Chapter 11

DIADROMOUS FISH HABITAT CONSERVATION AND RESTORATION RECOMMENDATIONS AND/OR REQUIREMENTS

Group I. Recommendations for All Commission-Managed Diadromous Species

Dams and Other Obstructions

General Fish Passage

1) States should work in concert with the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) to identify hydropower dams that pose significant impediment to diadromous fish migration, and target them for appropriate recommendations during Federal Energy Regulatory Commission (FERC) relicensing.
2) States should identify and prioritize barriers in need of fish passage based on clear ecological criteria (e.g., amount and quality of habitat upstream of barrier, size, status of affected populations, etc.). These prioritizations could apply to a single species, but are likely to be more useful when all diadromous species are evaluated together.
3) A focused, coordinated, well supported effort among federal, state, and associated interests should be undertaken to address the issue of fish passage development and efficiency. The effort should attempt to develop new technologies and approaches to improve passage efficiency with the premise that existing technology is insufficient to achieve restoration and management goals for several East Coast river systems.
4) Where obstruction removal is not feasible, install appropriate passage facilities, including fish lifts, fish locks, fishways, navigation locks, or notches (low-head dams and culverts).
5) At sites with passage facilities, evaluate the effectiveness of upstream and downstream passage; when passage is inadequate, facilities should be improved.
6) Dams/obstructions where upstream passage structures will be installed should be evaluated for effectiveness of downstream passage. Upstream passage structures should not be installed at these sites, unless downstream passage can be made safe, effective, and timely.
7) Facilities for monitoring the effectiveness of the pass should be incorporated into the design where possible.
8) Before designing and constructing fish passage systems, determine the behavioral response of each species of interest to major physical factors so that effectiveness can be maximized.
9) Protection from predation should be provided at the entrance, exit, and throughout the pass.
10) The passage facility should be designed to work under all conditions of head and tail water levels that prevail during periods of migration.
11) Passages are vulnerable to damage by high flows and waterborne debris. Techniques for preventing damage include robust construction, siting facilities where they are least exposed to adverse conditions, and removing the facilities in the winter.

Upstream Fish Passage

1) Diadromous fish must be able to enter the passage facility with little effort and without stress.
2) To prevent fish from becoming entrained in intake flow areas of hydropower facilities, construct behavioral barrier devices and re-direct them to safer passage areas.
3) Fish ascending the pass should be guided/routed to an appropriate area so that they can continue upstream migration, and avoid being swept back downstream below the obstruction.

Downstream Fish Passage

1) To enhance survival at dams during emigration, evaluate survival of fish passed via each route (e.g., turbines, spillage, bypass facilities, or a combination of the three) at any given facility, and pass fish via the route with the best survival rate.

Other Dam Issues

1) Where practicable, remove obstructions to upstream and downstream migration.
2) Locate facilities along the river where impingement rates are likely to be lowest.
3) Alter water intake velocities, if necessary, to reduce mortality to diadromous species.
4) To mitigate hydrological changes from dams, consider operational changes such as turbine venting, aerating reservoirs upstream of hydroelectric plants, aerating flows downstream, and adjusting in-stream flows.
5) Natural river discharge should be taken into account when alterations are being made to a river because it plays a role in the migration patterns of diadromous fish.

Water Quality and Contamination

1) Maintain water quality and suitable habitat for all life stages of diadromous species in all rivers with populations of diadromous species.
2) Non-point and point source pollution should be reduced in diadromous fish habitat areas.
3) Implement best management practices (BMPs) along rivers and streams, restore wetlands, and utilize stream buffers to control non-point source pollution.
4) Implement erosion control measures and BMPs in agricultural, suburban, and urban areas to reduce sediment input, toxic materials, and nutrients and organics into streams.
5) Upgrade wastewater treatment plants and remove biological and organic nutrients from wastewater.

6) Reduce the amount of thermal effluent into rivers. On larger rivers, include a thermal zone of passage.
7) Provide management options regarding water withdrawal and land use to minimize the impacts of climate change on temperature and flow regimes.
8) Discharge earlier in the year to reduce impacts to migrating fish.
9) Conduct studies to determine the effects of dredging on diadromous habitat and migration; appropriate best management practices, including environmental windows, should be considered whenever navigation dredging or dredged material disposal operations would occur in a given waterway occupied by diadromous species.
10) Introduction of new categories of contaminants should be prevented.

Habitat Protection and Restoration

1) When states have identified habitat protection or restoration as a need, state marine fisheries agencies should coordinate with other agencies to ensure that habitat restoration plans are developed, and funding is actively sought for plan implementation and monitoring.
2) Any project resulting in elimination of essential habitat (e.g., dredging, filling) should be avoided.
3) Substrate mapping of freshwater tidal portions of rivers should be performed to determine suitable diadromous fish habitat, and that habitat should be protected and restored as needed.
4) States should notify in writing the appropriate federal and state regulatory agencies of the locations of habitats used by diadromous species. Regulatory agencies should be advised of the types of threats to diadromous fish populations, and recommended measures that should be employed to avoid, minimize, or eliminate any threat to current habitat quantity or quality.
5) Each state encompassing diadromous fish spawning rivers and/or producer areas should develop water use and flow regime guidelines protective of diadromous spawning and nursery areas to ensure the long-term health and sustainability of the stocks.

Permitting

1) Develop policies for limiting development projects seasonally or spatially in spawning and nursery areas; define and codify minimum riparian buffers and other restrictions where necessary.
2) Projects involving water withdrawal (e.g., power plants, irrigation, water supply projects) should be scrutinized to ensure that adverse impacts resulting from impingement, entrainment, and/or modifications of flow and salinity regimes due to water removal will not adversely impact diadromous fish stocks.

3) State fishery regulatory agencies should develop protocols and schedules for providing input on Federal permits and licenses required by the Clean Water Act, Federal Power Act, and other appropriate vehicles, to ensure that diadromous fish habitats are protected.

Other

1) Promote cooperative interstate research monitoring and law enforcement. Establish criteria, standards, and procedures for plan implementation as well as determination of state compliance with management plan provisions.
2) Diadromous fish may be vulnerable to mortality in hydrokinetic power generation facilities, and such projects should be designed and monitored to eliminate, or minimize, fish mortality.
3) The use of any fishing gear that is deemed by management agencies to have an unacceptable impact on diadromous fish habitat should be prohibited within appropriate essential habitats (e.g., trawling in spawning areas or primary nursery areas should be prohibited).

Group II. Alosine-Specific Recommendations

Dams and Other Obstructions

Fish Passage

1) Passage facilities should be designed specifically for passing alosines for optimum efficiency at passing these species.
2) Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles).

Other Dam Issues

1) Ensure that decisions on river flow allocation (e.g., irrigation, evaporative loss, out of basin water transport, hydroelectric operations) take into account flow needs for alosine migration, spawning, and nursery use, and minimize deviation from natural flow regimes.
2) Ensure that water withdrawal effects do not impact alosine stocks by impingement/entrainment, and employ intake screens or deterrent devices as needed to prevent egg and larval mortality.
3) When considering options for restoring alosine habitat, include study of, and possible adjustment to, dam-related altered river flows.

Habitat Protection and Restoration

1) States should identify and quantify potential shad and river herring spawning and nursery habitat not presently utilized, including a list of areas that would support such habitat if water quality and access were improved or created, and analyze the cost of recovery within those areas. States may wish to identify areas targeted for restoration as essential habitat.
2) Resource management agencies in each state shall evaluate their respective state water quality standards and criteria to ensure that those standards and criteria account for the special needs of alosines. Primary emphasis should be on locations where sensitive egg and larval stages are found.
3) ASMFC should designate important shad and river herring spawning and nursery habitat as Habitat Areas of Particular Concern (HAPCs).

Permitting

1) All state and federal agencies responsible for reviewing impact statement for projects that may alter anadromous alosine spawning and nursery areas shall ensure that those projects will have no impact or only minimal impact on those stocks. Of special concern are natal rivers of newly established stocks or stocks considered depressed or severely depressed.

Stock Restoration and Management

1) When populations have been extirpated from their habitat, coordinate alosine stocking programs, including:
    a. reintroduction to the historic spawning area
    b. expansion of existing stock restoration programs, and
    c. initiation of new strategies to enhance depressed stocks.
2) When releasing hatchery-reared larvae into river systems for purposes of restoring stocks, synchronize the release with periods of natural prey abundance to minimize mortality and maximize nutritional condition. Determine functional response of predators on larval shad at restoration sites to ascertain appropriate stocking level so that predation is accounted for, and juvenile out-migration goals are met. Also, determine if night stocking will reduce mortality.
3) Manage alewife and blueback herring separately given that management actions will affect them differently due to their life history differences (currently, these species are managed as a single stock and lumped together in commercial catch records; this hinders understanding of fishery impacts to populations of river herring species).

River-Specific Habitat Recommendations

River-specific habitat recommendations for American shad can be found in:
Atlantic States Marine Fisheries Commission. 2007. American shad stock assessment report for peer review, volumes II and III. Atlantic States Marine Fisheries Commission Stock Assessment Report No. 07-01 (Supplement), Washington, D.C.

Group III. American Eel-Specific Recommendations

Dams and Other Obstructions

Upstream Fish Passage

1) Passage facilities should be designed specifically for passing American eel for optimum efficiency at passing this species.
2) Eel-specific passage structures should be installed on rivers where eels will gain access to habitat. Those areas which will gain large amounts of habitat due to the installation of a fish passage should be given first priority over those rivers which will only open a small portion of habitat.
3) Passages should be constructed so eels can locate the appropriate starting point for ascent (lower entrance of the pass). This can be achieved by placing the entrance where the eels naturally congregate or by providing an attracting mechanism. If eels gather naturally in more than one place, multiple passes, or multiple entrances to a single pass should be designed.
4) Eel ladders should be constructed so that the outflow of the holding tank or resting flow is directed towards the ramp. This may make it easier for eels to find the ladder, as they are attracted to the scent of other eels.
5) A strong flow should be provided close to the entrance of the bypass system to attract American eel to the ladder.
6) Eel swimming ability is important when considering the design of a pass. The maximum swimming speed and the ability to maintain that speed, as well as the influence of temperature on swimming ability should be taken into account.
7) To overcome the head difference at the facility without expending too much effort, the volume and velocity of the water flow within a pass should be restricted. A substrate should also be provided which slows and disorganizes the flow, and allows the eels to ascend the pass by crawling as much as swimming.
8) Facilities at or near the tidal zone should be designed to primarily pass elvers (90-130mm); however, larger fish will pass through the tidal zone, therefore facilities should be designed to accommodate eels up to 300 mm length range.
9) The size range of American eel that require passage increases with distance upstream. Facilities higher in the watershed should be designed for a greater size range.

10) The size of the American eel should be taken into account when selecting substrates for fish ladders for upstream migration. Smaller elvers require different substrates than larger yellow eels.

11) Natural substrates should not be used in eel passes, as they tend to deteriorate quickly and require constant replacement. Furthermore, some natural materials will not accommodate the size range of all eels because they are very selective. This does not apply to natural emergent vegetation, which can represent an important aspect of passage based on easement.

12) The exit of the pass should be extended into quieter water where there is a rough or weedy bottom. This will help the eels to escape and will provide cover.

13) Where funding is limited, facilities should be designed to pass a limited size range of eels, instead of all size ranges. It is therefore important to research the size range and other conditions of eels migrating through a particular site.

14) Vandalism and theft of eels are potential problems. To overcome this, robust construction and locked covers can help, as well as building facilities where the general public does not have access.

15) Artificial light should not be placed near eel ladders to ensure that migrations are not disrupted, and covers should be placed on passages to protect eels from direct sunlight.

Downstream Fish Passage

1) Important design criteria for bypass facilities targeting silver eels include:
    a. Size of the migrating fish
    b. Seasonal and diurnal timing of migration
    c. Environmental conditions that stimulate migration, and
    d. Behavior of the fish.
2) Bypass structures should include deterrents from turbine entry to attract and/or facilitate the downstream passage of eels via bypass facilities. Deterrents can either be behavioral or mechanical.
3) Cost-effective mitigation measures should be considered, including trap and transport of American eel downstream of the dam.
4) Where possible, turbine operations should be suspended to provide spill flows during times of peak downstream migration.
5) To reduce mortality in American eel, generation of hydropower should be reduced or ceased wherever practicable. This can be achieved by using criteria based on a combination of rainfall events and eel run timing factors.
6) Physical screens to exclude fish from intakes should be used where the obstruction is small relative to the flow of the river. Any screen that is effective for excluding salmon smolts where gaps are 12.5 mm or less is also effective for excluding all silver

eels. Approach velocities (i.e., calculated velocity component perpendicular to the screen face) used for salmonids should allow silver eels to avoid impingement on the screen.

Other Dam Issues

1) Where obstruction removal is not feasible, install passage facilities for American eel (e.g., wetted surfaces, ramps, bucket lifts, etc.) that provide optimum efficiency.

Water Quality and Contamination

1) Steps should be taken to eliminate or limit the contamination of American eel habitat from compounds that are known to accumulate in American eel.

Group IV. Atlantic Sturgeon-Specific Recommendations

Dams and Other Obstructions

Fish Passage

1) Passage facilities should be designed specifically for passing Atlantic sturgeon for optimum efficiency at passing this species.
2) Fish passage facilities should be designed to aid in the upstream and downstream passage of Atlantic sturgeon. Most fish ladders in Atlantic coast streams and rivers are designed to pass alosines, and the specific needs of sturgeon will need to be considered as passage facilities are improved or constructed.
3) The removal of dams, or the consideration of passage efforts, should be focused on those systems where Atlantic sturgeon historical habitat loss through blockage is greatest.

Habitat Protection and Restoration

1) Protection or restoration of critical habitat is considered the most beneficial conservation method for the restoration of sturgeons. Restore degraded historical habitat wherever possible. Also, habitat improvements that increase the survival of young-of-the-year are likely to make a strong contribution to population growth.
2) Water flows should be restored to appropriate levels during spawning season.
3) New spawning habitat should be created with the use of artificial reef materials in areas where hard substrate has been degraded.
4) ASMFC should designate important habitats for Atlantic sturgeon spawning and nursery areas as HAPCs.

Group V. Striped Bass-Specific Recommendations

Dams and Other Obstructions

Fish Passage

1) Passage facilities should be designed specifically for passing striped bass for optimum efficiency at passing this species.
2) Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase striped bass production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles).

Water Quality and Contamination

1) Federal and state fishery management agencies should take steps to limit the introduction of compounds which are known to be accumulated in striped bass tissues and which pose a threat to human health or striped bass health.
2) Every effort should be made to eliminate existing contaminants from striped bass habitats where a documented adverse impact occurs.
3) Water quality criteria for striped bass spawning and nursery areas should be established, or existing criteria should be upgraded to levels that are sufficient to ensure successful striped bass reproduction.

Habitat Protection and Restoration

1) Each state should implement protection for the striped bass habitat within its jurisdiction to ensure the sustainability of that portion of the migratory stock. Such a program should include:
    a. Inventory of historical habitats
    b. Identification of habitats presently used
    c. Specification of areas targeted for restoration, and
    d. Imposition or encouragement of measures to retain or increase the quantity and quality of striped bass essential habitats.
2) States in which striped bass spawning occurs should make every effort to declare striped bass spawning and nursery areas to be in need of special protection; such declaration should be accompanied by requirements of non-degradation of habitat quality, including minimization of non-point source runoff, prevention of significant increases in contaminant loadings, and prevention of the introduction of any new categories of contaminants into the area. For those agencies without water quality regulatory authority, protocols and schedules for providing input on water quality

regulations to the responsible agency should be identified or created, to ensure that water quality needs of striped bass stocks are met.

3) Each state should survey existing literature and data to determine the historical extent of striped bass occurrence and use within its jurisdiction. An assessment should be conducted of those areas not presently used for which restoration is feasible.

4) ASMFC should designate important habitats for striped bass spawning and nursery areas as HAPCs.

Permitting

1) All state and federal agencies responsible for reviewing impact statements and permit applications for projects or facilities proposed for striped bass spawning and nursery areas shall ensure that those projects will have no or only minimal impact on local stocks, especially natal rivers of stocks considered depressed or undergoing restoration.