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TR-2013-1 Fishway Inspection Guidelines (6/5/2013)

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FISHWAY INSPECTION GUIDELINES

TR-2013-01

June 5, 2013

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Fish Passage Technical Report Series, UMass Amherst

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Suggested citation: University of Massachusetts Amherst, Fish Passage Technical Report, TR-2013-1 (June 2013), UMass Amherst Libraries, University of Massachusetts.

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1.0 General

This technical report provides guidance for engineers, biologists, operators, regulators and dam owners involved in the inspection of fishways at dams. Volitional fish ladders, fish lifts, and other fish passage and protection facilities are devices of varying complexity frequently integrated into sophisticated reservoir management and hydropower installations. As with any device, maintenance of fish passage facilities is necessary to ensure their proper operation. Improper operation of fishways may limit or eliminate entire year classes of diadromous fish. Routine fishway inspections are a critical component of an overall fish passage operation and maintenance plan.

2.0 Definition of a Fishway

Fishway (or fish pass) is a generic term for those structures and measures which provide for safe, timely, and effective upstream and downstream fish passage. Fishways include physical structures, facilities, or devices necessary to maintain all life stages of fish, and operations and measures related to such structures, facilities, or devices which are necessary to ensure their effectiveness. Examples include, but are not limited to, volitional fish ladders, fish lifts, bypasses, guidance devices, and operational shutdowns.

3.0 Types of Fishways

Fish passes can be broadly categorized as either technical fishways or nature-like fishways. Nature-like fishways include bypass channels, rock ramps and other passage structures that approximate (either functionally or aesthetically) natural river reaches. Technical fishways employ engineering designs that are typically concrete, aluminum, polymer, and wood, with standardized dimensions, using common engineering construction techniques. The physical and hydraulic structure of nature-like fishways is markedly different from technical fishways, and the inspection of nature-like fishways is beyond the scope of this report. Technical fishways (hereafter, simply fishways) can be further categorized as upstream or downstream passes. Figure 1 shows these categories and common types of fishways.

<u>Baffled-Chute Fishways</u>: Baffled chutes are a subset of upstream volitional ladders designed to reduce velocities in a sloping channel to levels against which fish can easily ascend. Baffled chutes common to the Eastern United States include:

- Steeppass Model A — 21-inch wide, 27-inch tall, baffled aluminum channel
- Steeppass Model A40 — 40-inch tall, deepened version of the Model A steeppass
- Standard Denil — 2-to-4 foot-wide (typically concrete) channel with wooden baffles

<u>Pool-Type Fishways</u>: Pool-type upstream fishways are designed to link headwater and tailwater through a series of (typically concrete) pools through and over which water cascades slowly. Pool-types include:

- Pool-and-Weir — pools often separated by rectangular weirs; may also include orifices
- Ice Harbor — variant of the pool-and-weir type; characterized by two weirs separated by central C-shaped vertical baffle

- Half Ice Harbor — modified Ice Harbor; characterized by one weir opposite an L-shaped vertical baffle
- Vertical Slot — flow through pools via deep, narrow, full-depth slots rather than an overflow weir
- Serpentine — similar to a vertical slot with a winding, tortuous horizontal flow path

Fish Lifts/Locks: Fish lifts or elevators are non-volitional upstream fishways that attract fish into an entrance channel and mechanically crowd them above a hopper before lifting them into an impoundment (or alternatively, into an exit channel hydraulically linked to an impoundment). Fish lifts differ from volitional ladders in that they usually possess numerous mechanical, hydraulic, and electrical components. A fish lock is similar to a lift where the hopper and lift tower is replaced with a full-height, columnar structure (i.e., lock) that can be filled with water. Fish locks are rare on Atlantic coast and are therefore not addressed directly in this document.

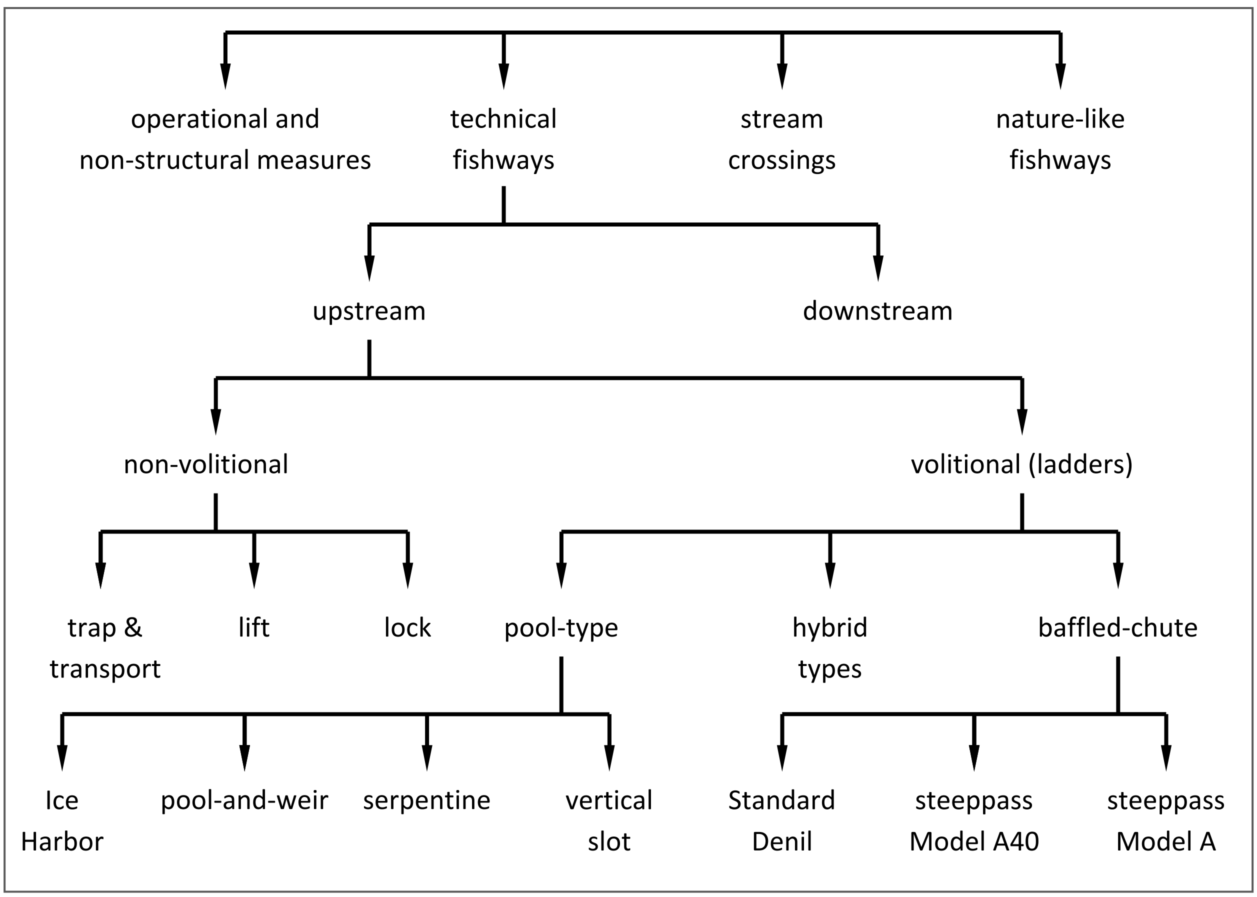

Figure 1. Common fishway types in the eastern U.S.

Downstream Passage: Facilities designed to protect and pass out-migrating fish are varied and diverse ranging from simple overflow weirs to highly complex guidance screens with attraction water recycling systems, bypasses, plunge pools, and fish sampling systems. Typically, these systems consist of four primary components:

- Physical/behavioral guidance screen or bar rack
- Bypass opening (e.g., weir, chute, sluice, or orifice)
- Conveyance structure (i.e., open channel or pressurized conduit)
- Receiving pool

The bypass opening is intended to function as a safe outlet for fish migrating downstream past the dam. Exclusion screens or behavioral guidance screens (or racks) are designed to create physical and/or hydraulic cues that encourage fish to move towards and pass through the bypass opening. Receiving waters or plunge pools are typically necessary to safely transition fish to waters below the dam. Receiving waters generally refer to the existing tailrace or tailwater below the dam; plunge pools are separately excavated pits, or built-up basins, which provide adequate depth to prevent plunging fish from impacting the channel bottom, concrete apron, or other submerged feature.

Eel Pass: Eel passes (or eelways) are upstream passage structures that provide a path over the dam for catadromous elvers and juvenile eels. These structures typically consist of an attraction water delivery system incorporated into ramp lined with various wetted media which eels use to propel themselves up the ramp. They may provide a full volitional pathway for up-migrating eels or terminate in a trap or lift.

The above list represents some of the more common fishways used to mitigate the impacts of stream barriers on the east coast of the United States. However, the reader should be aware that there are numerous other types, variations of these technologies, and auxiliary components not described herein.

4.0 An Approach to Fishway Inspection

The holistic definition of a fishway (as described in Section 2.0) should convey the importance of assessing fishway conditions in a comprehensive manner that considers a) the path of fish past a barrier, and b) the aggregate passage conditions and timing due to the interaction of numerous (non-fishway) structures and operations. Unfortunately, such myriad interactions cannot be enumerated or described in a generalized way. Consider these examples:

- the strength of the hydraulic cue created by a fishway entrance jet may be influenced by tailwater elevation (which, in turn, may be affected by turbine discharge);
- salmonids may ascend over weirs under plunging flow conditions, clupeids may not;
- the efficacy of fishway attraction flow may be compromised by the sequence of turbine operations resulting in delays in upstream migration;
- sweeping velocities in front of a downstream bypass guidance screen may be influenced by generation, trash loading, or spill; and

- water surface elevations throughout a ladder may be influenced by flashboard failure at the upstream spillway.

Therefore, the reader is strongly encouraged to keep the broadest definition of a fishway in mind when performing inspections so as to avoid a myopic view of individual fishway components that may obscure the integrated functionality critical to the proper operation of these facilities.

Certain anomalous conditions or occurrences are seen more frequently at fishways. Inspectors should be keenly aware of, and document, these issues:

- Damage to, or degradation of, structural components
- Visual or auditory evidence of poorly functioning mechanical components
- Leaf litter, large woody debris, or sediment in the fishway
- Adverse water levels in and adjacent to the fishway
- Eddies, jumps, aeration and other unusual hydraulic phenomena
- Evidence of fish delay, entrainment, impingement, injury, or mortality
- Original design deficiencies

5.0 Equipment

Inspectors should anticipate the equipment needed to properly perform the inspection. Furthermore, ensuring the equipment is in proper working order is a prudent step in pre-inspection planning. Battery operated electronic equipment (e.g., total station, camera) should be charged. Digital instruments (e.g., acoustic Doppler velocity meter) may require calibration. In general, all equipment should be checked prior to traveling to the site of the dam or barrier.

The following is a list of items which may prove useful during inspection:

- Inspection checklist — Suggested checklist attached to this document
- Pencil and field book — Checklist may be insufficient to document anomalous conditions
- Voice recorder — Digital recordings can augment notes
- Digital camera — Photographs and video of field conditions are essential to inspection
- Staff gage — Gage (e.g. survey rod) used to measure water surface elevations
- Tape measure — Allows measurement of relevant fishway geometry
- Flashlight — Covered channels and transitions may not be lit
- Lumber crayon — Inspector may wish to mark water levels during operational changes
- Watertight boots — Recommended for inspecting de-watered fishways
- Velocity meter — Useful in assessing velocity barriers and impingement “hot spots”
- Survey/hand level — For precise measurement of HGL or elevation changes

Given the proximity to moving water, heavy equipment, and the steep terrain associated with dams, fishways are potentially hazardous sites. Safety equipment is always recommended. Moreover, fishways are often located at large hydroelectric facilities where rigorous safety programs have been

implemented. Safety plans which identify anticipated risks and possible hazards are becoming a more common practice and should be reviewed prior to assessing the facilities. If you are unfamiliar with the site, be sure to contact the dam owner to ensure proper safety protocols are met.
Standard safety equipment may include:

- Hard hat
- Steel-toed boots
- Safety glasses
- Hearing protection (if entrance to the powerhouse is necessary)
- Harness and fall protection
- Personal floatation device (PFD)
- High-visibility orange safety vest
- First-aid kit (equipped bee sting treatment)

6.0 Performing an Inspection

Fishway inspections are best performed in a systematic fashion. The inspection checklist included with this document is intended to guide the reader through a logical sequence from exit to entrance. However, the checklist is intended only as a guide and should not replace good observational skills, adequate record keeping, or site-specific experience. The inspector is strongly encouraged to review any standard operating procedures (SOP) and as-built drawings of the fish passage structures prior to arriving on site. Figures 2 and 3, which illustrate major components of fishways, may help orient the novice inspector.

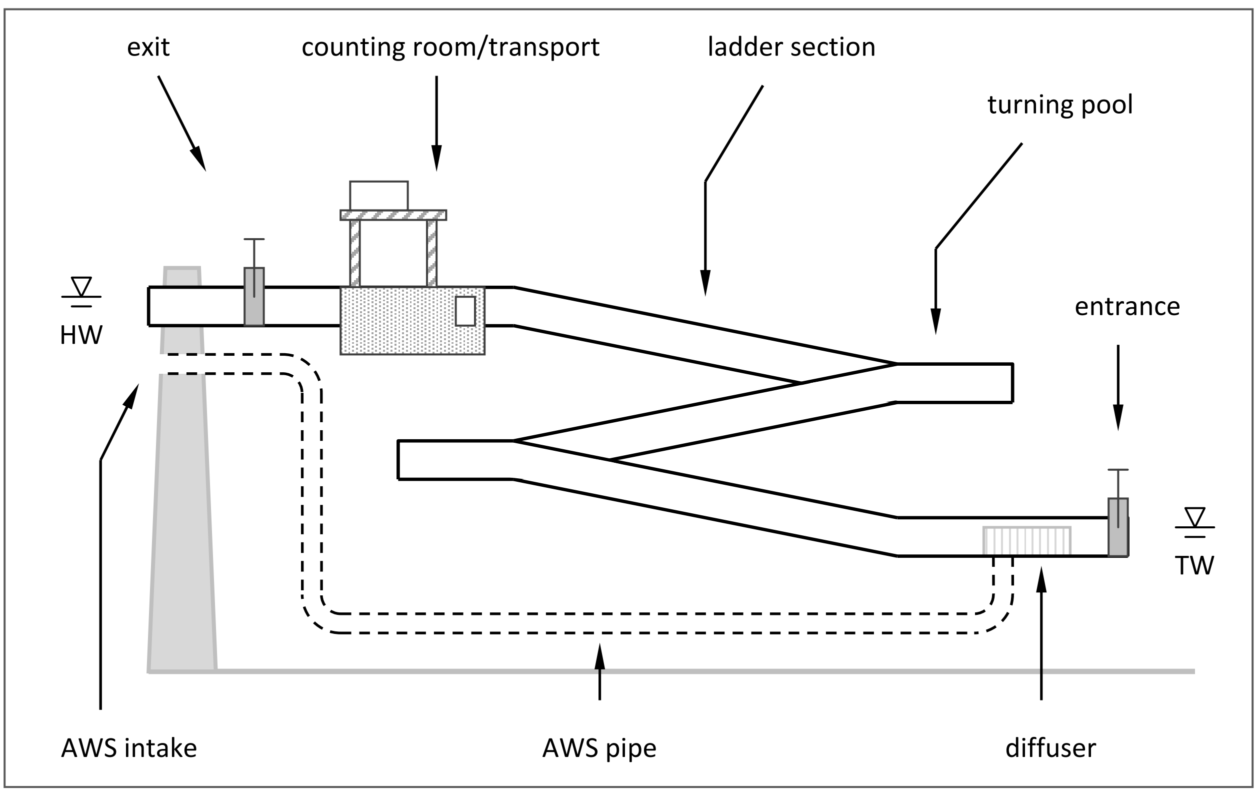

Figure 2. Major components in typical volitional fish ladders

Information gathered on anomalous conditions (either on this checklist or in supplemental records) should include these three important elements:

1. **Location**: Record the location where conditions are of interest. If the location is a standard fishway component then identify it as such:
    - "fishway entrance gate"
    - "3rd turning pool upstream of the entrance"
    - "downstream bypass plunge pool"

    If the location possesses no standard name, describe it in relation to a clearly identifiable, datum or nearby feature:
    - "… 7 feet upstream of the antenna array bond-out"
    - "… overflow pool at elevation 110.5 feet USGS"
    - "… on intake rack 30 feet out from right abutment"
2. **Extent**: Measure or estimate the dimension(s) of the problem or condition:
    - "2-foot by 3-foot section of the wedge-wire screen"
    - "overtopping of 3-feet of water"
    - "6 inches of sediment"
3. **Detail**: A brief description of the condition should be included:
    - "a swirling horizontal eddy forms in the turning pool during operation"
    - "an impassable hydraulic drop forms over the weir crest"
    - "fish trapped behind skimmer wall

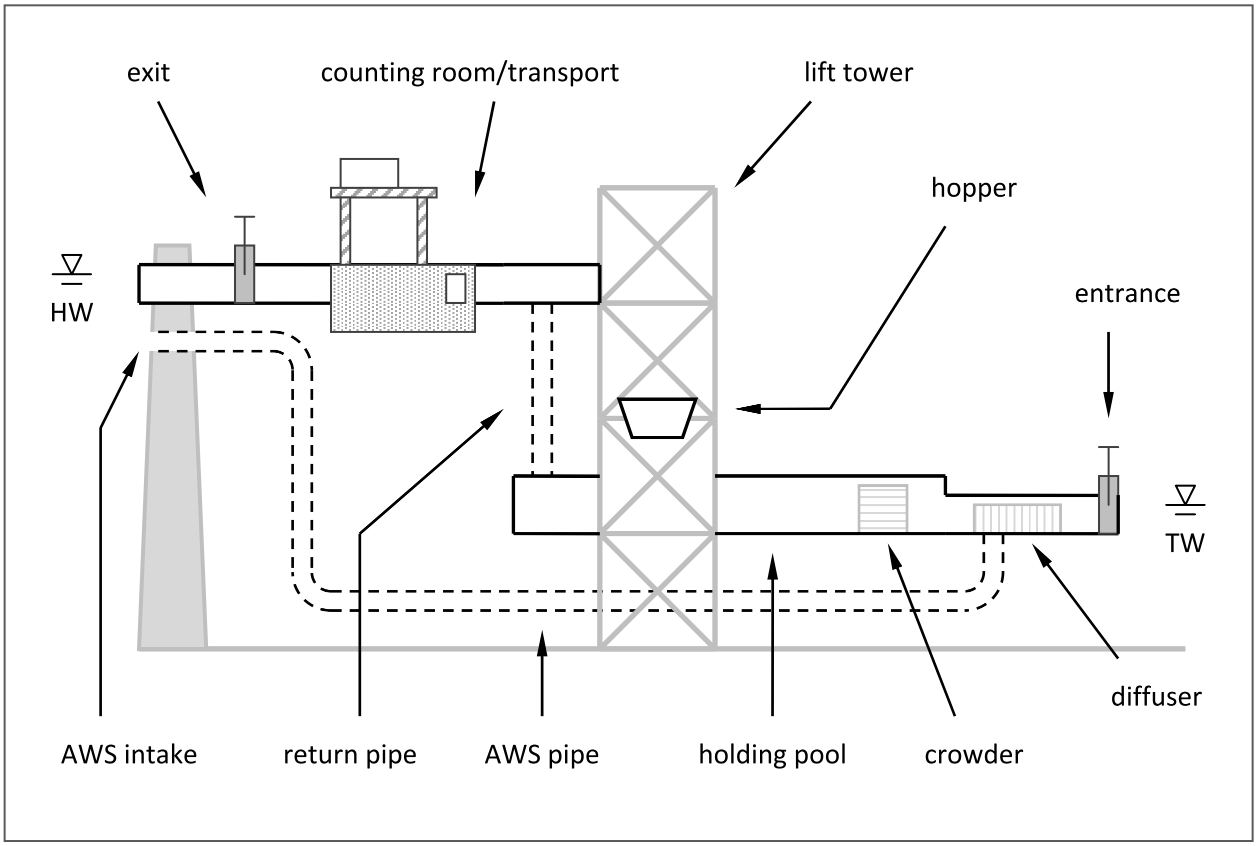

Figure 3. Major components in typical non-volitional fish lifts

7.0 Checklist

The FISHWAY INSPECTION CHECKLIST included in this technical report is formatted to guide the inspector in a sequential manner moving down-gradient from the fishway exit to the fishway entrance. Numbered checklist items are written as questions requiring the user to verify the structural, hydraulic, or operational functionality of fishway components. Comment space is provided at the end of each major section. These major sections are:

Reason for Inspection: Fishways are often inspected during the peak of a migratory fish run to evaluate the facility while operating at design capacity. However, they may be inspected at opening (i.e., start of the season), shut-down, or post-flood to assess damage. Recording the reason for the inspection provides important context for the subsequent notes.

Fishway Status: It is equally important to note whether or not the fishway is de-watered and whether or not it is operating at the time of the site visit. For pre- (or post-) season inspections, the need to examine specific components may dictate the status of the fishway. For instance, a watered, operating fishway may allow for an assessment of the hydraulics, but will also obscure potential problems below the waterline.

Hydrology & Ecology: Fishways vary according to site hydrology and the target species for which they were designed. The inspector should note the target species and mark the approximate migration periods on the upstream (U/S) and downstream (D/S) migration scales. Comments on fish health issues (i.e. VHS, descaling, parasitism) and noting the presence of invasive species may prove useful to resource agencies.

The river flow influences numerous operational aspects of fishway operation including the headpond and tailwater elevation, adjustable gate settings, and entrance jet velocities. The USGS is the principal agency tasked with maintaining stream gages in the U.S. If the dam owner/operator cannot provide the current river flow, the USGS stream gage network should be used:

http://waterdata.usgs.gov/nwis

Additionally, the inspector may consider recording the water temperature at the fishway entrance channel and in the headpond. The movement of many migratory species is linked to water temperature. Surface water temperatures in the impoundment are typically higher than the river and may be further influenced municipal treatment plants and industrial cooling water. A significant difference in fishway temperature versus headpond temperature could indicate undue solar warming in the AWS or fishway pools.

Hydropower Operations: It is well known that dams are barriers to the passage of riverine and migratory aquatic species. Hydroelectric facilities present additional fishway operational challenges and represent a significant hazard to down-migrating fish. Inspectors should document powerhouse capacity, unit type, methods of remote operation, and any operational links between the fishway and turbine sequencing. For example, turbines adjacent to the fishway entrance may be prioritized to enhance attraction flow. Similarly, Kaplan units (which may be less harmful to some species than comparable Francis units) may be preferentially operated during the downstream migration period. Turbine rotational speed often correlates to mortality, and could be documented if the information is available on site. For estimates of approach velocity (in the forebay), inspectors may choose to estimate the turbine intake dimensions. For inspections of dams without powerhouses, users may strike through this section.

Upstream Fishway Exit: The exit typically refers to those components that connect the ladder or lift to the headpond or river upstream of the barrier. It is important to note that the upstream fishway exit is also the hydraulic intake to the fishway (and these seemingly contradictive definitions can cause confusion). The inspector should look for conditions that may prevent or delay fish from quickly exiting the fishway such as debris accumulation, partially opened gates, dark shadows, bright lights and noise-inducing structures. One should also document any evidence that fish are not quickly moving up into the impoundment (and beyond the immediate hydraulic influence of adjacent flood gates, turbines, or other water intakes). If possible, record the headpond water surface elevation.

Ladder: The chute, channel, or pools connecting the entrance to exit are commonly called the ladder. Debris, sediment and failure of wooden water-retaining structures (e.g., blocking boards, weir crests) are the most common causes of operational failure in otherwise-effective fishways. Though time-consuming, the entire ladder can be rigorously inspected for problems in a de-watered state. In an operating and watered state, blockages and board failures can be more quickly identified by the anomalous water surface elevations and flow patterns these problems create. For inspections of lifts, users may strike through this section.

Fishlift: The lift includes the lift tower, holding pool, hopper (i.e., bucket), crowder, brail, and any associated electrical, hydraulic and mechanical components. It also includes any water conveyance between the exit and the entrance (e.g., transfer from hopper to exit flume). Grating on the crowder and exclusion gate behind the hopper are particularly susceptible to debris blockage. Debris can lead to altered flow patterns and velocities, but sharp woody debris lodged in the grating may also injure fish. It is recommended that the inspector observe a complete lift cycle while on site; if possible, the lift cycle should be timed to ensure it is operating within design parameters. Unusual sounds, binding, and vibration during operation are indicators of a problem. Where possible, the operators should accompany the inspectors; operators can provide invaluable insight into the condition of the equipment. For inspections of ladders, users may strike through this section.

Upstream Fishway Entrance: For both lifts and ladders, the entrance consists of a channel of varying length leading fish into the ladder/lift from the tailwater below the dam. Larger hydropower facilities may include collection galleries that consist of a flume with manifold gated entrances. Regulating the attraction jet velocity is perhaps the most critical aspect influencing the effectiveness of the entrance. In the presence of varying tailwater, velocities are controlled through installation of (overflow) weir boards in a slot at the entrance. Alternatively, larger facilities may be equipped with an (overflow) lift gate. Regardless, the gate or boards serve as submerged weirs that locally accelerate the flow to create an attraction jet. The water surface elevations between the entrance channel and the tailwater correlate to the strength of the attraction jet and should be diligently recorded by the inspector. If possible, record the tailwater elevation.

Auxiliary Water System: The fishway must produce a sufficiently strong attraction jet at the entrance often in the presence of other competing flows (e.g., spill, powerhouse discharge). Lifts generate no flow by themselves, and ladders may not discharge enough flow to create an adequate attraction signal. Auxiliary Water Systems (AWS) provide an additional source of water to augment the attraction flow. AWS commonly consist of an intake at the headpond, anti-vortex devices, a headgate, a conveyance pipe, valves, a diffuser chamber, and diffuser outlets. Most of these components are underground or underwater; however the inspector should examine the intake screen for blockages and, if possible, verify the current AWS discharge (with the dam owner or operator).

Downstream Passage Facilities: Access to much of the downstream passage system (e.g., floating boom, intake racks) may be problematic. At a minimum, fishway inspectors should examine the accessible racks/screens, downstream bypass, bypass weir, any fish sampling systems, conveyance structures, and plunge pool. For rack or screens that cannot be measured directly, inspectors may estimate depths and widths (or inquire of the dam owner and/or operator). Unfavorable hydraulic conditions (e.g., lack of guidance, excessive velocities, impinging jets), debris blockages, partially open gates which obstruct fish movement, and incorrectly installed bypass weirs are among the more common deficiencies.

Counting & Trapping: A minority of fishways are equipped with counting rooms and trapping facilities. While not integral to the passage of fish, these elements may support critical monitoring and research programs. Where appropriate, trap gates and lift mechanisms should be operated and examined for serviceability and fish safety. A courtesy engineering assessment of the counting room may be welcomed by the operator and/or resource agency biologist.

Eel Pass: This section is intended to capture elements related to upstream eel passage. Downstream eel passage (if it exists) can be addressed in the "Downstream Passage Facilities" section. Critical elements of the eelway include ensuring the ramp is sufficiently wet and that the media is clean of debris. If the ramp terminates in a trap, check to ensure the trap box receives adequate flow and that eels cannot escape. If the trap box appears overcrowded, notify the project or agency biologist immediately. Uncovered ramps may be susceptible to predation. Additionally, make observations on the attraction water supply system (e.g., water source, approximate flow, flow conditions at the base of the ramp, leakages)

Inspections are time-consuming and demand one's full attention. Advance preparation will enhance the quality of the inspection. Therefore, it is recommended that the inspector fill out as much of the form as possible prior to arriving on site. As discussed in Section 6.0, fishway SOPs and as-built drawings are valuable sources of information that should be reviewed in advance.

8.0 Disclaimer

These fishway inspection guidelines were developed by the authors with input from other subject-matter experts. They are intended for use by persons who have the appropriate degree of experience and expertise. The recommendations contained in these guidelines are not universally applicable and should not replace site-specific recommendations, limitations, or protocols.

The authors have made considerable effort to ensure the information upon which these guidelines are based is accurate. Users of these guidelines are strongly recommended to independently confirm the information and recommendations contained within this document. The authors accept no responsibility for any inaccuracies or information perceived as misleading. The findings and conclusions in these guidelines are those of the authors and do not necessarily represent the views of the University of Massachusetts Amherst, Integrated Statistics, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, or the United States Geological Survey.

9.0 Acknowledgements

Reviews, important information, and valuable insight were provided by Steve Gephard, Connecticut DEEP Inland Fisheries Division; Gail Wipplehauser and Oliver Cox, Maine Department of Marine Resources; Ed Meyer, National Oceanic and Atmospheric Administration; Steve Shepard, John Warner, and Jesus Morales, U.S. Fish and Wildlife Service; and Ben Rizzo, U.S. Fish and Wildlife Service (retired).

The authors thank these individuals for their thoughtful contributions.

FISHWAY INSPECTION CHECKLIST

Dam/Project Name: ______________________ Waterway: ______________________

Owner (Organization): ______________________ Date/Time: ______________________

Inspector(s): ____

Owner's Representative(s) On-site: ______________________________________

Comments: ____

STATUS

Reason for inspection: ☐ opening ☐ during season/run ☐ shutdown ☐ construction ☐ other ______________________

Fishway Status:
- ☐ de-watered/non-operational
- ☐ watered/operational
- ☐ watered or underwater/non-operational
- ☐ damaged/operational
- ☐ unknown damaged/non-operational

HYDROLOGY & ECOLOGY

1. Target species for fishway: ______________________

2. U/S migration period: J F M A M J J A S O N D

3. U/S fish passage design flow:
   - HIGH ______ (cfs)
   - LOW ______ (cfs)

4. D/S migration period: J F M A M J J A S O N D

5. Drainage & current river flow (if known): ______ (mi^2) ______ (cfs)

Comments on Hydrology & Ecology: ______________________
____

HYDROPOWER OPERATIONS

6. Is the fishway and dam part of a hydroelectric project? ☐ YES ☐ NO
7. Is there a powerhouse at this location? ☐ YES ☐ NO
8. Powerhouse hydraulic capacity: ______ (cfs)
9. Project generating capacity: ______ (MW)
10. Number and type of hydroelectric turbines:

Francis:	Kaplan:	Bulb:	Other:

11. Are units sequenced on/off to enhance fish passage? ☐ YES ☐ NO

If YES, describe operations: ______________________
____

Comments on Hydropower Operations: ______________________
____

Dam/Project Name: ____

UPSTREAM FISHWAY EXIT

12. Waterway upstream of the exit is clear of debris: ☐ YES ☐ NO
13. Headgate and/or headboards are in good condition ☐ YES ☐ NO ☐ n/a
14. If operational, have headboards been removed or gates raised? ☐ YES ☐ NO ☐ n/a
15. Are adjustable weirs/baffles set to track HW? ☐ YES ☐ NO ☐ n/a
16. Trashrack is in place and clean? ☐ YES ☐ NO ☐ n/a
17. Trashbooms are in place? ☐ YES ☐ NO ☐ n/a
18. Is a staff gage installed in the fishway exit channel? ☐ YES ☐ NO
19. Is a staff gage installed in the headpond? ☐ YES ☐ NO
20. Differential head measured between exit and headpond: ______ (ft.)

Comments on Exit: ____

____

LADDER (Not Applicable for Lifts or Locks)

21. Ladder type: ☐ Vertical Slot ☐ Ice Harbor ☐ Pool&Weir ☐ Denil ☐ Steeppass
☐ other: ____
22. Fishway is free of trash and large woody debris: ☐ YES ☐ NO
23. Was the fishway de-watered during inspection? ☐ YES ☐ NO ☐ n/a
24. Concrete walls/floors are free of cracks, erosion, leaks, spalling: ☐ YES ☐ NO ☐ n/a
If NO, describe extent and location: ____

____

25. Pools are free of sand, rocks, and other material: ☐ YES ☐ NO ☐ n/a
If NO, describe accumulations, locations and plan to remove: ______________________________

____

26. Baffles, baffles plates, and/or or weirs are installed properly, installed at the correct elevation, and were found in good condition: ☐ YES ☐ NO ☐ n/a
If NO, describe problems and locations (e.g., number from entrance): ______________________________

____

27. Has the fishway been inspected for damage that created sharp edges, formed wooden splinters, or resulted in new obstacles (in the flow field) that could injure fish? ☐ YES ☐ NO ☐ n/a
Comments: ____
28. Is the protective grating cover in place and structurally sound? ☐ YES ☐ NO ☐ n/a
29. Representative head measurement (over weir crest, through vertical slot): ______ (ft.)

If measured, describe location and method (e.g., pool number from entrance, with staff gage):

____

____

Comments on Ladder: ____

____

____

____

____

____

Dam/Project Name: ____

FISHLIFT (Not applicable for Ladders)

30. Was the lift cycled (operated) during this inspection? ☐ YES ☐ NO
31. Holding pool is relatively free of debris: ☐ YES ☐ NO
32. Hopper raises smoothly without binding or vibrating: ☐ YES ☐ NO ☐ n/a
33. Mechanical crowder opens/closes/operates properly: ☐ YES ☐ NO ☐ n/a
34. Crowding proceeds in a manner consistent with design: ☐ YES ☐ NO

If NO, describe problems and locations: ____

____

35. Hopper properly aligns with chute during exit channel transfer: ☐ YES ☐ NO ☐ n/a
36. Is the exit channel (between lift and exit) free of debris? ☐ YES ☐ NO ☐ n/a
37. Other mechanical components appear in good working order: ☐ YES ☐ NO

If NO, describe problems and locations: ____

____

38. Lift appears free of sharp corners that could injure fish: ☐ YES ☐ NO
39. Lift cycles manually or automatically: ☐ Manual ☐ Automatically
40. Cycle time of lift (fishing to fishing): ▶ ________ (min.)
41. Hopper volume (if known): ▶ ________ (ft^3)

Comments on Lift: ____

____

____

UPSTREAM FISHWAY ENTRANCE

42. Is the approach to the entrance(s) free of debris and obstructions? ☐ YES ☐ NO
43. Are boards properly installed in the entrance? ☐ YES ☐ NO ☐ n/a
44. Are adjustable gates tracking TW? ☐ YES ☐ NO ☐ n/a
45. If operational, does the entrance jet appear appropriate? ☐ YES ☐ NO ☐ n/a
46. Is a staff gage installed in the fishway entrance channel? ☐ YES ☐ NO
47. Is a staff gage installed in the tailwater area? ☐ YES ☐ NO
48. Differential head measured between entrance and tailwater: ▶ ________ (ft.)

Comments on Entrance: ____

____

____

AUXILLIARY WATER SYSTEM

49. If the fishway is operational, is the AWS operating? ☐ YES ☐ NO ☐ n/a
50. AWS flow is driven by: ☐ Gravity ☐ Pump ☐ Other
51. The AWS intake screen is undamaged and free of debris: ☐ YES ☐ NO ☐ n/a
52. AWS appears free of debris or other blockages: ☐ YES ☐ NO
53. AWS flow (in cfs or % of turbine discharge) ▶ ________
54. Has this flow been verified? ☐ YES ☐ NO ☐ n/a

If YES, by whom and/or how? ____

Comments on AWS: ____

____

DOWNSTREAM PASSAGE FACILITIES

55. Are there facilities specifically design for d/s passage on site? ☐ YES ☐ NO
56. If so, are d/s facilities open and operational? ☐ YES ☐ NO ☐ n/a
57. Identify all possible SAFE routes for d/s passage at this site:
☐ d/s bypass ☐ spillway ☐ floodgate ☐ logsluice ☐ surface collect.

If other routes, describe: ____________________

58. Flow field in impoundment appears conducive to d/s passage: ☐ YES ☐ NO ☐ n/a
If NO, describe problems and locations: ____________________

____

59. If appropriate, are overlays in place on trash racks? ☐ YES ☐ NO ☐ n/a
60. Are screens (or overlays on trashracks) relatively free of debris? ☐ YES ☐ NO ☐ n/a
61. Is there any evidence of fish impingement on racks or screens? ☐ YES ☐ NO
If YES, describe problems and locations: ____________________

____

62. Is the d/s bypass intake adequately lit and free of debris? ☐ YES ☐ NO ☐ n/a
63. Is the d/s conveyance free of debris and obstructions? ☐ YES ☐ NO ☐ n/a
64. Are sharp corners evident in the bypass which could injure fish? ☐ YES ☐ NO ☐ n/a

65. Approximate depth of flow over bypass crest: ______ (ft.)

66. Does d/s bypass discharge into sufficiently deep pool/water? ☐ YES ☐ NO ☐ n/a

67. Approximate plunge height from d/s bypass crest to receiving pool/water: ______ (ft.)

68. Is there evidence of significant predation at receiving pool/water? ☐ YES ☐ NO
If YES, describe: ____________________

69. D/S Bypass flow (in cfs or % of turbine discharge) ______ (cfs/%)

Comments on D/S Passage: ____________________

____

____

____

COUNTING & TRAPPING

70. Is the facility equipped for trapping & sorting? ☐ YES ☐ NO
71. Systems for transfer from tank to truck appear in order? ☐ YES ☐ NO ☐ n/a
72. Do mech. components (e.g., winches, gates) appear serviceable? ☐ YES ☐ NO ☐ n/a
73. Were gates/winches tested during inspection? ☐ YES ☐ NO
Note any concerns: ____________________

____

74. Is there a counting house/room at the site? ☐ YES ☐ NO
75. Is the counting window clean and properly lit? ☐ YES ☐ NO ☐ n/a
76. Is CCTV and camera system operating properly? ☐ YES ☐ NO ☐ n/a
77. If counts are automated (e.g. resistance), is it functioning? ☐ YES ☐ NO ☐ n/a

Comments on Counting & Trapping: ____________________

EEL PASS

78. Is there an eel pass on site? ☐ YES ☐ NO ☐ n/a

79. If YES, what is the type of eel pass:

☐ volitional ramp (TW to HW) ☐ permanent ramp & trap/lift ☐ temporary ramp & bucket

80. Describe the eel pass substrate media type:

☐ stud (peg) ☐ bristle ☐ geotextile mat ☐ other: ______________________

81. Is the eel pass currently operating (i.e., wetted and installed)? ☐ YES ☐ NO ☐ n/a

Identify the water source (i.e., gravity, pump): ____

82. Is the media clean of debris and watered throughout? ☐ YES ☐ NO ☐ n/a

Describe depth of flow and adequacy of attraction: ____

Comments on Eel Pass: ____

____

<u>OBSERVATIONS ON THE PRESENCE AND/OR MOVEMENT OF FISH DURING INSPECTION</u>:

<u>GENERAL COMMENTS</u>:

<u>RECOMMENDATIONS</u>: