

EAST FORK PROJECT – FERC NO. 2698-NC

FISHERIES STUDY

INTRODUCTION

During the biological studies consultation process subsequent to the issuance of the First Stage Consultation Package for the East Fork Hydroelectric Project, the state and federal resource agencies identified the need for additional fisheries data in the vicinity of the project. Accordingly, a Technical Leadership Team (TLT) comprised of representatives from the North Carolina Wildlife Resources Commission (NCWRC), the United States Fish and Wildlife Service (USFWS), the United States Forest Service (USFS), the Land Trust for the Little Tennessee and the applicant was established to develop fisheries studies for the various Nantahala Area hydro projects. The study for the East Fork Project consisted of qualitative fisheries surveys in the short bypasses between the dams and powerhouses of the Bear Creek and Cedar Cliff developments and quantitative surveys in the East Fork Tuckasegee River and Wolf Creek bypasses of the Tennessee Creek development. The objectives of the study were to: (1) Describe the fishery resources in the bypasses associated with the East Fork Project, and (2) Determine any potential project-related impacts to the fishery resources at the project.

METHODS

The fisheries study consisted of population estimates and supplemental qualitative sampling in the lower Tennessee Creek and Wolf Creek bypasses and qualitative surveys in the bypasses between the Bear Creek dam and powerhouse and Cedar Cliff dam and powerhouse. The population sampling and data analyses were conducted utilizing the depletion sampling methodology and protocols outlined in the NCWRC's *Trout Stream Management Standardized Sampling and Data Analysis Methods* (Borawa 1996). The qualitative sampling was conducted utilizing standard backpack electrofishing techniques.

Depletion population estimates were conducted at one location each in the lower Tennessee Creek (also known as Bona's Defeat) and Wolf Creek bypasses, just upstream of the Tennessee Creek powerhouse. The sampling site in the Tennessee Creek bypass, EF-1, was located approximately 100 m upstream of the confluence with the East Fork Tuckasegee River. Due to the high gradient nature and remoteness of the Tennessee Creek bypass, logistical and safety considerations necessitated that the sample site be located in the lower portion of the bypass. The sample reach was 100 m in length and averaged 7.9 m in width. Sampling at EF-1 was conducted on October 10, 2001. Prior to sampling, block nets were placed across the stream at the upstream and downstream ends of the study reach to ensure that fish did not move into or out of the study reach during sampling. Three backpack electrofishing units were used to conduct a standard three-pass depletion sample. In addition to the depletion sampling, qualitative sampling of selected pools and riffles in the bypass upstream of EF-1 was conducted with a single

backpack unit to determine if the species assemblages in the high gradient region were similar to those at EF-1.

The sampling site in the Wolf Creek bypass, EF-2, was located approximately 50 m upstream of the Tennessee Creek powerhouse. This sample reach was 100 m in length and averaged 4.8 m in width. Sampling at EF-2 was also conducted on October 10, 2001. Prior to sampling, block nets were placed across the stream at the upstream and downstream ends of the study reach to ensure that fish did not move into or out of the study reach during sampling. As with Location EF-1, a standard three-pass depletion sample was conducted, however, due to the narrower channel width, only two backpack electrofishing units were used to sample Location EF-2. Also, as was conducted at Location EF-1, additional qualitative sampling of selected pools and riffles in the bypass upstream of Location EF-2 was conducted with a single backpack electrofishing unit to determine if the species assemblages in the higher gradient region were similar to those at Location EF-2.

The site for the qualitative sampling of the Bear Creek bypass was located immediately upstream of the confluence of the bypass with the Bear Creek tailrace. Only approximately 30 m of bypass channel had sufficient flow to permit sampling. A single backpack electrofishing unit was used to sample this site.

The site for the qualitative sampling of the Cedar Cliff bypass was located approximately 50 m upstream of the Cedar Cliff powerhouse. The sample reach was 150 m in length. Two backpack electrofishing units were used to sample this site. At the time of sampling, flows in the bypass were higher than normal. These higher flows were a result of problems with the minimum flow valve at the Cedar Cliff powerhouse. As a result of the valve problems, the minimum flow requirement for the river downstream of the Cedar Cliff development was being met by releases at the dam, hence the higher than normal flows in the bypass.

Catch data from depletion sampling at Locations EF-1 and EF-2 were summarized in tabular format by sample station and species for total catch, catch per unit of effort (CPUE) for both number of fish per hour and number of fish per 100 m of stream, population estimate, density (fish/ha), and standing crop (kg/ha). Population estimates and associated statistics were generated with Microfish 3.0 software (Van Deventer and Platts 1989). Results of qualitative sampling in the Bear Creek and Cedar Cliff bypasses and the supplemental qualitative sampling at Locations EF-1 and EF-2 were summarized in tabular format as number of fish by species and location.

RESULTS AND DISCUSSION

Location EF-1, Tennessee Creek Bypass

Depletion sampling at Location EF-1 yielded a total of 492 fish representing 12 species (Tables 1 and 2). The overall catch was representative of a relatively diverse assemblage of warmwater/coolwater species. In terms of abundance, minnows, northern hog suckers

and sunfish comprised the majority of the catch. No trout were collected from this site. The diverse assemblage of warmwater/coolwater species at Location EF-1 is likely related to its proximity to the headwaters of Bear Creek Reservoir and the resulting movement of fishes from the reservoir to the lower reaches of the bypass channel.

The population estimate for this reach of stream yielded an overall density of 6,879 fish/ha and an overall standing crop of 55.3 kg/ha (Table 3). In terms of number of fish, river chubs (2,625 fish/ha), Northern hog suckers (1,150 fish/ha) and central stonerollers (975 fish/ha) comprised the majority of the total catch. Rock bass was the most abundant game species collected (588 fish/ha). In terms of biomass, rock bass (19.4 kg/ha), river chubs (13.6 kg/ha) and Northern hog suckers (12.6 kg/ha) comprised the majority of the overall standing crop.

The additional qualitative sampling in the higher gradient portion of the bypass upstream of the depletion sample site did not yield any additional species (Table 4). The total number of species collected from this reach (5 species) was considerably less than the number from the downstream reach (12 species) and is likely related to the natural barriers to upstream migration that exist between the lower and upper reaches.

Location EF-2, Wolf Creek Bypass

Depletion sampling at Location EF-2 yielded a total of 290 fish representing 9 species (Tables 1 and 2). Similar to Location EF-1, the assemblage of fishes at EF-2 included both warmwater and coolwater species. Brown trout were also collected from Location EF-2. In terms of abundance, minnows, white suckers and sunfish comprised the majority of the catch. As with Location EF-1, the assemblage of warmwater/coolwater species found at Location EF-2 is indicative of the migration of fish from the headwaters of Bear Creek Reservoir into the lower reaches of the Wolf Creek bypass.

The population estimate for Location EF-2 yielded an overall density of 6,140 fish/ha and an overall standing crop of 37.7 kg/ha (Table 3). In terms of number of fish, creek chubs (2,200 fish/ha), blacknose dace (1,980 fish/ha), white suckers (820 fish/ha) and central stonerollers (520 fish/ha) comprised the majority of the total catch. Redbreast sunfish was the most abundant game species collected (320 fish/ha). In terms of biomass, white suckers (13.8 kg/ha), creek chubs (10.7 kg/ha) and blacknose dace (5.8 kg/ha) comprised the majority of the overall standing crop.

Consistent with sampling results from Location EF-1, the additional qualitative sampling in the higher gradient portion of the Wolf Creek bypass upstream of Location EF-2 did not yield any additional species (Table 4). The total number of species collected from this reach (5 species) was about half the number collected from the downstream reach (9 species) and, as was the case with the Tennessee Creek bypass, the lower species diversity is likely related to the natural barriers to upstream migration that exist between the lower and upper reaches.

Bear Creek Bypass

The qualitative sampling of the Bear Creek bypass resulted in the collection of only four blacknose dace (Table 5). This low catch is reflective of the small amount of available sampling habitat.

Cedar Cliff Bypass

The qualitative sampling in the Cedar Cliff bypass resulted in the collection of only two rainbow trout and one redbreast sunfish (Table 5). The higher bypass flows resulting from the minimum flow valve problems at the powerhouse do not appear to have attracted many fish to the bypass, however, the presence of the two rainbow trout is probably a result of increased accessibility due to the higher flows.

LITERATURE CITED

- Borawa, J. C. 1996. Trout stream management standardized sampling and data analysis methods. North Carolina Wildlife Resources Commission, Division of Boating and Inland Fisheries. 8 pp.
- Van Deventer, J. S. and W. S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data - users guide for Microfish 3.0. U. S. Forest Service General Technical Report INT-254. 29pp.

Table 1. Fish species occurrence by sample location for the East Fork Tuckasegee River bypass reaches EF-1 and EF-2, during 2001.

| Species | Location | |
|--------------------------------|-------------------|-------------------|
| | EF-1 ¹ | EF-2 ² |
| Central stoneroller | | |
| <i>Campostoma anomalum</i> | X | X |
| Warpaint shiner | | |
| <i>Luxilus coccogenis</i> | X | |
| River chub | | |
| <i>Nocomis micropogon</i> | X | |
| Blacknose dace | | |
| <i>Rhinichthys atratulus</i> | X | X |
| Longnose dace | | |
| <i>Rhinichthys cataractae</i> | X | |
| Creek chub | | |
| <i>Semotilus atromaculatus</i> | X | X |
| White sucker | | |
| <i>Catostomus commersoni</i> | | X |
| Northern hog sucker | | |
| <i>Hypentelium nigricans</i> | X | X |
| Brown trout | | |
| <i>Salmo trutta</i> | | X |
| Rockbass | | |
| <i>Ambloplites rupestris</i> | X | |
| Redbreast sunfish | | |
| <i>Lepomis auritus</i> | X | X |
| Bluegill | | |
| <i>Lepomis macrochirus</i> | X | X |
| Spotted bass | | |
| <i>Micropterus punctulatus</i> | X | X |
| Greenside darter | | |
| <i>Etheostoma blennioides</i> | X | |
| | | |
| Total Number of Species | 12 | 9 |

¹ Tennessee Creek bypass reach

² Wolf Creek bypass reach

Table 2. Catch per unit of effort (number per hour and number per 100 m of stream) for Locations EF-1 and EF-2, Tennessee Creek and Wolf Creek bypasses, during October 2001.

| Common Name | Scientific Name | EF-1 | | EF-2 | | EF-1 | EF-2 |
|----------------------------|--------------------------------|-------------|---------|-------------|---------|-----------|-----------|
| | | Total Catch | No./hr. | Total Catch | No./hr. | No./100 m | No./100 m |
| Brown trout (wild) | <i>Salmo trutta</i> | -- | -- | 2 | 1 | -- | 2 |
| Central stoneroller | <i>Campostoma anomalum</i> | 71 | 38 | 26 | 15 | 71 | 26 |
| River chub | <i>Nocomis micropogon</i> | 188 | 101 | -- | -- | 188 | -- |
| Warpaint shiner | <i>Luxilus coccogenis</i> | 30 | 16 | -- | -- | 30 | -- |
| Blacknose dace | <i>Rhinichthys atratulus</i> | 28 | 15 | 90 | 53 | 28 | 90 |
| Longnose dace | <i>Rhinichthys cataractae</i> | 9 | 5 | -- | -- | 9 | -- |
| Creek chub | <i>Semotilus atromaculatus</i> | 1 | 1 | 104 | 61 | 1 | 104 |
| Northern hog sucker | <i>Hypentelium nigricans</i> | 78 | 42 | 1 | 1 | 78 | 1 |
| White sucker | <i>Catostomus commersoni</i> | -- | -- | 39 | 23 | -- | 39 |
| Rock bass | <i>Ambloplites rupestris</i> | 33 | 18 | -- | -- | 33 | -- |
| Redbreast sunfish | <i>Lepomis auritus</i> | 27 | 14 | 16 | 9 | 27 | 16 |
| Bluegill | <i>Lepomis macrochirus</i> | 7 | 4 | 11 | 6 | 7 | 11 |
| Spotted bass | <i>Micropterus punctulatus</i> | 9 | 5 | 1 | 1 | 9 | 1 |
| Greenside darter | <i>Etheostoma blennioides</i> | 11 | 6 | -- | -- | 11 | -- |
| Total | | 492 | 263 | 290 | 171 | 492 | 290 |

Table 3. Fish population estimates by species for Locations EF-1 and EF-2, Tennessee Creek and Wolf Creek bypass reaches, during October 2001.

| Species | Location | |
|--|--------------------------|--------------------------|
| | EF-1 | EF-2 |
| | 100m x 7.95m = 0.08ha | 100m x 4.82m = 0.05ha |
| Brown trout (wild) <i>Salmo trutta</i> | | |
| Total catch | | 2 |
| Catch by Run (1) (2) (3) | | (2) (0) (0) |
| Est. population | | 2 |
| +/- Confidence | | x |
| Number of fish/hectare | | 40 |
| Kg of fish/hectare | | 1.7 |
| Central stoneroller <i>Campostoma anomalum</i> | | |
| Total catch | 71 | 26 |
| Catch by Run (1) (2) (3) | (43) (17) (11) | (22) (3) (1) |
| Est. population | 78 | 26 |
| +/- Confidence | 5 | 0 |
| Number of fish/hectare | 975 | 520 |
| Kg of fish/hectare | 2.0 | 2.5 |
| River chub <i>Nocomis micropogon</i> | | |
| Total catch | 188 | |
| Catch by Run (1) (2) (3) | (112) (48) (28) | |
| Est. population | 210 | |
| +/- Confidence | 9 | |
| Number of fish/hectare | 2,625 | |
| Kg of fish/hectare | 13.6 | |
| Warpaint shiner <i>Luxilus coccogenis</i> | | |
| Total catch | 30 | |
| Catch by Run (1) (2) (3) | (22) (6) (2) | |
| Est. population | 30 | |
| +/- Confidence | 1 | |
| Number of fish/hectare | 375 | |
| Kg of fish/hectare | 0.7 | |
| Blacknose dace <i>Rhinichthys atratulus</i> | | |
| Total catch | 28 | 90 |
| Catch by Run (1) (2) (3) | (17) (8) (3) | (50) (31) (9) |
| Est. population | 29 | 99 |
| +/- Confidence | 2 | 6 |
| Number of fish/hectare | 363 | 1,980 |
| Kg of fish/hectare | 1.4 | 5.8 |

Table 3. Continued.

| Species | Location | |
|--|----------------------------------|----------------------------------|
| | EF-1 100m x 7.95m = 0.08ha | EF-2 100m x 4.82m = 0.05ha |
| Longnose dace <i>Rhinichthys cataractae</i> | | |
| Total catch | 9 | |
| Catch by Run (1) (2) (3) | (6) (1) (2) | |
| Est. population | 9 | |
| +/- Confidence | 1 | |
| Number of fish/hectare | 113 | |
| Kg of fish/hectare | 0.6 | |
| Creek chub <i>Semotilus atromaculatus</i> | | |
| Total catch | 1 | 104 |
| Catch by Run (1) (2) (3) | (1) (0) (0) | (65) (30) (9) |
| Est. population | 1 | 110 |
| +/- Confidence | x | 4 |
| Number of fish/hectare | 13 | 2,200 |
| Kg of fish/hectare | 0.2 | 10.7 |
| Northern hog sucker <i>Hypentelium nigricans</i> | | |
| Total catch | 78 | 1 |
| Catch by Run (1) (2) (3) | (46) (15) (17) | (1) (0) (0) |
| Est. population | 92 | 1 |
| +/- Confidence | 9 | x |
| Number of fish/hectare | 1,150 | 20 |
| Kg of fish/hectare | 12.6 | 0.3 |
| White sucker <i>Catostomus commersoni</i> | | |
| Total catch | | 39 |
| Catch by Run (1) (2) (3) | | (24) (11) (4) |
| Est. population | | 41 |
| +/- Confidence | | 2 |
| Number of fish/hectare | | 820 |
| Kg of fish/hectare | | 13.8 |
| Rock bass <i>Ambloplites rupestris</i> | | |
| Total catch | 33 | |
| Catch by Run (1) (2) (3) | (16) (8) (9) | |
| Est. population | 47 | |
| +/- Confidence | 15 | |
| Number of fish/hectare | 588 | |
| Kg of fish/hectare | 19.4 | |

Table 3. Continued.

| Species | Location | |
|--------------------------------|----------------|----------------|
| | EF-1 | EF-2 |
| | 100m x 7.95m = | 100m x 4.82m = |
| Redbreast sunfish | | |
| <i>Lepomis auritus</i> | | |
| Total catch | 27 | 16 |
| Catch by Run (1) (2) (3) | (16) (11) (0) | (13) (2) (1) |
| Est. population | 27 | 16 |
| +/- Confidence | 1 | 0 |
| Number of fish/hectare | 338 | 320 |
| Kg of fish/hectare | 3.1 | 2.0 |
| Bluegill | | |
| <i>Lepomis macrochirus</i> | | |
| Total catch | 7 | 11 |
| Catch by Run (1) (2) (3) | (4) (1) (2) | (4) (6) (1) |
| Est. population | 7 | 12 |
| +/- Confidence | 1 | 3 |
| Number of fish/hectare | 88 | 240 |
| Kg of fish/hectare | 0.4 | 1.1 |
| Spotted bass | | |
| <i>Micropterus punctulatus</i> | | |
| Total catch | 9 | 1 |
| Catch by Run (1) (2) (3) | (6) (3) (0) | (0) (1) (0) |
| Est. population | 9 | 1 |
| +/- Confidence | 0 | x |
| Number of fish/hectare | 113 | 20 |
| Kg of fish/hectare | 0.5 | 0.1 |
| Greenside darter | | |
| <i>Etheostoma blennioides</i> | | |
| Total catch | 11 | |
| Catch by Run (1) (2) (3) | (5) (6) (0) | |
| Est. population | 11 | |
| +/- Confidence | 1 | |
| Number of fish/hectare | 138 | |
| Kg of fish/hectare | 0.8 | |
| Total Fish | | |
| Number of fish/hectare | 6,879 | 6,140 |
| Kg of fish/hectare | 55.3 | 37.7 |

Table 4. Results of supplemental qualitative sampling in the Tennessee Creek and Wolf Creek bypasses during October 2001.

| Common Name | Scientific Name | Location | |
|-----------------------------|--------------------------------|-------------------|-------------------|
| | | EF-1 ¹ | EF-2 ² |
| Central stoneroller | <i>Campostoma anomalum</i> | 2 | 15 |
| River chub | <i>Nocomis micropogon</i> | 8 | -- |
| Blacknose dace | <i>Rhinichthys atratulus</i> | -- | 1 |
| Longnose dace | <i>Rhinichthys cataractae</i> | 1 | -- |
| Creek chub | <i>Semotilus atromaculatus</i> | -- | 3 |
| Brown trout (wild) | <i>Salmo trutta</i> | -- | 1 |
| Rock bass | <i>Ambloplites rupestris</i> | 1 | -- |
| Redbreast sunfish | <i>Lepomis auritus</i> | 1 | 6 |
| | | | |
| Total Fish Collected | | 13 | 26 |
| Total Fish Species | | 5 | 5 |

¹ Tennessee Creek bypass reach

² Wolf Creek bypass reach

Table 5. Results of qualitative sampling of the Bear Creek and Cedar Cliff bypasses during June 2001.

| Species | Location | | | |
|------------------------------|-------------|-------------------|-------------|-------------------|
| | Bear Creek | | Cedar Cliff | |
| | No. of Fish | Total Length (mm) | No. of Fish | Total Length (mm) |
| Blacknose dace | | | | |
| <i>Rhinichthys atratulus</i> | 4 | 50 | -- | |
| | | 50 | | |
| | | 74 | | |
| | | 82 | | |
| Rainbow trout (wild) | | | | |
| <i>Oncorhynchus mykiss</i> | -- | | 2 | 191 |
| | | | | 293 |
| Redbreast sunfish | | | | |
| <i>Lepomis auritus</i> | -- | | 1 | 112 |