

UNITED STATES OF AMERICA 129 FERC ¶ 62,201
FEDERAL ENERGY REGULATORY COMMISSION

Appalachian Power Company

Project No. 2210-169

ORDER ISSUING NEW LICENSE

(December 15, 2009)

Article 406. Habitat Management Plan. Upon the effective date of this license, the licensee shall implement the *Habitat Management Plan*, filed July 15, 2008, and shall include the following modifications.

- (a) The 1st sentence on page 5, section 2.1.4, of the proposed plan is revised to read, "A property owner may apply for a permit to modify the existing vegetation for the following reasons, as defined in the SMP: ..."
- (b) Habitat enhancement projects shall not be limited to areas adjacent to public access areas, islands, and areas adjacent to undeveloped shoreline, but could include appropriate areas adjacent to some homeowner developments and commercial areas that are within the project boundary.
- (c) Monitoring of habitat project sites shall include photographs that can be downloaded into a GIS database.
- (d) All large habitat projects constructed specifically as structures to attract fish for angling purposes shall be marked by buoys as "fish attractors."
- (e) The licensee shall develop, in consultation with the members of the Habitat Technical Review Committee, materials to educate the public to the benefits of preserving shoreline/aquatic habitats, as well as establishing/creating appropriate habitats (including detailing the types of projects that can be implemented).

The approved *Habitat Management Plan* may not be amended without prior Commission approval.

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SUMMARY

The Smith Mountain Project (No. 2210) is licensed to Appalachian Power Company (Appalachian) and is a pumped storage hydroelectrical project located on the Roanoke River in Bedford, Campbell, Franklin and Pittsylvania counties in Virginia. The upper reservoir of the pumped storage facility is the Smith Mountain Development, while the lower reservoir is the Leesville Development.

The purpose of this Habitat Management Plan (Plan) is to identify measures for protecting, enhancing and creating habitat within Project lands and waters and to outline how this will be accomplished over the term of the new license. The goal of this Plan is to maintain the ability to construct private access to the Project waters while protecting and enhancing the habitat along the shoreline.

The Habitat Management Plan is being submitted to the Federal Energy Regulatory Commission (FERC) as part of the license application and reflects the measures that Appalachian will be responsible for as the licensee. However, there will be times when it makes sense to develop a cooperative agreement between Appalachian and other parties to manage a resource in a mutually beneficial way. These types of agreements will be outside of relicensing and may reflect additional measures that are above those required by this management plan.

1.0 INTRODUCTION

This Habitat Management Plan has been prepared to identify measures to protect, enhance and create littoral habitat within Project lands and waters and to outline how this will be accomplished over the term of the new license. The goal of this plan is to maintain the ability to allow for the construction of private access to the Project waters while protecting and enhancing the habitat along the shoreline within the project boundary. This Plan, which has been prepared in consultation with agencies and stakeholders, will be filed as part of the license application.

1.1. SMITH MOUNTAIN DEVELOPMENT AND LEESVILLE DEVELOPMENT PROJECT LANDS AND WATERS

The Smith Mountain Project consists of two developments, both located on the Roanoke River in Bedford, Campbell, Franklin, and Pittsylvania counties in Virginia. The upper development of the Project is Smith Mountain and the lower development is Leesville. The Smith Mountain Development has five generating units, with a combined generating capacity of 586 MW. The reservoir behind Smith Mountain dam has a surface area of 20,260 acres at an operating pool elevation of 795 feet National Geodetic Vertical Datum 1929 (NGVD) and 500 miles of shoreline. The Leesville Development has two generating units, with a combined generating capacity of 50 MW. The reservoir behind the Leesville dam has a surface area of 3,260 acres at an operating pool elevation of 613 NGVD and 100 miles of shoreline.

The Project boundary for the Smith Mountain Development is 800 feet NGVD. The Project boundary for the Leesville Development is 620 feet NGVD. During operations of the pumped storage facility, the Smith Mountain reservoir can fluctuate up to 2 feet, while the Leesville reservoir fluctuates up to 13 feet (between elevation 600 feet and 613 feet).

Habitat within the project boundary comes from a variety of sources including overhanging trees, woody debris, wetlands, aquatic vegetation, and other submerged structures. As development continues around the shorelines of both lakes, this habitat is altered and/or removed. The Shoreline Management Plan (SMP) dated August 29, 2003, as approved and modified by FERC's order issued July 5, 2005, and amended by FERC's orders issued April 14, 2006 and February 23, 2007 addresses the removal of vegetation on land between the water and the project boundary and has provisions to protect wetlands and woody debris sites as defined in the plan. The SMP does not address other types of habitat that is removed from shoreline clearing for docks or the installation of riprap.

In 2006, Appalachian retained Devine, Tarbell and Associates (DTA) to conduct a Littoral Zone Habitat Study as part of Appalachian's relicensing efforts for the Project. The study report provides information on lake shore activities and their potential effect on fish and fish habitat that utilize the littoral zone (DTA 2007). As part of the consultation process for relicensing, it was determined that a Habitat

Management Plan should be prepared to address current and future habitat needs under the term of the new license. This includes the mitigation for habitat that is altered and/or removed by shoreline construction and implementation of projects to enhance habitat in areas that have limited existing habitat.

Appalachian is proposing to adopt the terms of the current SMP as part of the new FERC license. The current SMP is scheduled to be revised in 2010, and as such, Appalachian will be providing a revised SMP within one year following the issuance of a new license. There are measures identified in this Management Plan that will be incorporated into the next revision of the SMP.

1.2. PURPOSE OF HABITAT MANAGEMENT PLAN

The purpose of this Habitat Management Plan is to identify measures for protecting, enhancing and creating habitat within Project lands and waters and to outline how this will be accomplished over the term of the new license. The goal of this plan is to maintain the ability to allow for the construction of private access to the Project waters while protecting and enhancing the habitat along the shoreline.

2.0 HABITAT ENHANCEMENT AND PROTECTION

The purpose of this section of the Plan is to outline how habitat will be protected and enhanced over the term of the next license.

2.1 PROTECTION UNDER THE SHORELINE MANAGEMENT PLAN

The Smith Mountain Project Shoreline Management Plan (SMP) contains provisions for protecting habitat such as wetlands, woody debris and areas identified by the Virginia Natural Heritage Program as important natural communities.

2.1.1 Wetland Habitat as defined in the SMP

The shoreline adjacent to wetland habitat is classified as follows and includes fringed wetland areas, which are a diverse assemblage of herbaceous and woody plant (emergent/submerged and scrub/shrub) species in shallow water habitat and scrub-shrub habitat:

Impact Minimization Zone:

- Wetlands that span less than 100 feet of linear shoreline

Conservation / Environmental Zone:

- Large wetland areas (e.g. 100 feet or more of continuous shoreline length), usually associated with streamheads at the back of coves

Development within an Impact Minimization Zone (IMZ) is limited, but possible, based on a review of the related plans, including mitigation for any impacts to resources. This requires review and approval by the resource agencies and Federal Energy Regulatory Commission (FERC). Development within the Conservation / Environmental Zones is prohibited.

2.1.2 Woody Debris

The shoreline adjacent to woody debris habitat is classified as follows:

Impact Minimization Zone:

- Areas classified as large woody debris. The definition of large woody debris areas is “Areas of large downed trees with a density of more than 5 trees greater than 10 inches in diameter per 100 linear feet of shoreline.”

Development within an IMZ is limited, but possible, based on a review of the related plans, including mitigation for any impacts to resources. This development requires review and approval by the resource agencies and FERC.

2.1.3 Natural Heritage Areas and Wildlife Management Areas

The shoreline adjacent to areas identified by the Virginia Natural Heritage Program and the Smith Mountain Wildlife Management Area are classified as follows:

Impact Minimization Zone:

- Areas adjacent to Smith Mountain Wildlife Area

Conservation / Environmental Zone:

- Areas identified by the Virginia Natural Heritage Program as important natural communities.

Development with an IMZ is limited, but possible, based on a review of the related plans, including mitigation for any impacts to resources. This development requires review and approval by the resource agencies and FERC. Development within the Conservation / Environmental Zones is prohibited.

2.1.4 Shoreline Vegetation

Vegetation within the Project boundary must be preserved if present. Ground disturbing activities in this area must be minimal in order to maintain the function of the buffer under the conditions of the Shoreline Management

Plan. A property owner may apply for a permit to modify the existing vegetation cover by removing vegetation for the following reasons:

- Provide for reasonable view of the water
- Construct access paths to the shoreline and/or dock
- Construct erosion and sediment control measures along the shoreline
- General maintenance to the vegetated area

If vegetation is removed, it shall be replaced with native vegetation as detailed in the SMP in order to maintain the function of the vegetative buffer along the shoreline. In the event that vegetation is removed from within the Project boundary without a permit, the responsible individual may be required to replace vegetative materials within the Project boundary.

2.1.5 Aquatic Vegetation

The management of existing aquatic vegetation is addressed in Appalachian's Aquatic Vegetation Management Plan that is being filed as part of Appalachian's license application. The introduction of native, aquatic vegetation where this type of habitat is lacking is covered in Section 2.3 of this Habitat Management Plan.

2.2 MITIGATION FOR THE LOSS OF HABITAT DUE TO SHORELINE DISTURBANCE

Disturbance along the shoreline for the construction of a boat dock or the installation of shoreline stabilization can result in the removal of important habitat along the shoreline and the littoral zone. Trees and woody debris along the shoreline, especially trees that overhang or protrude into the water, provide important habitat that is utilized by a variety of aquatic, semi-aquatic, and terrestrial organisms.

2.2.1 Dock Construction

The SMP will be revised to require mitigation for lost habitat due to the construction of a dock. At the time of dock construction, it will be required that bundles of woody debris and/or cedar trees or other approved material be anchored and contained within the area under the stationary portion of the dock. Guidelines for bundling and anchoring woody debris and/or cedar trees are located in Appendix A of this Plan. If it is deemed that the site is not suitable for habitat replacement (e.g. the water is too shallow or too deep, it creates navigational issues, etc.), then off-site mitigation will be required.

2.2.2 Shoreline Stabilization

The SMP will be revised to require mitigation for lost habitat due to the clearing of shoreline and installation of riprap to replace the function of the woody debris. At the time of shoreline disturbance, it will be required that bundles of woody debris and/or cedar trees or other approved material be anchored at sufficient depths adjacent to the disturbed shoreline. Guidelines for bundling and anchoring woody debris and/or cedar trees are located in Appendix A of this Plan. If it is deemed that the site is not suitable for habitat replacement (e.g. the water is too shallow or too deep, it creates navigational issues, etc.), then off-site mitigation will be required. Recommended mitigation will depend on existing habitat at the site prior to disturbance.

2.2.3 Vegetation Removal

The SMP will be revised to require mitigation for lost habitat due to the removal of vegetation along the shoreline that is extending over into the water. This will include any dead vegetation that is overhanging into the water. At the time of vegetation removal, any vegetation extending out into the water will need to be replaced with alternative habitat. Guidelines for alternative habitats are located in Appendix A of this Plan. If it is deemed that the site is not suitable for habitat replacement (e.g. the water is too shallow or too deep, it creates navigational issues, etc.), then off-site mitigation will be required.

2.2.4 Mitigation in an Impact Minimization Zone

Shoreline classified as an Impact Minimization Zone due to habitat features (i.e. wetlands, woody debris, Natural Heritage areas, etc.) can not be developed without agency review and receiving FERC approval. The first preference will be to design around these habitat features so as to not disturb them. If this is not an option, the landowner will need to develop a mitigation plan in consultation with the various resource agencies to mitigate for the loss of habitat for consideration. If a plan can be agreed upon, it will be forwarded to the FERC as part of the request for approval. If it is deemed that the site is not suitable for habitat replacement (e.g. the water is too shallow or too deep, it creates navigation issues, etc.), then off-site mitigation may be considered. There may be times when the habitat can not be adequately replaced and the disturbance of the shoreline within the Project boundary will not be allowed.

2.2.5 Failure to Comply

Failure to comply with the requirements for mitigation may result in either 1) revocation of the dock or shoreline stabilization permit, 2) installation of habitat by Appalachian and/or other authority at the property owners cost or (3) owner contributing to a fund that will be used for off-site mitigation. These items are listed by preference.

2.3 ENHANCEMENT IN AREAS OF LIMITED HABITAT

Habitat at the Project is of key importance to the fish, birds, reptiles and other animals that live at the lake. This section of the plan provides a process for enhancing and/or creating additional habitat in areas where there is limited or poor habitat. This overall plan will be adaptive in nature and modified as necessary based on the previous year's experiences and will incorporate new techniques as they are identified.

A Habitat Management Technical Review Committee will be established with representation from Appalachian, Virginia Department of Game and Inland Fisheries, Smith Mountain Lake Association, Leesville Lake Association, Tri-County Lake Administrative Commission and one at-large member with experience in habitat enhancement. The purpose of the technical committee will be to plan habitat enhancement projects at the Project and to review enhancement / mitigation projects submitted by individuals or community groups.

A list of areas and the type of habitat to be added is included in Appendix B of this plan. These areas include land adjacent to public access sites, islands, and areas adjacent to undeveloped shoreline (including Appalachian- owned properties) on both Smith Mountain and Leesville Lakes. Sites identified to date include shoreline at the Smith Mountain Lake State Park, VDGIF's public boat ramp access sites, Franklin County Park, Appalachian-owned islands, Appalachian's two public picnic areas, and other Appalachian-owned properties including the three sites set aside for future public use. A map of these sites is located in Appendix C. Each site will be assessed for the type of habitat that should be created. Habitat to be considered will include both natural and man-made fish attraction structures, vegetative plantings, and native (non-aggressive) aquatic vegetation. Appendix A contains guidelines for constructing the various types of habitats. These guidelines will be revised as necessary based on experience that is gained each year. The sites have been prioritized and a schedule developed for implementing the measures. This schedule is located in Appendix B. These areas will also be considered as areas where the off-site mitigation that is required under Section 2.2 can be located if approved by the Technical Committee.

Demonstration projects that have the dual benefits of habitat and erosion control will be developed for a site on Smith Mountain lake and a site on Leesville lake. Appalachian, in consultation with VDGIF, will develop detailed plans for the two demonstration projects. The plans will be provided to the Habitat Technical Review Committee for review and comment. Following the consultation, the detailed plans will be filed with the Commission for review and approval. The proposed areas for these two demonstration projects are noted on the map in Appendix C.

Information will be provided to the lake community containing ideas on how to enhance habitat adjacent to their properties. Partnering with interested communities, clubs and associations to construct enhancement projects will be encouraged. Information on how to locate the enhancement sites will also be provided to the community in the form of brochures and a website.

A fund will be set up to support habitat enhancement projects for Leesville and Smith Mountain Lakes. Appalachian will contribute \$25,000 per year (adjusted by appropriate Consumer Price Index) to this fund. This money will be used for habitat enhancement projects on the lakes as determined in consultation with the Technical Committee. Additional funds may come from the state, counties, grants, mitigation payments, or partnering groups.

3.0 MONITORING AND CONSULTATION MEASURES

The purpose of this section of the Plan is to outline how the plan will be monitored and the process for consultation with the state agencies and other interested stakeholders.

3.1 Monitoring

Mitigation measures under Section 2.2 will be verified when the completed dock, riprap or vegetation removal project is inspected. Follow-up inspections of random projects may also be performed to ensure the measures stay in place. For projects required under Section 2.2.4, GIS data will be collected and the mitigation measures will be inspected periodically to ensure the measures remain in place.

GIS data for all enhancement projects under Section 2.3 will be collected and the areas included on a map. This information will be made available publicly to the fishing community. These sites will be inspected annually to qualitatively assess their success and ensure they are functioning as designed. The criteria to assess the structures will include ensuring that they are in place, are in relatively the same condition as when installed and they remain secure. Following the fifth year of plan implementation, Appalachian will consult with VDGIF to assess habitat enhancement areas for comparison with areas without the enhancements. The results of this exercise will be provided in the five-year report to FERC to determine success of the enhancements.

3.2 Consultation

An overall plan for enhancement projects will be developed in consultation with the Technical Review Committee. The table in Appendix B will be developed as part of this consultation process. The plan outlines locations, types of habitat, and parties to be involved in the enhancement projects. The Technical Review Committee will meet at least once per year to review the overall plan and recommend changes as needed. IMZ mitigation plans will be circulated to members of the Technical Review Committee for review and comment. (Note: The agencies that are already required under the Shoreline Management Plan's requirements will still be involved in the IMZ review process.) Additional meetings will be held on an as-needed basis.

3.3 Reporting

The enhancement plan that is developed as part of the Habitat Management Plan will be reviewed annually by the Technical Review Committee and revised as needed by Appalachian. Appalachian will prepare an annual report outlining the enhancement work that has been completed. It will include a) monitoring information associated with Section 3.1 above; b) a summary of the enhancement projects that have been completed including details on the habitat types; c) education measures that have been implemented; and d) any recommendations for changes to the Habitat Plan. A five year report will be compiled for submission to the Federal Energy Regulatory Commission. Included in this report will be support documents indicating consultation with the Technical Review Committee, a summary of the annual report findings as described above, an assessment of the success of the enhancements and any changes in the Habitat Plan that will require Commission approval.

4.0 Education

The Technical Review Committee will identify measures to share information with the lake community related to the importance of habitat, measures that individuals can undertake to improve habitat along their shoreline, and opportunities to partner on habitat enhancement projects.

5.0 Coordination with Other Management Plans

The Erosion Monitoring Plan includes the requirement to develop two demonstration projects that incorporate both erosion control and habitat along shoreline of each of the two lakes. Appalachian, in consultation with VDGIF, will develop detailed plans for the two demonstration projects. The plans will be provided to the Habitat Technical Review Committee for review and comment. Following the consultation, the detailed plans will be filed with the Commission for review and approval.

A copy of the annual Habitat Enhancement report will be provided to the Debris Technical Review Committee for their information. This will provide the Debris Technical Review Committee with information on the qualities of debris that provide habitat and where these projects are located so they will not be disturbed. This will also provide the Habitat Technical Review Committee with input on how any proposed enhancement projects could create issues from a navigation standpoint.

A copy of the annual Debris report will also be provided to the Habitat Technical Review Committee for their information. This will provide information to the committee regarding potential debris accumulation areas so these areas can be assessed for habitat potential.

Appendix A – Mitigation Guidelines and Specifications

The following information is provided as guidelines for constructing Habitat Enhancement Projects under the Habitat Management Plan. Since this plan is adaptive in nature, these guidelines will be modified as necessary to take into consideration experience from previous year's projects and new techniques as they are identified.

Cover:

Natural:

- 1) Submerged Trees
- 2) Felling

Artificial:

- 1) Plastic Structures
- 2) Wooden Structures

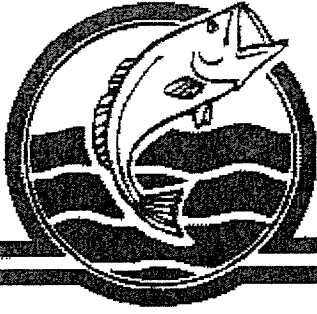
Riprap Structures:

Plantings: Native Vegetation (Water willow)

Source Documents:

Southern Division American Fisheries Society (AFS) Reservoir Committee Habitat Manual for Use of Artificial Structures in Lakes and Reservoirs
(<http://www.sdafs.org/reservoir/manuals/habitat/Main.htm>)

Aquatic Plant Establishment Workshop Presentation: Propagation and Establishment of Native Vegetation, 2006 SDAFS Spring Meeting
(<http://www.sdafs.org/reservoir/manuals/aqveg/veghome.htm>)



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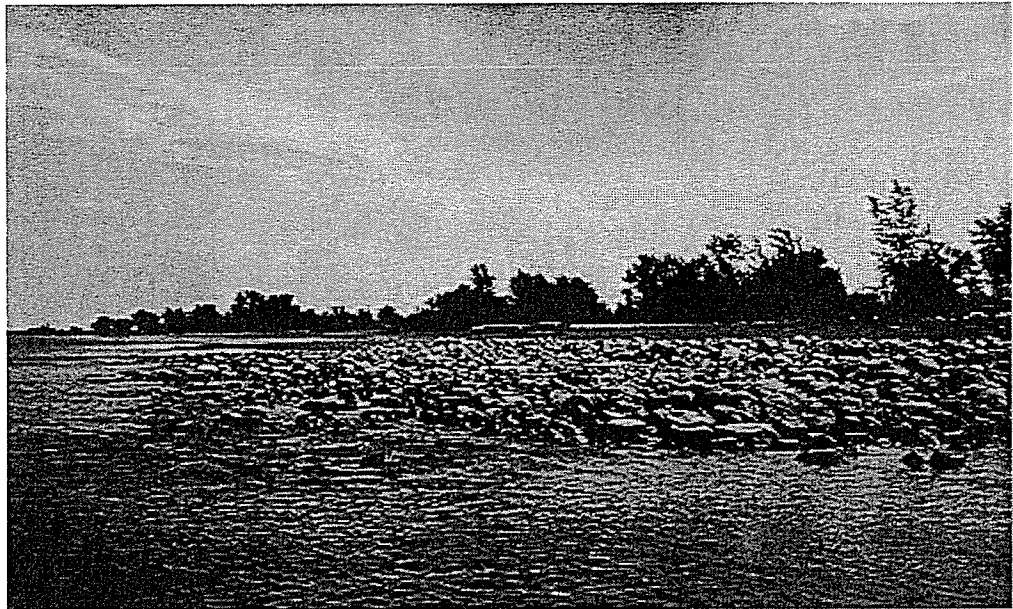
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Habitat Manual for Use of Artificial Structures in Lakes and Reservoirs



Compiled by the Southern Division AFS Reservoir Committee
Summarized by Kim Tugend, University of Florida

The Reservoir Committee of the Southern Division of the American Fisheries Society conducted a survey of state agencies to identify: (1) agency goals of habitat enhancements, (2) preferences for different habitat enhancement methods, (3) advantages and disadvantages of various habitat enhancement methods; and (4) efforts to assess fish-population responses to habitat enhancements. The survey began by identifying biologists within each state who have conducted numerous habitat-enhancement efforts for that agency. Once these contacts were identified, they were sent written questionnaires. The questionnaires asked respondents to evaluate each type of structure (e.g., brush piles, substrate modifications) that have been used by the state agency including advantages/disadvantages of each method, agency goals for habitat enhancements, and a summary of efforts to assess fish-population responses to

habitat enhancements. Aeration, fertilization, planting (e.g., aquatic vegetation and trees), and water level fluctuations were omitted from the survey.

This online Habitat Enhancement Manual summarizes the results of the survey and includes the opinions of the respondents. The purpose of this manual is to provide biologists, students, and other interested parties with information that can optimize habitat-enhancement efforts. We reviewed references, including state reports, graduate theses, and peer-reviewed journal articles, for each structure type.

We would like to thank all survey recipients and members of the Southern Division AFS Reservoir Committee for their efforts in compiling the survey data. *The information contained herein does not reflect the opinions or views of the American Fisheries Society or the Southern Division Reservoir Committee. Contact your state agency prior to placing any of these structures for information concerning specific permits or licenses required.*

To obtain information concerning particular structures, types of structures, an overall summary of survey results, please choose one of the links below.

Summary of Results
Cover
Shoreline Stabilization Structures
Spawning Structures
Substrate Modifications

We welcome any suggestions, concerns or comments you may have with regards to this manual. You may direct your comments to Dr. Mike Allen at msal@gnv.ifas.ufl.edu.

Manual last updated on August 30, 2000



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As the name implies, this category is defined by structures which provide cover. Of all the structures reported (n=159 responses), 81% were intended for use as fish attractors to increase angler catch and harvest, 39% as nursery habitat for juvenile fish, 34% as adult habitat/sanctuary, and 20% as spawning habitat. For our purposes, we have divided cover into two classes: natural (e.g., brush piles, felling) and artificial (e.g., tires, wooden structures, plastic structures). For more information, please select one of the following:

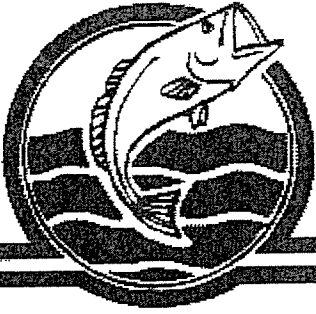
Natural Cover

- [Submerged Trees](#)
- [Felling](#)

Artificial Cover

- [Plastic Structures](#)
- [Tires](#)
- [Wooden Structures](#)

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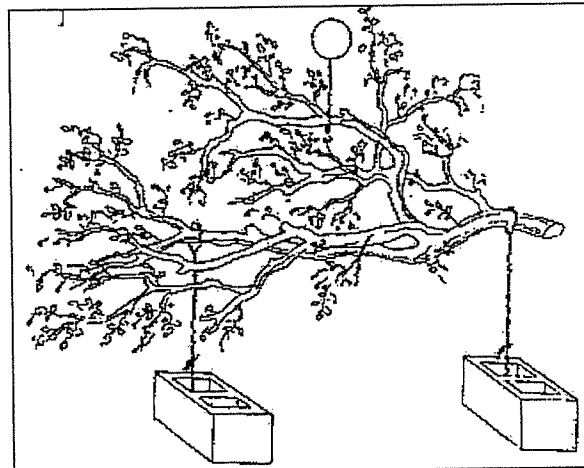
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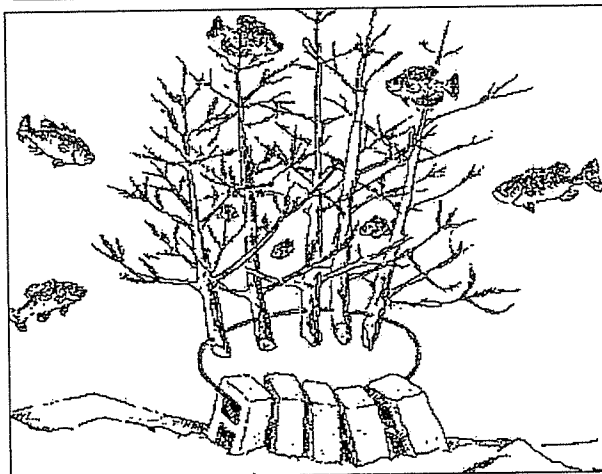
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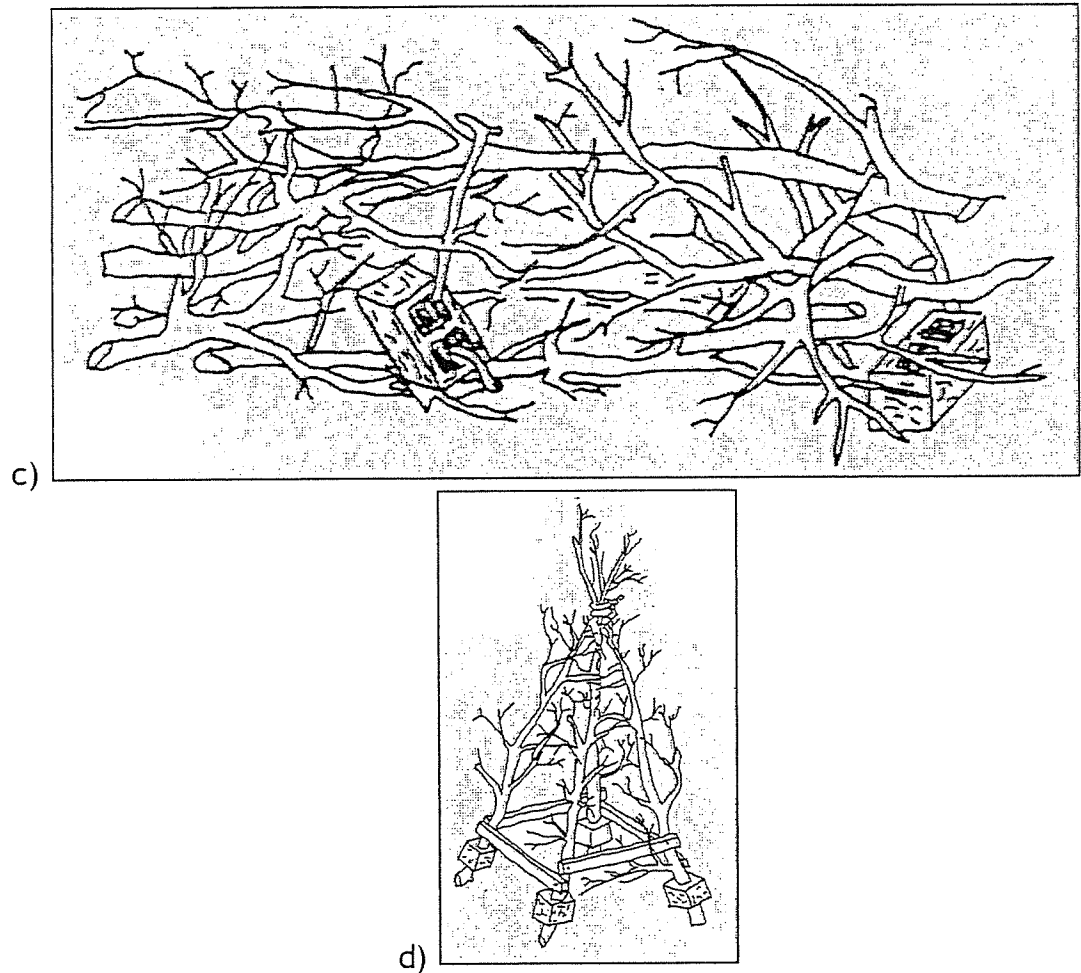
A variety of tree types are used by state agencies depending on availability. These include: ash, cedar, citrus, cottonwood, elm, fir, hickory, juniper, locust, lodgepole, manzanita, mesquite, persimmon, pine, and willow. Some common configurations are pictured below (a-suspended horizontal placement; b-suspended vertical bundle; c-horizontal bundle; d-tepee or pyramid type).



a)



b)



Click here for [map](#) of states that used this method.

Major reasons used:

- low or no cost
- availability of materials

Reported advantages:

Most studies indicate increased angler catch rates and/or catch per unit effort of sportfish around structures, including largemouth bass (*Micropterus salmoides*), crappie (*Pomoxis* sp.), bluegill (*Lepomis macrochirus*), and channel catfish (*Ictalurus punctatus*) (see references below).

Some structures provide nursery habitat for young fish (e.g., Cofer 1991).

Structures can be colonized by periphyton, a food source for macroinvertebrates.

Good for public relations (e.g., Christmas tree recycling programs).

Reported disadvantages:

Materials may deteriorate with age, so fish use may decrease over time.

Structures are prone to snagging tackle.

Due to lure loss, angler use may decrease.

Recommendations:

Trees placed vertical in the water column may be more effective for longer periods of time than those lying horizontal.

One solution for limiting snags is tying multiple trees together in the vertical position forming rows of trees. This allows fisherman to cast between rows and avoid snagging.

If suspended off the bottom, problems with siltation or fluctuating water levels can be minimized.

Species of tree may be important. Trees which provide more dense cover, such as cedar, concentrate smaller fish; whereas trees which provide less dense coverage, such as oak, concentrate larger fish (Cofer 1991).

Mean reported time to create/place one structure/unit: 15 hrs (range 0.1 - 160, n=63)

Mean reported life of structure/unit: 9 yrs (range 1 - 100, n=61)

Degrees of Satisfaction:

- *average ratings on a scale of 1 - 5 with 1 being very satisfied and 5 being very dissatisfied.
- fish attractor to increase angler catch and harvest 1.8 (n=53)
- fish production/spawning habitat 2.0 (n=11)
- adult habitat/sanctuary 2.1 (n=21)
- recruitment 2.6 (n=30)

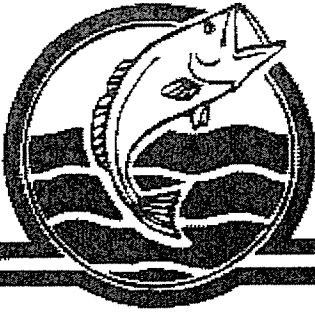
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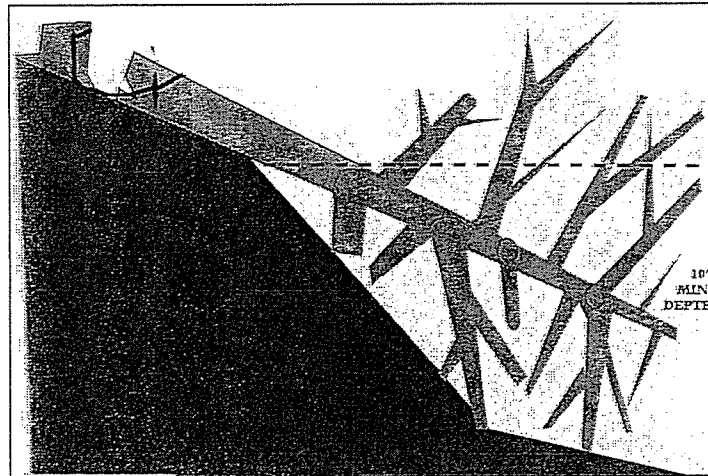
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Species used depend on those which were locally available. Survey responses included alder, cottonwood, hardwood, oak, sycamore, and willow. A typical configuration is pictured below. The shoreline tree is felled into the lake or reservoir and anchored to the remaining stump via cable.



Click here for [map](#) of states that used this method.

Main reasons used:

- availability of materials (i.e., shoreline trees)
- low cost

Reported advantages:

Trees do not have to be moved to the lake/reservoir (i.e., saves money and time).

Reported disadvantages:

Felling may lose its effectiveness at low water levels.

Recommendations: none reported

Mean reported time to create/place one structure/unit: 0.7 hrs (range 0.2 - 2, n=14)

Mean reported life of structure/unit: 15 yrs (range 2 - 10, n=15)

Degree of Satisfaction:

**average ratings on a scale of 1 - 5 with 1 being very satisfied and 5 being very dissatisfied

- fish attractor to increase angler catch and harvest 1.7 (n=12)
- adult habitat/sanctuary 2.2 (n=6)
- fish production/spawning habitat 2.6 (n=5)
- recruitment 3.0 (n=6)

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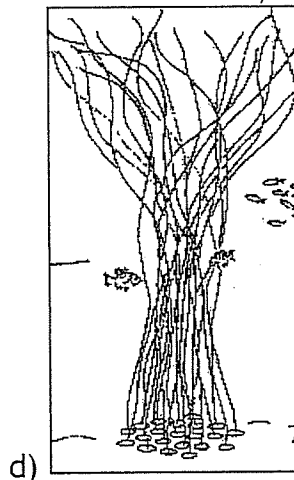
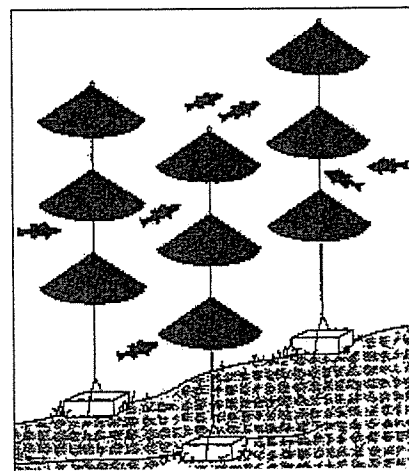
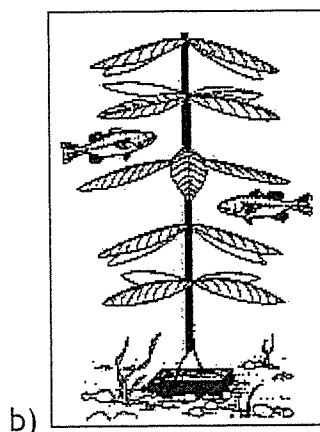
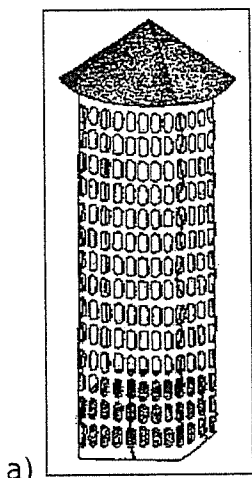
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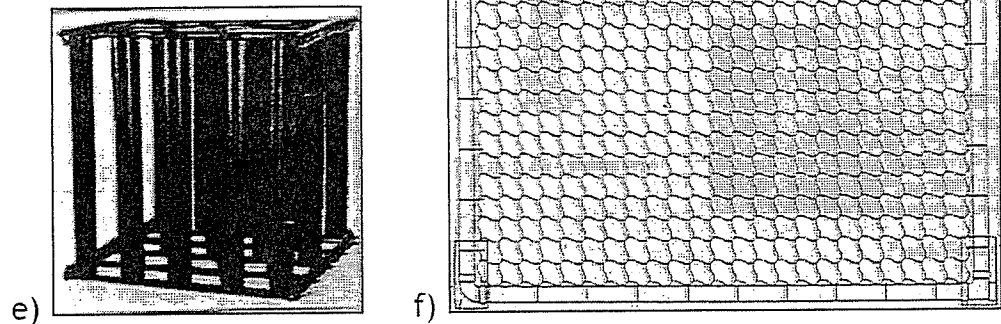


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Pictured above are (a) a [fish condo](#), (b) a [Fish 'N Tree](#) (c) Mushroom Hat Structures, (d, e) [Berkley FISH HABs](#) (string and pallet varieties, respectively), and (f) a [GeoWeb panel](#). Other structures included in this category are PVC pipe stake beds, plastic streamers and ribbons, plastic buckets, and pipes. Below, we have listed the survey responses for these different types of plastic structures.

Fish 'N Trees

Fish 'N Trees are manufactured by Plastics Research and Development Corporation (PRADCO), POB 1587 Fort Smith, AR, 800-422-FISH.

Click here for [map](#) of states that used this method.

Main reasons used:

- perceived effectiveness
- experimentation
- longevity of materials
- water quality concerns.

Reported advantages:

Structures are durable and long-lived.

Because the leaves are buoyant and rotate freely, lures tend not to snag.

Reported disadvantages:

These structures may be expensive and prone to vandalism during exposure in reservoirs with fluctuating water levels.

Leaves may sag when covered with periphyton or silt.

Recommendations: none reported

Mean reported time to create/place one structure/unit: 19 hrs (range 2 - 48, n=3)

Mean reported life of structure/unit: 6 yrs (range 4 - 8, n=2)

Related state reports:

McKinney, S. P., and five co-authors. 1992. Longevity of fish attractor materials. 1991 - 1992 Fish Management Annual Progress Report. State of Florida Game and Fresh Water Fish Commission, Tallahassee.

McKinney, S. P., and four co-authors. 1993. Longevity of fish attractor materials. 1988-1993 Completion Report. State of Florida Game and Fresh Water Fish Commission, Tallahassee.

Plastic Mesh-Type Structures

Some structures included in this category have perforations for the sole purpose of providing cover for small fish by excluding others on the basis of size. These include, among others, cubed structures such as plastic chicken crates, which may be stacked on top of each other and structures composed of plastic netting or snow/safety fencing. Cylinders composed of netting may or may not be topped with "Chinese hats" (e.g., [fish condo](#), Fig. a). Snow fencing may also be stretched around and between trees. Other structures are used to provide cover for adult fish and include such structures as [GeoWeb panels](#) (Fig. f) which may be hung vertically or in pairs to form a pup tent.

Click here for [map](#) of states that used this method.

Main reasons used:

- longevity
- low cost
- few tackle hang ups
- availability of materials

Reported advantages:

Most reports indicate use of these structures by juvenile sportfish, including largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*).

Structures are good for use in water supply reservoirs where organic materials are not allowed.

Structures are durable and long-lived.

Reported disadvantages:

Structures may entangle the lower units and propellers of outboard motors at low water levels or when placed in shallow areas.

Structures may experience silting problems and so limit fish access in some reservoirs.

Growth of periphyton, an important food source for macroinvertebrates, on structures is limited in low fertility waters.

Recommendations:

Structures are not recommended for low fertility or silt-laden systems. As mentioned above, silting may coat the structures limiting fish access, and periphyton growth on structures is limited in low fertility waters (Lemons 1992).

Mean reported time to create/place one structure/unit: 12.9 hrs (range 1 - 90, n=10)

Mean reported life of structure/unit: 26.7 yrs (range 8 - 100, n=9)

Degree of Satisfaction:

**average ratings on a scale of 1 - 5 with 1 being very satisfied and 5 being very dissatisfied.

- recruitment 2.3 (n=3)
- fish attractor to increase angler catch and harvest 2.3 (n=7)
- adult habitat/sanctuary 2.5 (n=2)

Related state reports:

Lemons, B. 1992. Lake Powell artificial habitat project. Final Report. Arizona Game and Fish Department, Page.

McKinney, S. P., and five co-authors. 1992. Longevity of fish attractor materials. 1991 - 1992 Fish Management Annual Progress Report. State of Florida Game and Fresh Water Fish Commission, Tallahassee.

McKinney, S. P., and four co-authors. 1993. Longevity of fish attractor materials. 1988-1993 Completion Report. Florida Game and Fresh Water Fish Commission, Tallahassee.

Owen, G., A. L. Egbert, and J. V. Shireman. 1995. Fish attractors. 1994-1995 Completion Report. Florida Game and Fresh Water Fish Commission, Tallahassee.

Berkley FISH HAB

FISH HABs come in two varieties, string and pallet types, and are manufactured by Berkley, One Berkley Drive, Spirit Lake, IA 51360, 800-237-5539. All states which reported this type of structure utilized the pallet variety, and one state utilized both.

Click here for map of states that used this method.