ascending upstream as far as the Route 633 crossing. If the beaver dam were absent, river herring could ascend up to the Route 633 culvert, an impassable structure at stream mile 0.2 (see the following description). If this culvert were modified to permit fish passage (and in the absence of beaver-related obstructions) river herring would ascend no more than 0.3 of an additional mile upstream (to stream mile 0.5) due to shallows. This stream is also known as Deweys Creek.

Structural Evaluations

Road crossing: Route 633

Date evaluated: 04/25/88

Passage status: impassable

Structure type: two CMPs

Size: ~ 1.2 m

Vertical drop: ~ 5 cm

Depth in culvert: 8 cm

Velocity in culvert: ~ 1.0 m/s

Notes: This culvert is impassable to river herring due to the vertical drop at the outlet, and shallow water within the pipes. On the date of evaluation, a downstream beaver dam was impounding water in the stream immediately below the outlet of this culvert. Visitations at several tide levels indicate that high tides do not elevate the water level in this stream enough to inundate the outlet of this culvert. If the beaver dam below this crossing were absent, the vertical drop at the culvert outlet would be greater than what is indicated above. On the date of evaluation, there was a beaver dam at the inlet of this culvert, also. Due to the barrier created by this culvert, river herring used to concentrate below the culvert outlet (prior to the construction of the downstream beaver dam), making this location a productive spot for dip netters.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 2.5

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower tidal portion of this small tributary for spawning. It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.2. The Route 633 culvert would be a barrier to upstream migrations of river herring at all times, except when high tide backs water up into the pipes. On 22 April 1988,between mid and high tide, river herring could have ascended upstream to the outlet of the Route 633 culvert, but the culvert pipes had inadequate depth for river herring to negotiate (5 cm). During high tide on 27 April 1988, water was backed up into this culvert, providing adequate depth for river herring passage. However, beaver dams at the culvert inlet would currently prevent river herring from ascending beyond the Route 633 crossing at high tide. If the beaver dams were absent, river herring could continue upstream at least as far as the tidal influence extended. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2.

Structural Evaluations

Road crossing: Route 633

Date evaluated: 04/27/88

Passage status: passable

Structure type: two concrete pipes

Size: ~ 2.0 m

Vertical drop: none

Depth in culvert: ~ 15 cm

Velocity in culvert: < 20 cm/s

Notes: This evaluation was made at high tide. The above measurements are from the culvert inlet; depth at the outlet was 25-30 cm. River herring can ascend the short reach of stream below this crossing from mid to high tide, but this culvert is only passable during high tide. When the tide does not back water up into this culvert, it has inadequate depth for the passage of river herring (water depth of 5 cm at the inlet on 22 April 1988). The inlets of both culvert pipes are currently blocked by impassable beaver dams, preventing river herring from ascending upstream of this crossing.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 1.9

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring use the lower tidal portion of this small tributary for spawning. Footpaths alongside the stream and a discarded herring dip net indicate that fishermen may dip for river herring in this tributary. It is unlikely that river herring would ascend much beyond the head of tide due to shallows, but we put the estimated upstream limit for river herring at stream mile 0.2. However, a beaver dam approximately 30 m upstream of the Route 633 crossing would presently block upstream migrations in the vicinity of stream mile 0.1.

Structural Evaluations

Road crossing: Route 633

Date evaluated: 04/22/88

Passage status: passable

Structure type: concrete pipe

Size: ~ 2.0 m

Vertical drop: none

Depth in culvert: 38 cm

Velocity in culvert: < 20 cm/s

Notes: This evaluation was made between mid and high tide. The above measurements were made at the pipe inlet, the shallowest portion of the culvert. River herring would have no difficulty negotiating this culvert between mid and high tide. It was not evaluated at low tide, but it is likely that this culvert (and the stream immediately below) would have inadequate depth for river herring passage at low tide. Stream-side footpaths and a discarded herring dip net upstream of this crossing indicate that river herring ascend upstream of this crossing.

LITTLE CREEK

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Quantico Creek

Miles above mouth: 0.4

Use category: probable

Mileage open: 0.7

Migration obstruction: stream morphology

Narrative: It is probable that river herring use this tributary for spawning. Currently, a beaver dam at stream mile 0.3 would likely impede upstream migrations of river herring. In the absence of this beaver dam, it is probable that river herring would continue upstream until shallow riffles impeded their progress. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.7. No highways cross the portion of stream that river herring would use. Both of the U.S. Marine Corps road crossings on the lower 0.7 mile of this stream are passable bridges.

CHOPAWAMSIC CREEK

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 78.5

Use category: confirmed (D, L)

Mileage open: 4.6

Migration obstruction: U.S. Marine Corps ford

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that fishermen capture river herring in the vicinity of the U.S. Marine Corps road crossings near the stream mouth (stream mile 0.1-0.2). We could not locate any individuals familiar with anadromous fish usage of this tributary upstream of stream mile 0.3. However, numerous beaver dams between stream miles 2.3 and 3.6 would block any upstream migrations from presently ascending above tidal influence. In the absence of beaver obstructions, it is probable that river herring would ascend this tributary as far as an impassable U.S. Marine Corps road crossing at stream mile 4.6. This road crossing structure is a ford composed of concrete slabs across the stream. Water flowing over the ford cascades down the nearly-vertical downstream edge of this concrete structure, dropping 35-40 cm. This steep drop was impassable on 20 April 1988, and would be so during most spawning seasons. For this reason, we assigned the upstream limit for river herring runs to this structure. It may be possible for river herring to ascend this barrier during certain periods of high discharge (a site evaluation during a period of high discharge would aid in this determination), in which case they could ascend an additional 0.6 mile to the base of the Nolan H. Gray Reservoir dam at stream mile 5.2. The two U.S. Marine Corps bridges near the stream mouth are passable to any anadromous fishes that may encounter them. The Russel Road bridge (U.S. Marine Corps structure) at stream mile 4.6 (immediately downstream of the impassable ford described above) is passable to river herring (the only anadromous species that would encounter it). There are no highway crossings between the Nolan H. Gray Reservoir dam and the impassable U.S. Marine Corps ford at stream mile 4.6.

Structural Evaluations

Road crossing: I-95

Date evaluated: 04/20/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: ~ 22 cm

Velocity in culvert: ~ 50 cm/s

Notes: In the absence of beaver obstructions, it is probable that river herring would ascend beyond this bridge. Downstream beaver dams presently block any river herring spawning migrations. Of the two bridges, the northbound bridge had the shallowest water under it (see measurements above). Stream discharge was low on the date of evaluation. The riffles downstream of, and underneath, the northbound bridge would be passable to any river herring that ascended to them.

Road crossing: US 1

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: In the absence of downstream beaver dams, it is probable that river herring would ascend beyond this bridge. Downstream beaver dams presently block any river herring spawning migrations. On the date of evaluation, the water level under this bridge appeared to be elevated as a result of a downstream beaver dam. In the absence of the beaver dam, it is probable that the stream under this bridge would be passable to river herring.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 3.6

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: If river herring ascended Chopawamsic Creek as far as the mouth of this tributary, it is probable that they would utilize the lower 0.1 mile of this small stream. Shallows would prevent river herring from ascending farther than stream mile 0.1. Presently, beaver dams would prevent river herring from ascending Chopawamsic Creek to the mouth of this tributary. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 2.9

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: If river herring ascended Chopawamsic Creek as far as the mouth of this tributary, it is probable that they would utilize the lower 0.1 mile of this small stream. Shallows would prevent river herring from ascending farther than stream mile 0.1. Presently, beaver dams would prevent river herring from ascending Chopawamsic Creek to the mouth of this tributary. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 2.6

Use category: probable

Mileage open: 0.5

Migration obstruction: stream morphology

Narrative: If river herring ascend Chopawamsic Creek as far as the mouth of this tributary, it is probable that they utilize the lower 0.5 mile of this small stream (the portion that meanders through the floodplain swamp of Chopawamsic Creek). Shallows would prevent river herring from ascending farther than stream mile 0.5. Presently, beaver dams may prevent river herring from ascending Chopawamsic Creek to the mouth of this tributary. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 2.5

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: If river herring ascend Chopawamsic Creek as far as the mouth of this tributary, it is probable that they utilize the lower 0.3 mile of this small stream (the portion that meanders through the floodplain swamp of Chopawamsic Creek). Shallows would prevent river herring from ascending farther than stream mile 0.3. Presently, beaver dams may prevent river herring from ascending Chopawamsic Creek to the mouth of this tributary. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 2.2

Use category: probable

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary (the lower 100 m or less). River herring could not ascend much beyond the head of tide due to shallows. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 1.9

Use category: probable

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary (the lower 100 m or less). River herring could not ascend much beyond the head of tide due to shallows. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Quantico, VA.-MD.

Tributary of: Chopawamsic Creek

Miles above mouth: 0.3

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this channelized tributary. River herring could not ascend much beyond the head of tide due to shallows; therefore, we put the estimated upstream limit for river herring at stream mile 0.3. No roads cross the portion of stream that river herring would use.

TANK CREEK

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 77.3

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary. River herring could not ascend much beyond the head of tide due to shallows; therefore, we put the estimated upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 76.3

Use category: confirmed (L)

Mileage open: 0.7

Migration obstruction: stream morphology

Narrative: Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that river herring ascend this tributary to spawn. Three local fishermen were interviewed regarding river herring runs in this stream; a synopsis of their independent statements follows. Apparently, a sand bar has developed at the mouth of this tributary in recent years, preventing river herring from ascending this stream except during high tide. As the tide recedes, the sand bar becomes exposed, and the stream discharge spreads out as it flows over (and percolates through) the sand delta. As a result, river herring runs in this stream have declined in recent years. River herring now enter this stream at high tide, ascending upstream of the Route 633 culvert (passable at high tide only) until shallows prevent them from going farther. In recent years, river herring have ascended no farther than stream mile 0.2 (0.1 mile upstream of the Route 633 culvert), but in the past when the fish were more numerous, they ran upstream to the vicinity of stream mile 0.5. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.7.

Structural Evaluations

Road crossing: Route 633

Date evaluated: 04/27/88

Passage status: passable

Structure type: two concrete pipes

Size: ~ 1.2 m

Vertical drop: none

Depth in culvert: 12 cm

Velocity in culvert: ~ 1.0 m/s

Notes: This evaluation was made when the tide was relatively high, and water was backed up into the outlets of the culvert pipes. Water depth at the outlet of the right descending pipe was 23 cm, with a velocity of approximately 50 cm/s. However, at the time of evaluation, the tidal influence did not extend upstream the entire length of the inclined pipes, so depth decreased towards the inlet. The upper meter or so of the right descending pipe was free flowing, with a depth of 12 cm, and a velocities of approximately 1.0 m/s. Although this is suboptimal for river herring passage, determined fish could negotiate this short reach of shallow water. All three fishermen that were interviewed remarked that river herring have no difficulty ascending through this culvert when the tide is high. However, when the tide recedes, these pipes may become a barrier to upstream movement of river herring. On 20 April 1988, when the tide was lower, the outlet of the right descending pipe had a depth of only 10 cm, with water velocities of approximately 2.0 m/s. It is doubtful that river herring would be successful at ascending the length of this pipe under these flow conditions. On both days that this structure was visited, stream discharge was low.

AQUIA CREEK

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 71.8

Use category: confirmed (D, L)

Mileage open: 11.7

Migration obstruction: Aquia Creek Dam (Smith Lake)

Narrative: Davis et al. (1970) reported that alosids spawn in this tributary. Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that American shad utilize the lower tidal portion of this tributary (presumably for spawning), and that there are strong spawning runs of river herring up to the base of Aquia Creek Dam (Smith Lake). Jesse R. Baldwin (former Prince William County resident and avid fisherman) confirmed that river herring ascend this stream to the base of Aquia Creek Dam, but remarked that the numbers of fish have declined substantially in recent years. J.S. Brent (Stafford County resident and fisherman) stated that river herring historically ascended Aquia Creek beyond the site of the existing Aquia Creek Dam, but he did not know how far upstream their range extended.

Structural Evaluations

Road crossing: I-95

Date evaluated: 04/20/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: 18 cm

Velocity in culvert: ~ 1.7 m/s

Notes: On the date of evaluation, stream discharge was low for the spring of the year. The shallowest portion of the thalweg under these two bridges is in a riffle at the upstream side of the southbound bridge (see measurements above). The shallowest portion of the thalweg under the northbound bridge had a depth of 40 cm, with velocities of approximately 50 cm/s. River herring would have no difficulty ascending the stream under these two bridges River herring are known to run upstream of this crossing.

Road crossing: US 1

Date evaluated: 04/19/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to run well upstream of this crossing. River herring can negotiate the stream at this bridge with ease. This is a popular location for fishermen to dip for river herring.

AUSTIN CREEK

USGS topographic quadrangle: Stafford, VA.

Tributary of: Aquia Creek

Miles above mouth: 6.9

Use category: confirmed (L)

Mileage open: 1.7

Migration obstruction: stream morphology

Narrative: J.S. Brent, Marvin Jett, and D.R. Lanew (Stafford County residents and fishermen) informed us that river herring used to ascend Austin Creek up to the vicinity of the US 1 crossings near stream mile 1.5. Mr. Brent said that river herring did not ascend much beyond the US 1 southbound crossing due to an increase in stream gradient and forking of the stream immediately above the crossing. As a liberal estimate, we put the upstream limit for river herring at stream mile 1.7, approximately 0.2 mile upstream of the US 1 southbound crossing. None of the three individuals listed above have observed river herring using this stream in recent years. Mr. Brent and Mr. Lanew stated independently that the decline in river herring runs up Austin Creek coincided with the installation of the sewage treatment plant that discharges in the vicinity of stream mile 0.9. In addition to the sewage discharge, extensive channel modification in the lower 1.0 mile of this stream, and beaver dams may have contributed to the decline of spawning runs in this tributary. On 19 April 1988, an impassable beaver dam was observed at stream mile 0.9, several meters upstream of the sewage outfall.

Structural Evaluations

Road crossing: US 1 (southbound)

Date evaluated: 04/19/88

Passage status: passable

Structure type: four-cell box

Size: ~ 2.6 X 3.2 m

Vertical drop: none

Depth in culvert: 17 cm

Velocity in culvert: ~ 80 cm/s

Notes: River herring are known to have ascended upstream of the site of this crossing. Historically, this was a popular dipping location for fishermen. On the date of evaluation, stream discharge was low, with all discharge flowing through the right descending cell; the other three cells were partially filled in. River herring would have no difficulty negotiating the stream through this culvert. On the date of evaluation, depth at the outlet was 24 cm (with maximum outlet velocity of ~ 50 cm/s), grading to a minimum depth of 17 cm at the inlet (with maximum inlet velocity of ~ 80 cm/s).

Road crossing: US 1 (northbound)

Date evaluated: 04/19/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring are known to have ascended upstream of this crossing. Historically, this was a popular dipping location for fishermen. River herring would have no difficulty negotiating the stream under this bridge.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Stafford, VA.

Tributary of: Austin Creek **Miles above mouth:** 1.5

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: Historically, river herring ascended Austin Creek to the mouth of this tributary. It is probable that river herring utilized the lower 0.1 mile or less of this tributary, but as a liberal estimate, we put their upstream limit at stream mile 0.2. No roads cross the portion of stream that river herring would use. To aid in identifying this tributary, it joins Austin Creek immediately upstream of the US 1 southbound crossing.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Stafford, VA.

Tributary of: Austin Creek **Miles above mouth:** 1.5

Use category: unlikely **Mileage open:** < 0.1

Migration obstruction: stream morphology

Narrative: Historically, river herring ascended Austin Creek to the the mouth of this tributary, but it is unlikely that river herring utilized this small tributary due to shallows near the stream mouth. If river herring did enter this tributary they could ascend no farther than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use. To aid in locating this tributary, it flows down through the old Stafford Wayside, adjacent to US 1.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Aquia Creek **Miles above mouth:** 4.8

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary (0.1 mile or less). River herring could not ascend much beyond the head of tide due to shallows. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Aquia Creek **Miles above mouth:** 3.7

Use category: probable **Mileage open:** 0.6

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary (0.4 mile or less). River herring could not ascend much beyond the head of tide due to shallows. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.6, provided the Richmond Fredericksburg and Potomac Railroad culvert (at stream mile 0.5) was passable. The photorevised (1978) USGS 7.5 minute topographic map indicates that there is a recent small impoundment immediately upstream of the railroad culvert, suggesting a beaver dam. Due to time limitations and poor access, the possible obstruction at this railroad crossing was not investigated. No roads cross the portion of stream that river herring would use.

BOARS CREEK

USGS topographic quadrangle: Widewater, VA.-MD.

Tributary of: Aquia Creek **Miles above mouth:** 3.4

Use category: probable **Mileage open:** 0.8

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary (0.6 mile or less). River herring could not ascend much beyond the head of tide due to shallows. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.8. No highways cross the portion of stream that river herring would use.

POTOMAC CREEK

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 68.9

Use category: confirmed (D, L)

Mileage open: 13.2

Migration obstruction: Abel Lake Dam

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that fisherman dip for river herring between stream miles 7.2 and 7.7. J.S. Brent (Stafford County resident and fisherman) spent his childhood and adolescence living near the site of Abel Lake Dam. Mr. Brent told us that in the mid 1950's, he would catch bushels of river herring (with a dip net) from the portion of Potomac Creek between the Route 627 bridge (stream mile 12.5) and the site of Abel Lake Dam (stream mile 13.2). He said that river herring continued upstream of the site of the presently existing Abel Lake Dam. Mr. Brent remarked that river herring runs in this stream have declined since his childhood, and the fish do not run upstream nearly as far as they once did, stopping several miles downstream of the Route 627 crossing. Several local fishermen and landowners remarked that river herring still ascend Potomac Creek to the vicinity of the Richmond Fredericksburg and Potomac Railroad bridge at stream mile 7.9, but the fish are not as numerous as they used to be. M.J. Morgan (riparian landowner that lives adjacent to the Route 626 crossing) told us that most river herring runs during a given spawning season no longer extend upstream beyond the Richmond Fredericksburg and Potomac Railroad bridge; however, on one or two days out of the spawning season, some river herring continue upstream at least as far as the Route 626 bridge, but not in sufficient numbers to attract fishermen. We assigned the upstream limit for river herring to the base of Abel Lake Dam, as it is within their historical range.

Structural Evaluations

Road crossing: Route 627

Date evaluated: 03/23/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: In the 1950's, river herring used to ascend Potomac Creek to some point well upstream of this crossing. River herring would have no difficulty negotiating the stream under this bridge.

Road crossing: I-95

Date evaluated: 03/23/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: ~ 30 cm

Velocity in culvert: ~ 40 cm/s

Notes: In the 1950's, river herring used to ascend Potomac Creek to some point well upstream of this crossing. River herring would have no difficulty negotiating the stream under these bridges. The above measurements are from the shallowest portion of the thalweg, on the downstream side of the southbound bridge. Natural riffles downstream of this crossing have depths of 20-25 cm.

Road crossing: US 1

Date evaluated: 03/23/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: In the 1950's, river herring used to ascend Potomac Creek to some point well upstream of this crossing. River herring would have no difficulty negotiating the stream under this bridge.

Road crossing: Route 626

Date evaluated: 03/23/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 25 cm

Velocity in culvert: ~ 40 cm/s

Notes: In recent years, river herring have ascended up to the vicinity of this crossing. The riffle under this bridge has adequate water depth and suitable velocities for river herring to negotiate without difficulty (see measurements above).

Road crossing: Route 608

Date evaluated: 03/23/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring have no difficulty ascending beyond this crossing every spawning season.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Stafford, VA.

Tributary of: Potomac Creek

Miles above mouth: 11.7

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It appears that river herring no longer ascend Potomac Creek as far as the mouth of this tributary. However, it is probable that river herring historically utilized the lower 0.1

mile of this tributary. Shallows riffles associated with stream gradient would prevent them from ascending much farther. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 10.1

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: If river herring presently ascend Potomac Creek as far as the mouth of this tributary (historically they did), then it is probable that they utilize the lower 0.1 mile of this tributary. Shallows riffles associated with stream gradient would prevent them from ascending much farther. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 9.7

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: If river herring presently ascend Potomac Creek as far as the mouth of this tributary (historically they did), then it is probable that they utilize the lower 100 m of this tributary. Shallows riffles associated with stream gradient would prevent them from ascending much farther. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.1. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 8.4

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend this small tributary to spawn. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 7.9

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the lower 0.1 mile of this tributary. Shallows riffles associated with stream gradient would prevent them from ascending much farther. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 7.7

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring would ascend this tributary to spawn due to shallows associated with gradient near the stream mouth. If they did enter this stream, shallows would prevent river herring from ascending more than a few meters above the stream mouth. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 7.2

Use category: probable

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the lower 0.4 mile of this small stream (the portion that meanders through the floodplain swamp of Potomac Creek). Shallows would prevent river herring from ascending farther than stream mile 0.4. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 6.6

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the lower 0.3 mile of this small stream (the portion that meanders through the floodplain swamp of Potomac Creek). Shallows would prevent river herring from ascending farther than stream mile 0.3. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Fredericksburg, VA.

Tributary of: Potomac Creek

Miles above mouth: 5.8

Use category: confirmed (L)

Mileage open: 0.7

Migration obstruction: stream morphology

Narrative: Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that river herring ascend the tidal portion of this small tributary, where they are captured near stream mile 0.5 by fishermen using dip nets. Shallows prevent river herring from ascending much beyond the head of tide, but to be liberal, we put their upstream limit at stream mile 0.7. No roads cross the portion of stream that river herring use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac Creek

Miles above mouth: 5.0

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this tributary. Shallows would prevent river herring from ascending much beyond the head of tide, but to be liberal, we put their upstream limit at stream mile 0.6. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac Creek

Miles above mouth: 4.9

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the tidal portion of this small tributary. Shallows would prevent river herring from ascending much beyond the head of tide, but to be liberal, we put their upstream limit at stream mile 0.2. No roads cross the portion of stream that river herring would use.

BEAVERDAM RUN

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac Creek

Miles above mouth: 2.3

Use category: probable

Mileage open: 1.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring spawn in the lower 0.8 mile of this tributary. Use of this tributary above stream mile 0.8 is unlikely due to shallows, but as a liberal estimate, we put the upstream limit for river herring at stream mile 1.2. No roads cross the portion of stream that river herring would use.

BLACK SWAMP BRANCH

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac Creek

Miles above mouth: 2.1

Use category: confirmed (L)

Mileage open: 0.9

Migration obstruction: stream morphology

Narrative: The senior author encountered a former commercial fisherman that used to catch river herring (with a dip net) in this tributary. A family member owned property along this stream, giving him access to the lower end, where the spawning runs occurred. The fisherman informed us that river herring runs stopped well downstream of the Route 600 crossing, and remarked that our estimated upstream limit for river herring (0.1 mile downstream of the Route 600 crossing) was liberal. No roads cross the portion of stream that river herring would use.

ACCOKEEK CREEK

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac Creek

Miles above mouth: 1.0

Use category: confirmed (D, L)

Mileage open: 8.0

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids utilize this tributary for spawning. Stuart P. Doggett (Law Enforcement Division, VDGIF) informed us that fishermen dip for river herring in the vicinity of stream mile 1.6. J.S. Brent and M. Jett (Stafford County residents and fishermen) told us that in the 1950's and 1960's, river herring runs extended up this stream to the vicinity of the Richmond Fredericksburg and Potomac Railroad crossing at stream mile 6.5. Both individuals stated independently that river herring did not ascend much above the railroad crossing due to an increase in stream gradient in that vicinity. As a liberal estimate, we put the upstream limit at stream mile 8.0, where the gradient exhibits a significant increase. However, beaver dams between stream mile 3.5 and the Route 609 bridge (stream mile 4.7) now prevent river herring from ascending above tidewater. Intensive trapping by a local resident has reduced the beaver population in recent years, and some of the older beaver dams have since washed out. Nevertheless, several impassable beaver dams remain in place, continuing to block river herring from ascending to historical spawning grounds.

Structural Evaluations

Road crossing: Route 608

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: ~ 40 cm

Velocity in culvert: ~ 30 cm/s

Notes: River herring historically ascended to some point upstream of this crossing. However, downstream beaver dams now prevent river herring from ascending up to this bridge. River herring would have no difficulty negotiating the stream under this bridge.

Road crossing: Route 609

Date evaluated: 04/20/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: 24 cm

Velocity in culvert: ~ 2.0 m/s

Notes: River herring historically ascended to some point upstream of this crossing. However, downstream beaver dams now prevent river herring from ascending up to this bridge. River herring would have no difficulty negotiating the stream under this bridge. Most of the stream under this bridge has water depths exceeding 50 cm, and velocities of less than 50 cm/s. Debris wedged against one of the bridge supports blocks the thalweg, forcing most of the discharge to flow over some riprap. This creates a short riffle (~ 1.0 m in length) with a minimum depth of 24 cm and velocities of approximately 2.0 m/s. River herring would have no difficulty negotiating this short reach of fast water.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Stafford, VA.

Tributary of: Accokeek Creek

Miles above mouth: 7.9

Use category: unlikely

Mileage open: < 0.1

Migration obstruction: stream morphology

Narrative: It is unlikely that river herring historically ascended Accokeek Creek as far as the mouth of this tributary. If they did, it is unlikely that river herring would have ascended this small tributary to spawn due to shallows which would prevent river herring from ascending more than a few meters upstream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 68.6

Use category: probable

Mileage open: 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring ascend and spawn in the tidal portion of this small tributary. River herring could not ascend much beyond the head of tide due to shallows, but as a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. No roads cross the portion of stream that river herring would use.

PASSAPATANZY CREEK

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 68.2

Use category: probable **Mileage open:** 2.0

Migration obstruction: stream morphology

Narrative: None of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). However, Davis et al. (1970) found evidence that alosids spawn in tributaries that flow into the Potomac River as far downstream as River Mile 37.9 (Popes Creek). Therefore, it is probable that river herring utilize this tributary for spawning. Due to the flat gradient of this stream, it may be possible for river herring to ascend well upstream of tidal influence (in the absence of beaver dams). As a liberal estimate, we put the upstream limit for river herring at the confluence of a significant tributary at stream mile 2.0. No roads cross the portion of stream that river herring would use.

DIRT BRIDGE RUN

USGS topographic quadrangle: Passapatanzy, VA.-MD.

Tributary of: Passapatanzy Creek **Miles above mouth:** 0.5

Use category: probable **Mileage open:** 1.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring utilize this tributary of Passapatanzy Creek for spawning. Due to the flat gradient of this stream, it may be possible for river herring to ascend well upstream of tidal influence (in the absence of beaver dams). As a liberal estimate, we put the upstream limit for river herring at stream mile 1.2, approximately 0.1 mile downstream of the Route 218 crossing. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 67.5

Use category: unlikely **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: Due to this stream's small drainage area, it is unlikely that the tidal portion of this tributary has salinities suitable for the spawning of anadromous species. In addition, the

stream above tidal influence is too shallow for even river herring to ascend. Therefore, it is unlikely that anadromous fish spawn in this small tributary. If river herring were to enter this stream, they could ascend no more than 0.1 mile due to shallows. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 66.5

Use category: unlikely **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: Due to this stream's small drainage area, it is unlikely that the tidal portion of this tributary has salinities suitable for the spawning of anadromous species. In addition, the stream above tidal influence is too shallow for even river herring to ascend. Therefore, it is unlikely that anadromous fish spawn in this small tributary. If river herring were to enter this stream, they could ascend no more than 0.1 mile due to shallows. No highways cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 63.9

Use category: probable **Mileage open:** 0.7

Migration obstruction: stream morphology

Narrative: None of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). However, Davis et al. (1970) found evidence that alosids spawn in tributaries that flow into the Potomac River as far downstream as River Mile 37.9 (Popes Creek). Therefore, it is probable that river herring utilize this tributary for spawning. It is unlikely that river herring would ascend above tidewater due to shallows, but as a liberal estimate, we put the upstream limit for river herring at stream mile 0.7. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Unnamed tributary **Miles above mouth:** 0.4

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: It is probable that river herring utilize the lower tidal portion of this tributary. Shallows would limit river herring usage of this stream to the lower 0.2 mile. No roads cross the portion of stream that river herring would use.

CHOTANK CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 58.8

Use category: confirmed (D) **Mileage open:** 3.7

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). Anadromous fish use would be restricted to the tidewater portion of this tributary due to shallows. Therefore, we put the upstream limit (for river herring) at stream mile 3.7, provided that the private road crossings at stream miles 3.0 and 2.4 are passable. Due to difficult access, these private crossings were not visited. There is a possibility that the earthen causeways associated with these private crossings may be used as dams, forming low-head impoundments. If this is true, than the upstream limit would have to be modified to reflect these barriers to upstream movement of fish. No highways cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Chotank Creek **Miles above mouth:** 2.0

Use category: probable **Mileage open:** 0.6

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Chotank Creek. Therefore, it is probable that river herring spawn in the tidewater portion of this small tributary. River herring could not ascend above tidewater due to shallows. Consequently, we put the upstream limit for river herring at stream mile 0.6. No highways cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Chotank Creek

Miles above mouth: 1.3

Use category: probable

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Chotank Creek. Therefore, it is probable that river herring spawn in the tidewater portion of this tributary. River herring could not ascend much above tidewater due to shallows. Consequently, we put the upstream limit for river herring at stream mile 0.4. No roads cross the portion of stream that river herring would use.

GAMBO CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 48.0

Use category: confirmed (D)

Mileage open: 3.5

Migration obstruction: highway culvert

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). It would be possible for river herring to ascend Gambo Creek as far as the US 301 culvert, an impassable structure at stream mile 3.5. This culvert is located immediately upstream of the normal tidal fluctuations, and on 12 April 1988, it had inadequate depth to permit river herring to pass. This culvert may be negotiable to river herring on days with unusually high tides. In addition, there is an impassable beaver dam at the inlet to this culvert. If this culvert were modified to permit fish passage, and in the absence of beaver dams, it is possible that river herring could ascend an additional 0.9 mile upstream to stream mile 4.4 (our liberal estimate of the upstream limit for river herring). A U.S. Navy culvert immediately downstream of the US 301 crossing is impassable at most times due to inadequate depth, but at high tide, water backs up into this structure, providing enough depth for river herring to negotiate the structure. Anadromous fish usage of this tributary should be monitored to ascertain if the US 301 culvert is indeed a blockage to spawning migrations. This would help determine if modification of the existing structure for fish passage is recommended.

Structural Evaluations

Road crossing: Route 635

Date evaluated: 04/12/88

Passage status: passable (?)

Structure type: two CMPs

Size: ~ 90 cm

Vertical drop: none

Depth in culvert: ~ 80 cm

Velocity in culvert: < 20 cm/s

Notes: In the absence of downstream obstructions (beaver dams and the US 301 culvert), it may be possible for river herring to ascend upstream to this structure. On the date of evaluation, a downstream beaver dam was impounding water into this culvert. This structure needs to be re-evaluated in the future when the downstream beaver is absent, permitting the stream at this culvert to be free-flowing.

Road crossing: US 301

Date evaluated: 04/12/88

Passage status: impassable

Structure type: two-cell box

Size: ~ 1.8 m

Vertical drop: none

Depth in culvert: ~ 5 cm

Velocity in culvert: ~ 60 cm/s

Notes: This culvert appears to be immediately upstream of the normal tidal influence. River herring could ascend the U.S. Navy culvert immediately downstream of the US 301 crossing during high tide only (the U.S. Navy culvert is impassable at lower tides due to shallow water). On 12 April 1988 at high tide, water depth in the US 301 culvert was approximately 5 cm at the inlet, grading to a depth of approximately 25 cm at the outlet. It appears that normal high tides do not increase the water depth in the US 301 culvert sufficiently to permit river herring to ascend the length of this structure. Unusually high tides may increase water depth the entire length of this culvert, allowing river herring to negotiate this crossing. Anadromous fish usage of this tributary should be monitored to ascertain if the US 301 culvert is indeed a blockage to spawning migrations. This would help determine if modification of the existing structure is desirable. On the date of evaluation, an impassable beaver dam was observed at the inlet to the US 301 culvert. The vegetation associated with the upstream beaver pond indicates that this beaver dam has been in existence for several years.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Gambo Creek

Miles above mouth: 0.9

Use category: probable

Mileage open: 1.0

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Gambo Creek. Therefore, it is probable that river herring spawn in the tidewater portion of this small tributary. River herring could not ascend much above tidewater due to shallows. Consequently, we put the upstream limit for river herring at stream mile 1.0. No highways cross the portion of stream that river herring would use.

UPPER MACHODOC CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 47.3

Use category: confirmed (D)

Mileage open: 15.4

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). Due to the large drainage area and flat gradient of this stream, it would be possible for at least river herring to ascend several miles upstream of tidewater. As a liberal estimate, we put the upstream limit for river herring at stream mile 15.4, approximately 0.1 mile upstream of the Route 611 crossing. However, numerous beaver dams would presently block upstream migrations of fish somewhere between the Route 611 crossing (stream mile 15.3) and the confluence of Pepper Mill Creek (stream mile 11.3).

Structural Evaluations

Road crossing: Route 611

Date evaluated: 04/21/88

Passage status: passable

Structure type: one-cell box

Size: ~ 1.7 m

Vertical drop: none

Depth in culvert: ~ 40 cm

Velocity in culvert: < 20 cm/s

Notes: In the absence of downstream beaver dams, it may be possible for river herring to ascend as far as this crossing. Presently, numerous downstream beaver dams would prevent river herring from ascending this far upstream. On the date of evaluation, a small beaver dam downstream was impounding water in this culvert, increasing the water depth 10-20 cm more than if the stream were free-flowing. If the downstream beaver dam were absent, this culvert would still have adequate depth for river herring to negotiate.

Road crossing: US 301

Date evaluated: 04/12/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that river herring ascend Upper Machodoc Creek as far as this crossing. River herring would have no difficulty negotiating the stream under these bridges.

Road crossing: Route 616

Date evaluated: 04/21/88

Passage status: passable

Structure type: three-cell box

Size: see below

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that river herring ascend Upper Machodoc Creek as far as this crossing. River herring would have no difficulty negotiating the stream in this culvert. Unfortunately, the senior author failed to record the dimensions of the culvert cells during field work.

Road crossing: Route 218

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that alosids ascend Upper Machodoc Creek as far as this crossing. The stream under this bridge is passable to any anadromous fish species.

PEPPER MILL CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Upper Machodoc Creek

Miles above mouth: 11.3

Use category: probable

Mileage open: 6.3

Migration obstruction: stream morphology

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Upper Machodoc Creek. Therefore, it is probable that river herring ascend Upper Machodoc Creek as far as the mouth of this tributary, and ascend this stream to spawn. Due to its large drainage area and flat gradient, this stream lacks any definitive barriers in the lower end. Consequently, we estimated that in the absence of beaver dams, river herring may be able to ascend upstream to the vicinity of stream mile 6.3 before shallows would block them. Presently, beaver dams would likely stop river herring between the Route 610 crossing (stream mile 4.3) and the Route 206 bridge (stream mile 1.5).

Structural Evaluations

Road crossing: Route 610

Date evaluated: 04/21/88

Passage status: passable (?)

Structure type: one CMP

Size: ~ 1.3 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: In the absence of downstream beaver dams, it is probable that river herring could ascend as far as this crossing. Presently, downstream beaver dams would likely prevent river herring from ascending this far upstream. On the date of evaluation, the outlet of this old culvert was submerged, and the inlet was filled to within 30 cm of the top. If river herring were not confused by this submerged pipe, they would have no difficulty negotiating the deep and slow water in this pipe. This culvert is old and in poor shape; in addition, it appears to be inadequate for a stream of this size.

Road crossing: Route 206

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that river herring ascend Pepper Mill Creek as far as this crossing. River herring would have no difficulty negotiating the stream under this bridge. A Department of Transportation road sign at this crossing states that the name of the stream at this bridge is "Lord Culpeper Stream".

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Pepper Mill Creek

Miles above mouth: 5.6

Use category: probable

Mileage open: 0.1

Migration obstruction: stream morphology

Narrative: If river herring were to ascend Pepper Mill Creek as far as the mouth of this tributary, it is probable that they would utilize the lower 100 m of this small tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.1. Presently, beaver dams on Pepper Mill Creek would prevent river herring from ascending upstream to the mouth of this stream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: King George, VA.-MD.

Tributary of: Pepper Mill Creek

Miles above mouth: 3.9

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: If river herring were to ascend Pepper Mill Creek as far as the mouth of this tributary, it is probable that they would utilize the lower 0.1 mile of this small tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.2. Presently, beaver dams on Pepper Mill Creek would likely prevent river herring from ascending upstream to the mouth of this stream. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Upper Machodoc Creek **Miles above mouth:** 10.6

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Upper Machodoc Creek. Therefore, it is probable that river herring ascend Upper Machodoc Creek as far as the mouth of this tributary, and ascend this small stream to spawn. Shallows would restrict river herring use of this stream to the lower 0.2 mile. No roads cross the portion of stream that river herring would use.

POPLAR NECK CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Upper Machodoc Creek **Miles above mouth:** 6.8

Use category: probable **Mileage open:** 0.8

Migration obstruction: highway culvert

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Upper Machodoc Creek. Therefore, it is probable that river herring ascend Upper Machodoc Creek as far as the mouth of this tributary, and ascend this stream to spawn. River herring could ascend this stream as far as the Route 617 crossing, an impassable structure at stream mile 0.8. On 21 April 1988, the Route 617 culvert had inadequate water depth for the passage of river herring. In addition, there was an impassable beaver dam at the inlet of the culvert. If this culvert were modified to permit fish passage, and in the absence of beaver dams, it is possible that river herring could ascend an additional 0.3 mile upstream to stream mile 1.1 (our liberal estimate of the upstream limit for river herring). Shallows would prevent river herring from ascending beyond stream mile 1.1.

Structural Evaluations

Road crossing: Route 617

Date evaluated: 04/21/88

Passage status: impassable

Structure type: one-cell box

Size: ~ 3.0 m

Vertical drop: none

Depth in culvert: 7 cm

Velocity in culvert: ~ 60 cm/s

Notes: It is probable that river herring ascend as far as this culvert. On the date of evaluation, this culvert had inadequate water depth for the passage of river herring. In addition, there was an impassable beaver dam (2.0 m or more in height) at the culvert inlet. If this culvert were modified to permit fish passage, and in the absence of beaver dams, it is possible that river herring could ascend an additional 0.3 mile upstream to stream mile 1.1 (our liberal estimate of the upstream limit for river herring). Shallows would prevent river herring from ascending beyond stream mile 1.1.

DEEP CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Upper Machodoc Creek

Miles above mouth: 2.0

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Upper Machodoc Creek. Therefore, it is probable that river herring ascend Upper Machodoc Creek as far as the mouth of this tributary, and they may utilize the tidal portion of this small tributary, provided the tidewater is not too saline. To be liberal, we assumed that salinities in this tributary are suitable for river herring, and have designated this stream as a probable spawning tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.6. Shallows would prevent river herring from ascending beyond stream mile 0.6.

Structural Evaluations

Road crossing: Route 615

Date evaluated: 04/12/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: If salinities in the tidal portion of this tributary are suitable for river herring spawning, then it is probable that river herring ascend as far as this crossing. River herring would have no difficulty negotiating the stream under this bridge.

WILLIAMS CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Upper Machodoc Creek

Miles above mouth: 1.6

Use category: probable

Mileage open: 2.8

Migration obstruction: stream morphology

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Upper Machodoc Creek. Therefore, it is probable that alosids ascend Upper Machodoc Creek as far as the mouth of this tributary, and ascend the tidal portion of this stream to spawn. River herring could ascend upstream as far as stream mile 2.8 before shallows would impede their progress.

Structural Evaluations

Road crossing: US 301

Date evaluated: 04/12/88

Passage status: passable

Structure type: two bridges

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that alosids ascend Williams Creek as far as this crossing. The stream under these bridges is passable to any anadromous fishes that ascend this far.

Road crossing: Route 206

Date evaluated: 04/12/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that alosids ascend Williams Creek as far as this crossing. The stream under this bridge is passable to any anadromous fishes that ascend this far.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Williams Creek

Miles above mouth: 1.4

Use category: probable

Mileage open: 0.6

Migration obstruction: stream morphology

Narrative: If river herring ascend Williams Creek to spawn, it is probable that they utilize the tidal portion (lower 0.6 mile) of this small tributary, also. Shallows would prevent river herring from ascending beyond stream mile 0.6. No roads cross the portion of stream that river herring would use.

BLACK MARSH

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 46.6

Use category: probable

Mileage open: 0.8

Migration obstruction: stream morphology

Narrative: None of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). However, Davis et al. (1970) found evidence that alosids spawn in tributaries that flow into the Potomac River as far downstream as River Mile 37.9 (Popes Creek). Therefore, it is probable that river herring utilize the tidal portion of this tributary for spawning, provided the tidewater is not too saline. To be liberal, we assumed that salinities in this tributary are suitable for river herring, and have designated this stream as a probable spawning tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 0.8. Shallows would prevent river herring from ascending beyond stream mile 0.8. No roads cross the portion of stream that river herring would use.

ROSIER CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 44.7

Use category: confirmed (D)

Mileage open: 3.2

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs

in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). It would be possible for at least river herring to ascend the entire length of this tidewater stream. No roads cross this tributary.

PINE HILL CREEK

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Rosier Creek

Miles above mouth: 3.2

Use category: probable

Mileage open: 2.4

Migration obstruction: unnamed dam

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Rosier Creek. Therefore, it is probable that river herring ascend Rosier Creek as far as the mouth of this tributary, and ascend this stream to spawn. River herring could ascend this tributary to the base of an impassable unnamed dam at stream mile 2.4 (1.9 miles upstream of the Route 205 crossing).

Structural Evaluations

Road crossing: Route 205

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: River herring would have no difficulty negotiating the stream under this bridge.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Dahlgren, VA.-MD.

Tributary of: Rosier Creek

Miles above mouth: 3.2

Use category: probable

Mileage open: 0.4

Migration obstruction: stream morphology

Narrative: None of the local residents that were interviewed knew of river herring using this tributary. However, Davis et al. (1970) found evidence that alosids spawn in Rosier Creek. Therefore, it is probable that river herring ascend Rosier Creek as far as the mouth of this tributary, and ascend this stream to spawn. As a liberal estimate, we put the upstream limit

for river herring at stream mile 0.4; shallows would prevent river herring from ascending farther. Presently, beaver dams would prevent river herring from ascending as far as the Route 205 crossing (stream mile 0.2). An old dam immediately upstream of the Route 205 crossing has washed out and would not impede upstream fish passage.

Structural Evaluations

Road crossing: Route 205

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge (?)

Size: -

Vertical drop: none

Depth in culvert: > 1.0 m

Velocity in culvert: < 20 cm/s

Notes: Due to the depth of water in the stream under this crossing, we could not determine for certain if this structure was a bridge; it could be a one-cell box culvert. On the date of evaluation, a beaver dam 20 m downstream was impounding water under this crossing. In the absence of downstream beaver dams, the stream under this crossing would have adequate depth and suitable velocities for the passage of river herring. Presently, downstream beaver dams would prevent river herring from ascending to this crossing.

GOLDMAN CREEK

USGS topographic quadrangle: Colonial Beach North, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 44.7

Use category: probable

Mileage open: 1.0

Migration obstruction: stream morphology

Narrative: None of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). However, Davis et al. (1970) found evidence that alosids spawn in tributaries that flow into the Potomac River as far downstream as River Mile 37.9 (Popes Creek). Therefore, it is probable that river herring utilize the lower tidal portion of this tributary for spawning, provided the tidewater is not too saline. To be liberal, we assumed that salinities in this tributary are suitable for river herring, and have designated this stream as a probable spawning tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 1.0; shallows would prevent river herring from ascending farther.

Structural Evaluations

Road crossing: Route 205

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: ~ 25 cm/s

Notes: River herring would have no difficulty negotiating the stream under this bridge.

MONROE BAY

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 41.6

Use category: confirmed (D)

Mileage open: 1.6

Migration obstruction: none

Narrative: Davis et al. (1970) reported that alosids spawn in Monroe Creek, indicating that alosids ascend the entire length of this tributary. No roads cross this tributary.

MONROE CREEK

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Monroe Bay

Miles above mouth: 1.6

Use category: confirmed (D)

Mileage open: 3.0

Migration obstruction: highway culvert

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). Given adequate stream discharge, it would be possible for river herring to ascend upstream of tidewater to the Route 658 crossing, an impassable culvert at stream mile 3.0 (see the following description). If the Route 658 culvert were modified for fish passage, river herring could ascend upstream an additional 0.6 mile, to stream mile 3.6 (our liberal estimate of the upstream limit for river herring), where shallows would prevent them from going farther.

Structural Evaluations

Road crossing: Route 628

Date evaluated: 04/21/88

Passage status: passable

Structure type: concrete pipe

Size: ~ 1.5 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: In the absence of the downstream blockage created by the Route 658 culvert, river herring may ascend upstream as far as this crossing. On the date of evaluation, river herring could have negotiated this culvert with ease.

Road crossing: Route 658

Date evaluated: 04/21/88

Passage status: impassable

Structure type: five CMPs

Size: ~ 1.4 m

Vertical drop: none

Depth in culvert: 6 cm

Velocity in culvert: ~ 150 cm/s

Notes: On the date of evaluation, stream discharge was low. It is probable that river herring may ascend upstream as far as this crossing given adequate stream discharge, but none of the local residents that were interviewed were aware of river herring runs in this stream. On the date of evaluation, four of the five pipes in this new culvert had water flowing through them. The three right descending pipes (two of which had water flow) had small vertical drops at their outlets. The two left descending pipes had no vertical drops at their outlets, but water depth in these pipes was too shallow for river herring to negotiate. The inlets of the left pipes had water depths of 19 cm and velocities of approximately 30 cm/s, but depth decreased to 6 cm at the outlets as the water accelerated to approximately 1.5 m/s in these inclined pipes. It is unlikely that river herring could negotiate this crossing at higher flows due to the number of pipes and the gradient in this culvert. If this structure were modified for upstream passage, river herring could possibly ascend an additional 0.6 mile upstream.

MATTOX CREEK

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Potomac River

Miles above mouth: 40.5

Use category: confirmed (D)

Mileage open: 9.6

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). Due to the large drainage area and flat gradient of this stream, it

would be possible for at least river herring to ascend several miles upstream of tidewater. As a liberal estimate, we put the upstream limit for river herring at stream mile 9.6, approximately 0.7 mile upstream of the Route 628 crossing. The dam immediately upstream of the Route 628 crossing is washed out, making it passable to river herring. Shallows would prevent river herring from ascending beyond stream mile 9.6.

Structural Evaluations

Road crossing: Route 628

Date evaluated: 04/21/88

Passage status: passable

Structure type: three-cell box

Size: ~ 3.5 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: If river herring ascend as far as this crossing, they would have no difficulty negotiating this culvert.

Road crossing: Route 627

Date evaluated: 04/21/88

Passage status: passable

Structure type: two-cell box

Size: ~ 2.5 m

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: If river herring ascend as far as this crossing, they would have no difficulty negotiating this culvert.

Road crossing: Route 205

Date evaluated: 04/21/88

Passage status: passable

Structure type: bridge

Size: -

Vertical drop: none

Depth in culvert: > 50 cm

Velocity in culvert: < 20 cm/s

Notes: It is probable that spawning alosids ascend as far as this crossing. The stream under this bridge is passable to any anadromous fish that would ascend this far.

KINGS MILL CREEK

USGS topographic quadrangle: Rollins Fork, VA.

Tributary of: Mattox Creek

Miles above mouth: 9.0

Use category: probable

Mileage open: 0.5

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Mattox Creek. Therefore, it is probable that river herring ascend Mattox Creek as far as the mouth of this tributary, and ascend this stream to spawn. Shallows would restrict river herring use of this tributary to the lower 0.5 mile. No roads cross the portion of stream that river herring would use; the Route 629 crossing is approximately 0.1 mile upstream of the estimated upstream limit for river herring.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Rollins Fork, VA.

Tributary of: Mattox Creek

Miles above mouth: 7.4

Use category: probable

Mileage open: 0.5

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Mattox Creek. Therefore, it is probable that river herring ascend Mattox Creek as far as the mouth of this tributary, and ascend this stream to spawn. Shallows would restrict river herring use of this tributary to the lower 0.5 mile. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Rollins Fork, VA.

Tributary of: Mattox Creek

Miles above mouth: 5.3

Use category: probable

Mileage open: 0.3

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Mattox Creek. Therefore, it is probable that river herring spawn in the tidal portion of this small tributary. River herring could not ascend beyond the head of tide due to shallows, so the upstream limit for river herring was put at stream mile 0.3. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Rollins Fork, VA.

Tributary of: Mattox Creek **Miles above mouth:** 4.4

Use category: probable **Mileage open:** 1.5

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Mattox Creek. Therefore, it is probable that river herring spawn in the tidal portion of this small tributary. River herring could not ascend much beyond the head of tide due to shallows, but as a liberal estimate, the upstream limit for river herring was put at stream mile 1.5, approximately 0.1 mile downstream of the Route 3 crossing. No roads cross the portion of stream that river herring would use.

UNNAMED TRIBUTARY

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Mattox Creek **Miles above mouth:** 3.4

Use category: probable **Mileage open:** 0.2

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Mattox Creek. Therefore, it is probable that river herring spawn in the tidal portion of this small tributary, provided the tidewater is not too saline. To be liberal, we assumed that salinities in this tributary are suitable for river herring, and have designated this stream as a probable spawning tributary. River herring could not ascend beyond the head of tide due to shallows, so the upstream limit for river herring was put at stream mile 0.2. No roads cross the portion of stream that river herring would use.

BRIDGES CREEK

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 39.5

Use category: probable **Mileage open:** 1.3

Migration obstruction: unnamed dam

Narrative: None of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). However, Davis et al. (1970) found evidence that alosids spawn in tributaries that flow into the Potomac River as far downstream as River

Mile 37.9 (Popes Creek). Therefore, it is probable that river herring utilize the tidal portion of this tributary for spawning, provided the tidewater is not too saline. To be liberal, we assumed that salinities in this tributary are suitable for river herring, and have designated this stream as a probable spawning tributary. As a liberal estimate, we put the upstream limit for river herring at stream mile 1.3; an unnamed dam would prevent river herring from ascending farther. No roads cross the portion of stream that river herring would use.

POPES CREEK

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Potomac River **Miles above mouth:** 37.9

Use category: confirmed (D) **Mileage open:** 3.5

Migration obstruction: unnamed dam

Narrative: Davis et al. (1970) reported that alosids use this tributary for spawning. However, none of the local residents that we interviewed were aware of anadromous fish spawning runs in this stream, or any other tributary that entered the Potomac River downstream of Potomac Creek (River Mile 68.9). An unnamed dam at stream mile 3.5 would prevent anadromous fish from ascending beyond tidewater. No roads cross the portion of stream that anadromous fish would use.

MORRIS RUN

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Popes Creek **Miles above mouth:** 2.9

Use category: probable **Mileage open:** 0.1

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Popes Creek. Therefore, it is probable that river herring spawn in the tidal portion of this small tributary. River herring could not ascend beyond the head of tide due to shallows, so the upstream limit for river herring was put at stream mile 0.1. No roads cross the portion of stream that river herring would use.

CANAL SWAMP

USGS topographic quadrangle: Colonial Beach South, VA.-MD.

Tributary of: Popes Creek **Miles above mouth:** 1.7

Use category: probable

Mileage open: 1.2

Migration obstruction: stream morphology

Narrative: Davis et al. (1970) found evidence that alosids spawn in Popes Creek. Therefore, it is probable that river herring spawn in this tributary, even though none of the local residents that we interviewed knew of river herring runs in this stream. As a liberal estimate, we put the upstream limit for river herring at stream mile 1.2 (the confluence with Thomas Branch); shallows would prevent river herring from ascending further. The old state road crossing at stream mile 0.3 is now in private ownership, and would not obstruct river herring.

Structural Evaluations

Road crossing: Route 624

Date evaluated: 04/21/88

Passage status: passable

Structure type: see below

Size: see below

Vertical drop: none

Depth in culvert: 24 cm

Velocity in culvert: ~ 50 cm/s

Notes: It is probable that river herring ascend as far as this crossing. River herring would have no difficulty negotiating this culvert, which consists of a main pipe constructed of concrete and lined with a composite material (fiberglass ?), and two auxiliary concrete pipes. Most of the stream discharge flows through the main pipe, which is roughly 90 cm in diameter. The minimum water depth in the main pipe is at the inlet (see measurements above), which river herring could negotiate without difficulty. The two additional, and smaller, concrete pipes under this road crossing have some water flowing through them, but not nearly as much as the main pipe. These smaller auxiliary pipes were not measured.

LITERATURE CITED

Atran, S.M., J.G. Loesch, W.H. Kriete, Jr., and B. Rizzo. 1983. Feasibility study of fish passage facilities in the James River, Richmond, Virginia. VIMS Special Report No. 269, Virginia Institute of Marine Science, Gloucester Point, VA. 109 p.

Barry, T. and B. Kynard. 1986. Attraction of adult American shad to fish lifts at Holyoke Dam, Connecticut River. North American Journal of Fisheries Management 6:233-241.

Davis, J., J.P. Miller, and W.L. Wilson. 1970. Biology and utilization of anadromous alosids. Completion Report 1967-1970. Anadromous Fish Project VA AFC-1, Virginia Institute of Marine Science, Gloucester Point, VA.

Hart, L. 1987. River birthing grounds: the James before dams. Virginia Wildlife 48(4):25-27.

Kynard, B. and J.P. Warner. 1987. Spring and summer movements of subadult striped bass, *Morone saxatilis*, in the Connecticut River. Fishery Bulletin 85:143-147.

Lippson, A.J., M.S. Haire, A.F. Holland, F. Jacobs, J. Jensen, R.L. Moran-Johnson, T.T. Polgar, and W.A. Richkus. 1979. Environmental atlas of the Potomac estuary. Power Plant Siting Program, Maryland Department of Natural Resources, Annapolis, MD. 279 p.

Loesch, J.G. 1981. Determination of the presence, species composition, and relative abundance of anadromous fishes in Pohick Creek, Fairfax, Virginia. Virginia Marine Resources Report No. 81-9. Virginia Institute of Marine Science, Gloucester Point, VA. 12 p.

Martin, J.D. 1984. Atlantic salmon and alewife passage through a pool and weir fishway on the Magaguadavic River, New Brunswick, during 1983. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1776. 11 p.

Martin, J.D. 1987. Atlantic salmon and alewife passage at the fishway on the Magaguadavic River, New Brunswick, during 1984. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 1938. 7 p.

Mudre, J.M., J.J. Ney, and R.J. Neves. 1985. An analysis of the impediments to spawning migrations of anadromous fish in Virginia rivers. Final Report. Virginia Highway Research Council, Virginia Department of Highways and Transportation, Charlottesville, VA. 81 p.

Odom, M.C., R.J. Neves, J.J. Ney, and J.M. Mudre. 1986. Use of tributaries of the lower James River by anadromous fishes. Final Report. Virginia Highway Research Council, Virginia Department of Highways and Transportation, Charlottesville, VA. 181 p.

Odom, M.C., R.J. Neves, and J.J. Ney. 1988. Potential use of tributaries of the middle James River by anadromous fishes. Final Report. Virginia Transportation Research Council, Virginia Department of Transportation, Charlottesville, VA. 318 p.

Province of Nova Scotia. 1984. Province of Nova Scotia environmental construction practice specifications. Province of Nova Scotia, Halifax. 40 p.

Provost, J., L. Verret, and P. Dumont. 1984. L'alose savoureuse an Quebec: synthese des connaissances biologiques et perspectives d'amenagement d'habitats. Rapport manuscript canadien des sciences halieutiques et aquatiques, No. 1793. 114 p.

Slatick, E. and L. R. Basham. 1985. The effect of Denil fishway length on passage of some nonsalmonid fishes. Marine Fisheries Review 47:83-85.

Tilsworth, T. and M. D. Travis. 1987. Fish passage through Poplar Grove Creek. Final Report, No. FHWA-AK-RD-87-15. State of Alaska Department of Transportation and Public Facilities, Fairbanks, AK. 107 p.

Weaver, C. R. 1965. Observations on the swimming abilities of adult American shad (*Alosa sapidissima*). Transactions of the American Fisheries Society 94:382-385.

Witherell, D. B. 1987. Vertical distribution of adult American shad and blueback herring during riverine movement. M.S. Thesis, University of Massachusetts, Amherst, MA. 27 p.

INDEX TO TRIBUTARY DESCRIPTIONS