

1947

RECOMMENDATIONS FOR MANAGEMENT OF
GREAT SMOKY MOUNTAINS NATIONAL PARK FISHERY

Submitted by:

Lloyd L. Smith, Jr.,
Assistant Chief, Biology Division,
National Park Service.

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GREAT SMOKY MOUNTAINS
NATIONAL PARK

I. FISHERY PROBLEMS OF GREAT SMOKY MOUNTAINS NATIONAL PARK

There are approximately 425 miles of excellent trout water in the Great Smoky Mountains National Park. These steep boulder strewn streams have good pools, rapids, and riffles but are poor in dissolved minerals and low in available trout foods. Good forest cover has reduced erosion to a minimum and except after heavy rains the water is clear and relatively constant in flow. The important game fish species which occur in the park are the Appalachian brook trout, the smallmouth bass and the introduced rainbow and New England brook trout. At the present time the rainbow trout is the principal resource of the angler. Occasionally brown trout are taken in some of the warmer waters and catches of smallmouth bass are often reported.

The fishery problems of the park must be considered in light of the fact that its streams constitute 20 to 30 percent of the good trout water of the southern Appalachian region and a substantial portion of all the trout streams in Tennessee. This important position in the fishery resources of the area creates a situation which cannot be met without careful recognition of the fishery management policies and procedures exercised in adjoining areas.

The fishing pressure exerted on the waters of the park is estimated to be between 15,000 and 20,000 fishermen days annually. In contrast to most national park areas the greater part of this load is provided by local residents living within a radius of 50 to 100 miles of the park boundaries. Many farmers living adjacent to the park fish several days per week. In addition to their numerical importance, local residents are also the most successful fishermen, usually taking more fish per trip than the tourists.

Since the building of the Tennessee Valley Authority reservoirs and the creation of large fish populations in these waters, there are probably more

local fishermen than ever before. High temperatures and increased availability of food in July and August cut down fishing success in the impoundments. Consequently, during this period there is a tendency for local anglers to shift from the impoundments to the trout streams of the park. As general fishing intensity in the vicinity builds up, this tendency will probably increase.

In view of the conditions outlined above, successful fishery management in the park is faced with several major problems. The most pressing is the establishment and maintenance of an adequate program of biological checks on fish populations and inventories of the fish removed from the streams each year. Unless the present deficiency in this line is corrected, successful maintenance of the fishery cannot be achieved.

A second problem which is basic concerns park policy. It must be determined whether fishing is to depend on natural reproduction lightly supplemented with artificially reared fish of catchable size or whether sufficient planting will be done to insure a high return regardless of present or future fishing loads. Although present policy does not contemplate intensive fishery management in park areas, the important position of Great Smoky Mountain waters in the general resources of the region will make the local fish policy an important factor in public relations and in inter-agency and state cooperation. Contingent upon the solution of the foregoing problem is the third which relates to the provision of an adequate supply of catchable-size fish to fulfil the planting requirements. At the present time a hatchery is maintained on the North Carolina side of the park near Smokemont to raise fish for this purpose. Since the efficiency of this hatchery is in question and extensive repairs are needed to keep it in operation, consideration should be given to other sources of fish.

To evaluate the extent and importance of these problems and to outline

a plan of management and observation, various investigations and conferences^{1/} were carried on in the Great Smoky Mountains National Park by Lloyd L. Smith, Assistant Chief, Biology Division, from May 25 to June 8, 1947. Since a large amount of biological work has been done on park streams by various investigators, part of the present task has been to integrate these findings into current management and future plans. During the present reconnaissance much time was devoted to a study of fishery administrative problems and fishing methods and intensity. No attempt was made to secure a quantitative check of the present fish populations since Holloway of the Fish and Wildlife Service recently made a comprehensive analysis.^{2/}

II. FISHERY INVENTORY AND INVESTIGATIONS

Organization

Successful administration of fishing resources in the Great Smoky Mountains National Park requires the development of a thorough program of biological check and inventory. Any plan of fishery management which does not incorporate continual biological check will have limited success and will always be inefficient. Because waters of the area are extensive and varied and because trout management, even when most efficient, is expensive, the observational and scientific work should be

^{1/} Meetings held at Gatlinburg, Tennessee, with John Blosz and Ancil Holloway of Fish and Wildlife Service; Randolph Shields, North Carolina Game and Fish Department; Charles Chance, Fisheries Biologist, Tennessee Conservation Department; and members of Great Smoky Mountains National Park staff.

^{2/} Report on the Fisheries of the Great Smoky Mountains National Park by Ancil D. Holloway, Biologist. Sept. 6 - Oct. 4, 1945.

directed by a competent biologist trained in fisheries who can spend his entire time in the park. To carry on the necessary studies, seasonal assistance, both professional and sub-professional, will be required. It is therefore recommended that provision be made for the establishment of a permanent biologist, P-3, position on the park staff and that the temporary help of at least two P-1 biologists or technicians be provided for the period of the fishing season. The principal function of these men will be to keep a constant check on the fish biology in park streams and to determine the annual utilization of fishes by the public.

Nature of Investigational Work

Academic problems of interest to scientists abound in park waters and many opportunities for basic investigations in fishery biology exist but studies required for careful management fall in three groups: inventory of fish utilization, check on fish populations, and check on success, recovery, and contribution of planted fish.

(1) Extent of fish utilization is the most vital information to be obtained from all waters where any heavy fishing is done. The many points of access to the streams make the task more than normally difficult. Some form of direct creel census in which fishermen are interviewed by biologists or clerks is essential. Since the number of watersheds to be covered will probably preclude complete inventory, a statistically sound method of sampling will have to be worked out. From these data satisfactory figures on fish removal can be projected. When fishermen become educated to the method and necessity for reporting, a system of voluntary returns may be used to supplement the direct census. All creel census procedure should be made as simple as possible to eliminate sources of error and unnecessary

inconvenience to fishermen. Essential data to be secured from each angler should include (1) number of fish of each species in the creel, (2) number of hours fished, (3) location of fishing effort on stream or section thereof, (4) type of tackle, (5) and if possible total weight of catch. Successful stocking is dependent on this information.

The principal streams to be covered are Abrams Creek, Forge Creek, Anthony Creek, Mill Creek (Cades Cove), West Prong Little River, Middle Prong Little River, main Little River from Sinks to headwaters, West Prong Little Pigeon, Middle Prong Little Pigeon, Cosby Creek, Big Creek (when fishing intensity becomes greater), Cataloochee Creek, Oconaluftee River and Bradley Fork, and Deep Creek and other streams on southwest side of park when fishing pressure develops.

(2) Another essential tool necessary to carry on successful stocking is a check on return and contribution of planted fish. This can be accomplished by fin clipping and check during creel census. Such studies can be confined to several typical areas and need not be extended to all waters. Results can be generally applied to streams of similar type and fishing load. Since the percentage of natural fish in the catch and the percentage return of planted fish will determine the number of fish which must be planted to maintain a certain quality of fishing under existing load conditions, this phase of the work cannot be neglected.

(3) Periodic checks on size and composition of trout populations must be made to establish the success of natural reproduction, and the availability of brood stock. Disasters such as severe floods, abnormal drought, or unusual temperatures in marginal streams may seriously affect stream economy. Population checks should be made by approved methods such as electric shock, cresol method, or in rare cases rotenone. The cresol method is probably

the most useful in the Smokies but the electrical method is most satisfactory where it can be applied.

(4) When conditions are favorable, the possibility of reconverting some streams from rainbow populations to native brook trout should be explored. It has been suggested that heavy planting with catchable-size native brook trout would eventually bring about the change. Others have considered that poisoning and repopulation is the only method which could be successfully applied. A definite answer to the question of reestablishing native species in areas now occupied by exotics would be important for all park areas as well as the Smokies. This problem is not of primary concern in current fishery management but should be attacked whenever practicable.

Since available resources may not permit immediate launching of a full-scale biological program, inventory of seasonal catch by some type of creel census, even on a limited scale, should be started in the spring of 1948. This activity can be expanded and other phases of the investigational program can be started when funds permit.

III. STREAM SYSTEMS

In the following discussion of the various drainage systems, detailed descriptions of the individual streams and the characteristics of the fish populations have not been attempted. Mr. Ancil Holloway of the Fish and Wildlife Service quite adequately discussed these systems in his report of October 4, 1945. The comments contained in the present discussion are based on Holloway's report and on field observations by Smith during the spring of 1947. Stocking recommendations are based on the evaluation of stream needs and are enumerated in Table I.

Abrams Creek Drainage.

Abrams Creek from the Cove to the high falls is the principal stream in

the Cades Cove area. It was closed during the 1947 season and therefore will not require stocking in 1948. The other streams in Cades Cove have received little use during the 1947 season largely because Abrams Creek could not be fished. Fish populations are sufficiently large so that no stocking needs to be done in them during 1948. Thereafter, if heavy fishing develops in the Cove, some stocking should be done in Forge Creek, Mill Creek, the lower part of Cove Creek, Abrams Creek and possibly Anthony Creek near the campgrounds. Although occasional native brook trout occur in these streams, only rainbow should be planted.

Little River Drainage.

West Prong. The greater part of the West Prong of the Little River is at present inaccessible by car. Consequently trout populations are in excellent condition and natural reproduction is adequately maintaining the stock of fish. More fishing could be done on this Prong without reaching the limits of its productivity. In the lower three miles, intensive fishing, however, makes light annual stocking with rainbow desirable.

Middle Prong. This Prong affords some of the best fishing in the Little River system. In its upper stretches it is well stocked with both rainbow trout and native brook trout, the latter being largely confined to the upper tributaries. Fish populations are adequate and no stocking is recommended except in the lower three miles where the fishing pressure is heavy and natural reproduction is less successful. In this stretch, especially in the vicinity of the parking area, regular plantings of rainbow trout will be necessary to maintain good fishing.

Little River, Main Branch. Little River is one of the principal trout streams on the Tennessee side of the park and sustains one of the heaviest fishing loads administered to any park water. The stream on the basis of its

ecological nature and accessibility is readily divided into three principal areas: (1) below the Sinks, (2) between the Sinks and Elkmont, and (3) above Elkmont. The lower two areas are very accessible by road and subject to heavy fishing pressure. A road block a short distance above Elkmont prevents access to the upper regions of the stream, except on foot. Below the Sinks the stream furnishes some spring rainbow fishing, but warm summer conditions and the presence of bass and other warm water fishes limits the take during the greater part of the season. Between the Sinks and Elkmont, heavy fishing is carried on throughout the season and rainbow trout are readily available although this section of the stream approaches maximum temperature conditions for trout during the warmest part of the year. The best section of the stream for the experienced angler is above the road block on the truck trail, where a good population of rainbow trout is present in the main stream, Fish Camp Prong, and other headwaters. It is recommended that moderate plantings of rainbow trout be made annually between the Sinks and the road barrier above Elkmont. Stocking above the barrier is not necessary to maintain good fishing.

Little Pigeon River.

West Branch. This stream runs through Gatlinburg, past park headquarters and throughout its entire length parallels the main highway over the mountain. It is very accessible and heavily fished, especially by novice fishermen. In its lower stretches some smallmouth bass are present but from park headquarters to Road Prong rainbows are the principal game fishes. Above Road Prong, brook trout predominate. Investigations indicate that although the stream is well populated with fish the availability of catchable-size trout is low. Therefore, it is recommended that moderate plantings of rainbow trout be made between the Sugarland Branch and Road Prong and that light plantings of brook trout be made above Road Prong.

Le Conte Creek.

This stream is well suited to either brook or rainbow trout, but it is not recommended for planting with catchable-size fish. It is intensively fished by juveniles from the vicinity of Gatlinburg and its proximity to this population center makes adequate law enforcement difficult. Problems of poaching are such that it is impractical to attempt to maintain a good quality of fishing by planting catchable-size fish in reasonable numbers. It is therefore recommended that natural reproduction be depended upon to stock the stream even though it does not maintain a quality of fishing similar to that in other park waters.

Roaring Fork.

This stream has the same problems as those affecting Le Conte Creek. It is therefore recommended that no stocking of catchable-size fish be made in this creek.

Little Pigeon River, Middle Prong. This prong is heavily fished, especially in the vicinity of the campground. Much of its best water is inaccessible by automobile and its upper stretches are included within the Research Area. Rainbow trout are plentiful, but moderate stocking of this species should be done below the road blocks.

Cosby Creek.

Cosby Creek is relatively short and has water suitable for brook trout. However, the heavy fishing load, particularly by local residents, will make stocking with brook trout less satisfactory than continued stocking with rainbow trout. The extent of the fishing load will probably reduce brood stock in accessible areas below that needed for adequate reproduction. It is therefore recommended that moderate stocking of catchable-size rainbow trout be made.

Big Creek.

Big Creek and its tributaries have been considered by some investigators to be the best trout waters in the Southern Appalachians. It is inaccessible by automobile so that its resources are exploited heavily only in the two or three miles above the road block. Fishing success is uniformly good on this stream. The fish population is large but the average size of the fish is relatively small. Since no heavier fishing than at present can be expected, no stocking is recommended.

Cataloochee Creek.

Cataloochee Creek is a heavily fished area which includes several large tributaries in addition to the main stream. A part of this system has been closed during the 1947 season, and the remainder of it appears to be well supplied with trout. Until such time as biological investigation indicates a marked falling off in trout populations and fishing success, no planting is recommended. When the fishing load becomes great enough to justify planting, rainbows should be stocked in the accessible areas.

Straight Fork.

Straight Fork is a relatively heavy fished stream and a good portion of its lower stretches within the park are accessible by automobile. It is recommended that this portion of the stream be stocked moderately with rainbow trout.

Oconaluftee River.

The Oconaluftee River is one of the most heavily fished streams on the North Carolina side of the park. It is accessible by automobile throughout its entire length and can be fished by novice fishermen with considerable ease. Trout populations are apparently adequate but relatively poor fishing has been reported from this stream during the current season. It is suited

primarily for rainbow trout and it is therefore recommended that moderate stocking of this species be carried on from Kephart Prong to the park boundary.

Bradley Fork. Bradley Fork is heavily fished although inaccessible to automobile travel. Fishing success was good during the early 1947 season, but natural reproduction is moderate. Stocking of rainbow trout in the lower two miles of this stream is recommended.

Deep Creek.

Deep Creek attracts many fishermen, particularly from Bryson City and its vicinity. Natural reproduction is good and rainbow trout populations are satisfactory. Moderate stocking of rainbow trout is recommended in the three miles of this stream above the ranger station. Observations by the local warden and fishermen indicate bass and bluegills are encroaching on the trout water in this area. A careful biological check should be made each year to determine the extent of this invasion. They may become so numerous that continued trout planting in the area specified will not be worth while. Indian Creek, a tributary of Deep Creek, is protected from the influx of warm water fishes by a falls near its confluence with the main stream. If intensive fishing for trout on this tributary depletes the fish stock, planting of rainbows should be carried on.

Hazel Creek.

Hazel Creek is now inaccessible except by boat from Lake Fontana. Also a good portion of its most productive waters lies outside of park boundaries in Tennessee Valley Authority land. The portion of this creek now lying within park boundaries is adequately stocked with fish and no planting will be needed. If present negotiations for transfer of Tennessee Valley Authority land in this watershed to the Park Service put this entire stream under park

jurisdiction, more intensive management may be required, especially when the proposed road from Fontana Dam to Bryson City on the north side of the Lake is constructed.

Approximately half way between the entrance of Haw Gap Branch and Bone Valley Creek the stream passes over a 6 foot falls which is believed to be impassable to all warm water fish that may originate in Lake Fontana. It will also prevent upstream migrations of trout. It is quite probable that the area below this falls may become so heavily inhabited with warm water fishes, especially bass, that trout management will be difficult. Under no circumstances should any warm water fish be placed above this falls.

Eagle Creek.

Eagle Creek is at present relatively inaccessible and approachable only by boat from Lake Fontana. Although there is considerable fishing pressure on it at this time, no planting should be attempted until it is made accessible by highway.

Twenty Mile Creek.

Twenty Mile Creek has been closed during the current 1947 season and so should need no planting in 1948. Thereafter moderate numbers of rainbow trout should be stocked in the lower three miles to support the heavy fishing pressure originating in Fontana Village and vicinity.

Minor Streams.

A number of minor streams, most of which have been closed to fishing in past years, are not considered in the foregoing discussion. Fishing pressure will be light on them because in most cases they are small without large resources. It is recommended that no attempt be made to build up fishing in them by planting of catchable-size fish.

into areas previously occupied exclusively by rainbows. This trend which is probably traceable to improvement of stream conditions through reforestation may eventually restore brook trout to many of the more favorable sites. It is therefore recommended that all catchable size trout planted in waters where rainbow trout now predominate be restricted to this species but that in no case should rainbow trout be planted in areas where brook trout predominate. This action is desirable because; (1) it is impractical under present conditions to restore brook trout to the lower heavily fished sections of the streams; (2) planted rainbows of catchable size will make a more sustained contribution to the annual creel than will brook trout because hatchery reared rainbow are less easily caught by novice anglers than hatchery reared brook trout, at least for the first few weeks after planting; (3) planted brook trout because they are more susceptible to anglers' lures are caught almost immediately after planting and so retain hatchery characteristics believed by anglers to be undesirable; (4) rainbow trout are available from many sources and their use will not require maintenance of special hatchery facilities such as would be desirable if native brook trout were used for planting purposes.

In sections of a few park streams where brook trout predominate and where the fishing load is very heavy, native brook trout should be planted if available.

Size of Fish to be Planted.

In all areas where natural production is insufficient to provide the desired return to the anglers, it is recommended that catchable-size fish be planted in preference to fingerlings. Natural reproduction in most cases will provide all fingerlings which can be reared naturally to catchable size. Additional fingerling planting will therefore not contribute materially to

the angler's creel. Catchable-size trout on the other hand will provide more fish to the creel because they are stocked to provide fish in excess of the natural producing capacity of the stream.

Areas to be Planted.

In general, only accessible and heavily fished stretches of the streams should be planted. These areas are usually paralleled by roads and do not include parts of streams accessible only by long walks. On the accompanying map are indicated in red, stream sections recommended for planting.

Investigations by Ancil Holloway of the Fish and Wildlife Service in 1945 indicated that the great majority of streams above the road blocks on truck trails were over-populated with small fish. Observations in the spring of 1947 and checks on anglers' catches confirm this finding. Until such time as very much heavier fishing load is experienced, planting in these stretches will be unnecessary.

Number of Fish to be Planted.

Park plans do not include the making of streams into a "fisherman's paradise" comparable to the trout streams in Pisgah National Forest where intensive management is practiced. Stocking in this latter area is carried on with the intention of insuring each fisherman an average return of five fish per trip. All stocking is contingent upon census returns and upon careful check of trout stream populations at the end of the season.

Table I indicates two proposed stocking policies for 57 miles of trout stream in the Great Smoky Mountains National Park. Plan "A" is based on the system used in Pisgah National Forest and the estimated present fishing load on park streams. Plan "B," which is recommended for use until changes in present fishing intensity occur, is based on half the stocking recommended under Plan A. Such a reduction is felt to be justified by the presence of

large numbers of unutilized fish in the headwaters of all streams. By keeping fishing better in the headwater areas, those downstream fishermen will be encouraged to shift upward out of the heavily used zones. Furthermore, a guaranteed catch of sizeable proportion to all anglers including the novice will tend to increase the fishing load continually requiring ever-increasing plants of hatchery raised fish. With the amount of stream available for such management in accessible park areas, it is difficult to predict the ultimate scope of such a management plan.

Utilization of stocking Plan B will require a distribution cost of approximately \$1,484.00 the first year and \$484.00 in each succeeding year provided that the park secures adequate fish transportation equipment (Table II).

Distribution of Fish.

The present antiquated method of fish distribution by means of milk cans and barrels should be abandoned as soon as modern fish transportation tanks can be made available. Detailed plans and specifications for such tanks are included in appendix 1. It is recommended that two independent units suitable for mounting on pickup trucks be built. Each unit can be made to carry approximately 100 pounds of fish or the equivalent number as calculated from the following weight tabulation.

TABLE I, PROPOSED PLANTING PROGRAM FOR THE
GREAT SMOKY MOUNTAINS NATIONAL PARK

	Miles to be stocked	PLAN A.		PLAN B.	
		No. of Fish	No. days for distribution	No. of Fish	No. days for distribution
Cades Cove (Forge Creek) (Mill Creek) (Cove Creek) (Abrams Creek)	10	3,000 Rainbow	6	1,500 Rainbow	3
West Prong (Little River)	3	600 Rainbow	1	300 Rainbow	1
Middle Prong (Little River)	3	4,000 Rainbow	6	2,000 Rainbow	3
Little River (Main Stream)	8	5,000 Rainbow	7	2,500 Rainbow	3.5
West Prong (Little Pigeon River)	5	1,500 Brook	1.5	750 Brook) 750 Rainbow)	1.5
West Prong (Little Pigeon River)	5	1,500 Rainbow	1.5	750 Rainbow	1.5
Middle Prong (Little Pigeon River)	5	1,500 Rainbow	3	750 Rainbow	2
Cosby Creek	2	700 Rainbow	2	700 Rainbow	.5
Straight Fork	3	1,000 Rainbow	1	500 Rainbow	4
Oconaluftee	4	5,000 Rainbow) 3,000 Rainbow)	8	2,500 Rainbow) 1,500 Rainbow)	1
Bradley Fork	3	1,000 Rainbow	1	500 Rainbow	.5
Deep Creek	3	1,000 Rainbow	2	500 Rainbow	21.5
Twenty Mile Creek	57	28,800	40	14,750	

TABLE II, FISH DISTRIBUTION COSTS AT
GREAT SMOKY MOUNTAINS NATIONAL PARK

PLAN A.

Cost of distribution:	Salaries, two men, 2 months - - - -	\$ 560.00
	Truck operation, 40 days - - - -	240.00
	Materials - - - - -	<u>75.00</u>
		\$ 875.00
	Cost of distribution tanks (2) - - -	<u>\$ 1,000.00</u>
	Total cost distribution (first year) - - -	\$ 1,875.00
	Total cost distribution (annual) - - - - -	\$ 875.00

PLAN B.

Cost of distribution:	Salaries, two men, 1 month- - - - -	\$ 280.00
	Truck operation, 21.5 days- - - - -	129.00
	Materials - - - - -	<u>75.00</u>
		\$ 484.00
	Cost of distribution tanks (2) - - -	<u>\$ 1,000.00</u>
	Total cost distribution (first year) - - -	\$ 1,484.00
	Total cost distribution (annual) - - - - -	\$ 484.00

<u>Size of Fish</u>	<u>Number per Pound</u>	<u>Number per 160-lb. Load</u>
9"	3.47	555.
8-3/4"	3.75	600.
8 1/2"	4.12	659.
8 1/4"	4.45	712.
8	4.94	790.
7-3/4"	5.40	864.
7 1/2"	5.99	958.
7 1/4"	6.50	1,040.
7"	7.35	1,176.

Approximately 1,000 fish of the type normally obtained from the hatchery can be carried for a period from six to eight hours in this equipment if ice is available or if transportation is accomplished in cool weather. In the event that the Smokemont hatchery is abandoned as a rearing station and retained merely as a staging point, the two transportation units can be placed on a ton and a half truck and used for carrying fish from the Walhalla or other neighboring hatcheries to the park. Distribution within the park can be accomplished by use of a single unit on a pickup truck. It is estimated that the cost of each unit will be approximately \$500.00.

The most efficient use of planted fish will be secured if the recommended numbers are not all placed in the stream at one time. If possible at least two and preferably three plantings should be made. Where numbers of fish at each planting would be too small for economical transportation, fewer plants can be made or several areas can be planted with one load.

V. MAINTENANCE OF KEPHART PRONG FISH HATCHERY AND OTHER REARING STATIONS

During the past 10 years the fish used for planting in Great Smoky Mountains National Park waters, have been grown for the most part at the Kephart Prong Hatchery near Smokemont. Throughout the history of this hatchery difficulties have been experienced which have lowered its efficiency and periodically caused considerable fish mortality. These troubles are inherent in the station and are referable principally to water quality and periodic low temperature conditions. Careful operation has overcome these disadvantages to a large degree but the source of the trouble is always present.

The hatchery is owned and physical maintenance of the plant is provided by the National Park Service. Operating personnel and costs of rearing fish and of grounds maintenance are provided by the Fish and Wildlife Service working in accordance with a cooperative agreement between this agency and the National Park Service. Distribution of fish to park waters is done by park personnel and vehicles.

At the present time the hatchery plant is badly run down and will require approximately \$5,000.00 for minimum repairs to place it in satisfactory operating condition.^{3/} By the time money can be made available (July 1, 1948) further deterioration will have occurred and cost of repairs will be greater.

If the station is to be maintained as a park facility in a condition comparable to other park structures, an additional expenditures of between \$8,000.00 and \$12,000.00 must be made to provide an additional residence, parking lot improvements, and approach developments. Additional power

^{3/} See attached estimate of maintenance cost prepared by Richard F. Dittman of the Fish and Wildlife Service.

generating equipment will have to be added and possibly other facilities such as domestic water supply improved.

The necessity for these rather extensive maintenance and development expenditures requires prompt decision on the future status of this hatchery. As outlined in the proposed planting program, the requirements of park fishery management will call for approximately 15,000 catchable-size fish annually. This number of fish cannot be raised efficiently at Kephart Prong and such low production cannot justify the maintenance expenditures now required. Unless total production were to be stepped up to two or three times the amount needed for current planting plans, costs could not be made comparable to other federal^{4/} and state hatcheries. During the season of 1946 the cost of each pound of trout raised at Kephart Prong Hatchery was \$1.88. This cost includes an allowance for only a minor amount of building maintenance, and none for major maintenance or distribution of fish. At the Pisgah Rearing Station where the U. S. Forest Service maintains the hatchery plant and takes care of distribution, costs for each pound of trout were \$0.63 during the past season. At the Fish and Wildlife Service Hatchery at Walhalla, fish cost \$1.95 per pound with all maintenance and overhead included. At the Berlin, New Hampshire, station of the Fish and Wildlife Service fish were raised for \$0.74 per pound. Although activities at all these hatcheries are not strictly comparable the sample figures indicate that the present operation at Kephart Prong cannot be justified on a basis of efficient operation.

In the event that the hatchery is abandoned, it is believed that federal hatcheries in the vicinity of the park could supply present needs for the park planting program. Should greater hatchery capacity be needed to fill

^{4/} Cost figures for federal hatcheries were provided by the Division of Game Fish and Hatcheries, U. S. Fish and Wildlife Service.

possible future demands additional trout could be more economically provided by expanding other federal hatcheries than by maintaining Kephart Prong facilities. It is therefore recommended that hatching and rearing of trout be discontinued at Kephart Prong and that present buildings be razed or adapted for other uses. The existing circular rearing pools can be maintained as a staging station to facilitate distribution of trout brought in from outside hatcheries. There is some evidence that trout brought in from other hatcheries, especially Erwin, sustain excessive mortality on transfer to park waters. This difficulty has been observed only at the hatchery and should be checked in other streams by holding transferred fish where they can be observed until extent of mortality is determined. If experiments prove that outside fish cannot be moved into park waters without too great a mortality, the need for a hatchery may have to be re-evaluated.

Cades Cove Rearing Station.

The rearing station at Cades Cove which consists of circular pools and oblong pools was carefully examined. Although the plant there has not been used for several years, the pools, with the exception of the water distribution system, seem to be in workable condition. However, water intakes at the site of the dam need cleaning and repair, and no residence or utility house is available. In view of the fact that water conditions are not ideal and that demand for fish in the park area is limited, it is recommended that no rehabilitation or plans for reopening this plant be made.

Chimneys Rearing Station.

The raceways and rearing pools at the Chimneys Rearing Station are in disrepair and could not be made workable without rehabilitation of the water distribution system and installation of residence and utility building. The rather limited capacity of this plant, the incompatibility of hatchery

development with other uses of the area, and the limited need for reared stock make rehabilitation or operation at this station unnecessary.

VI. FISHING REGULATIONS

In recent years there has been a tendency to complicate the form of regulations and to institute unimportant or at least not vitally necessary restrictions on fishing in park areas. This action has resulted in extra clerical work, frequent confusion and delay in getting out annual regulations for each park. Since it is highly desirable that all park regulations be as simple as possible and that those which must be changed annually are made available to park personnel well before the fishing season, very careful consideration has been given to the requirements of Great Smoky Mountains National Park. In making recommendations every effort has been made to accomplish simplification and clarity without creating administrative difficulties or endangering the fish populations. Although it will still be necessary to change regulations from time to time to conform with local needs, it is hoped that these changes can be based on careful biological knowledge and thorough inventory of the fisherman's take rather than on local pressure.

Open and Closed Waters.

Past regulations for this park have stipulated a number of closed waters. These closures have been based first on the assumption that depletion of the fish population had occurred and that a year of rest was necessary for rehabilitation; second, that headwater areas should be closed to act as fish reservoirs for the remainder of the stream; third, that it is desirable to close streams used for domestic water supply; and fourth, to preserve waters of the research area for purposes of scientific investigation.

After careful observation of fishing conditions and fish populations in park streams and the history of populations as indicated in previous scientific

investigations, it is believed that the best results can be obtained by permitting fishing on all park waters except those used for water supply and those in the research area. Existing fish populations do not show need for the protection afforded by stream closure and research has indicated that little or no benefit is to be derived from permanent fish refuges. On the contrary, spreading the fishing load to all available areas will relieve pressure on heavily fished streams and result in more economical use of all fish in the park. Since all streams must be patrolled whether they are open or closed, there should be no additional load on enforcement personnel when all waters are open. In the less important streams or headwaters which have been closed, it is a question whether legitimate fishermen will exceed the poachers which have used these areas in the past. There is definite evidence that the psychological effect of a closed water on the fishermen sometimes defeats the purpose of the closure because poaching and attempted illegitimate use of the water is greatly increased. The warden and ranger force which is now available cannot prevent a certain amount of fishing on all closed areas. The natural protection which this wilderness provides poachers makes the patrol job exceedingly difficult.

In view of the above considerations it is recommended that all waters of the park be opened to fishing except the following water-supply streams:

Mingus Creek,

Lands Creek,

Chestnut Branch;

and the following streams of the research area:

all branches of Ravens Fork,

Middle Prong of the Little Pigeon River and its
tributaries above Ramsey Prong.

In connection with the closure of the research area it should be pointed out for the benefit of future research investigators that some poaching undoubtedly occurs on these waters and for that reason the fish populations cannot be considered as undisturbed.

Open Season.

The open seasons as they now exist are in conformity with the seasons maintained in Tennessee and North Carolina. There appears to be no reason for altering them. It is therefore recommended that fishing in the park be permitted from sunrise to sunset, from May 16 to August 31, inclusive.

Restrictions on the Use of Bait.

For several years fly fishing only has been permitted in waters of Great Smoky Mountains National Park. During the current season bait fishing has been permitted in certain streams, especially those in the less accessible regions, and fly fishing only has been permitted in the most heavily fished areas. Careful observation of the success attained by both fly fishermen and bait fishermen indicates that on the average the bait fisherman is much less successful than the fly fisherman. In general the most skillful fishermen use flies and the novice is more inclined to use bait.

It is the opinion of rangers, wardens, and local fishermen that the total number of fishermen using park waters has not been increased substantially by easement of the restriction against bait fishing. It is believed that the restriction of fly fishing in the heavily fished waters will not significantly reduce the fishing load in these areas. On the other hand, it prevents the taking of large cannibalistic trout which inhabit the large pools and which in the normal course of fishing, especially in the warmer months, do not rise to a fly. It is desirable to remove some of these large fish annually to permit greater survival of small and medium size trout. Having two types

of bait restriction on different parts of the same stream greatly increases enforcement problems and is therefore undesirable. In view of these considerations, it is recommended that fishing with both natural bait and flies be permitted in all streams provided, however, that no minnows, dead or alive, shall be used as bait and that the gathering of natural baits of any kind within the boundaries of the park shall be prohibited.

Size Limits.

Present size restrictions on trout permit the taking of fish which are greater than 7 inches in length or which have been injured in the catching. The exception to the size limit which is afforded by the clause regarding injury makes practical enforcement of the size limit almost impossible. The majority of small fish which are taken and released by the anglers probably suffer injuries resulting in impairment of growth and eventual death. This may not be obvious to the angler and death may not actually occur for several days or weeks after the injury. The waste is a very tangible one, however, and could probably be reduced by permitting the retention of all fish regardless of size in the creel. Many fishermen who now continue to fish after having caught several times their limit of small fish will probably be satisfied to retain some small fish in the creel to make up the limit, thus reducing the overall load on larger fish. It is considered impractical, however, to require that the first 10 fish taken, regardless of size, be retained in the creel.

We therefore recommend that size limits be removed from trout in the Great Smoky Mountains National Park as soon as conformity or acquiescence can be obtained from the states of Tennessee and North Carolina. Since the fishery technicians of both states, the Fish and Wildlife Service and the Park Service are in general agreement on the principle of removing size limits,

it is suggested that administrative representations to the proper state officials be made by the Director of the National Park Service indicating his desire for removal of size limits.

The catch of bass in park waters is small, and it is very doubtful whether any use is served by restricting the size limit on this species. It is recommended that size limits be removed from this species also when conformity of adjacent states is secured.

Limit of Daily Catch.

Present bag limits on bass and trout appear to be satisfactory. It is therefore recommended that the daily and possession limits on trout be 10 fish and on black bass, 8 fish; provided, however, that mixed creels of trout and bass shall not exceed 10 fish in the aggregate. No creel limit should be placed on carp or any species other than those referred to above.

Fishing Licenses.

At present the park issues no fishing licenses or permits. A state license is valid in the park only in that area lying within the state lines. This requires that the fisherman intending to use all park waters secure two licenses, one from North Carolina and one from Tennessee. If he is a non-resident of both states he must secure two non-resident licenses at a considerable cost.

It is recommended that the states of North Carolina and Tennessee enter into some type of joint agreement whereby one fishing license can be issued which will permit fishing throughout the park area. It is further suggested that administrative officers of the National Park Service make such recommendations to the two states concerned.

Accessibility to Streams from Truck Trails.

There has been considerable controversy concerning the opening of truck

trails to public use by automobiles, especially those which parallel trout streams. It has been pointed out that this action would redistribute the fishing load and permit more effective utilization of park fishery resources. This argument carries considerable weight because it is acknowledged by technicians that many headwaters and portions of streams now accessible only by walking are underfished and that a large harvestable supply of fish goes to waste annually.

Although from a fish management standpoint, opening of truck trails under present fishing conditions would be desirable, several considerations appear to make this action unwarranted from the point of view of long-range policy. First, easy access would tend to reduce general park values. Second, the trails are not now suitable for public travel and would require very substantial improvement and maintenance if open to public use. Many bridges would have to be rebuilt and the roads widened to permit safe travel. Opening of these inaccessible areas to car travel would greatly increase the total fishing load, thereby increasing the problem of maintaining fish populations. Greater accessibility would also heighten the fire hazard. In view of the foregoing considerations, it is recommended that for the present at least truck trails remain closed to public access.

VII. SUMMARY OF FISHING CONDITIONS AND FISH MANAGEMENT RECOMMENDATIONS

1. Fisheries resources of the park are now in good condition with the greater part of available streams underfished.
2. Heavily fished and accessible sections of most streams are in good condition but will require sustained stocking with catchable-size trout to maintain satisfactory fishing.

3. Native brook trout are slowly moving from headwaters to areas formerly occupied exclusively by rainbow but efforts to eliminate rainbow by artificial means are not practical at this time.
4. A thorough program of biological investigation and inventory of fish use should be initiated under the direction of a permanent P-3 Biologist attached to the park staff.
5. Approximately 15,000 catchable-size rainbow should be planted in park streams annually until creel census and investigation show greater needs.
- ✓ 6. Kephart Prong Hatchery (Smokemont) should be abandoned as a fish rearing station and fish should be secured from other hatcheries outside the park.
7. The park should be provided with modern fish transportation equipment.
8. Roads and trails now closed to motor travel should remain closed for administrative reasons.
9. All waters of the park should be open to public fishing except those used for water supply and those in the research area.
10. Both bait and fly fishing should be permitted in park waters except that use of any bait fish should be prohibited.
11. Size limits are undesirable because they prevent utilization of undersized crowded populations and because a large percentage of small fish handled die. However, until the states of North Carolina and Tennessee can be encouraged to change, a limit of 7 inches on trout and 10 inches on bass should be retained. It is desirable to take any steps possible to encourage states to initiate action on removal of size limits.
12. Daily and possession limits are to be 10 trout and 8 bass or in

mixed creels a total of 10 fish. No limits are to be imposed on other fishes.

13. A single uniform fishing license for the entire park should be developed jointly by the states of Tennessee and North Carolina.

Submitted by:

A handwritten signature in cursive script, reading "Lloyd L. Smith, Jr.", written in dark ink.

Lloyd L. Smith, Jr.,
Assistant Chief, Biology Division,
June 27, 1947.

APPENDIX I

Construction of Fish Distribution Unit.

A suitable fish distribution unit can be constructed in accordance with the attached plans prepared by the Fish and Wildlife Service. Essentially the units are comprised of redwood or cypress wooden tanks lined with galvanized sheet metal. The 12 gauge sheet metal lining keeps the tanks water tight and the wood, in addition to giving mechanical strength, provides considerable insulation against warming of water. All iron piping should be galvanized and all valves bronzed bodied.

Machinery for water circulation and aeration is mounted at the rear of the tanks on the same skids used as basic elements of the tanks themselves. If the machinery mountings as indicated on the drawings should prove unsatisfactory on account of space requirements of trucks, they can be altered to suit the needs. The drawings show water circulation pump, air pump and connection for bottled oxygen supply.

The unit is composed of two compartments, each measuring $26\frac{1}{2}$ " by 36" inside dimension. A 20" depth of water or up to the overflow is ordinarily carried during transportation of fish. The weight of the unit when empty is approximately 800 lbs. and weight when loaded with water, excluding fish, is approximately 2,600 lbs. The pump used for water circulation is a $1\frac{1}{2}$ " Jaeger water pumping unit, or equivalent, capable of furnishing 50 gallons per minute at 10' static suction lift and is self-priming. It is powered by an intermediate $\frac{3}{4}$ to 1 horsepower air-cooled Briggs-Stratton or equal gas engine. Free oxygen delivered from oxygen bottles through standard reducing valve equipment is introduced into the bottom of each compartment of the unit through a 5" x 8" carborundum stone, especially made for this purpose.

The lids of the two compartments are ventilated by means of a 3" perforated brass plate installed over a 3" hole bored in the center of the cover. This is essential to permit escape of carbon dioxide or other gases which may accumulate over the surface of the water. As will be noted from the drawing, compartments for carrying ice to reduce water temperature have been located on the side of the unit. These compartments will accommodate approximately 200 lbs. of crushed ice which lies over the inlet and outlet pipes.

The introduction of air into the water circulating system is accomplished by a specially designed aspirator or suction T built into the inlet pipe to each compartment. A 5/16" copper tube is connected to the aspirator and extends to the top of the tank or above the water level carried in the tanks.

Field tests of this equipment have shown that use of either the water circulating system or the free oxygen distribution system will maintain fish in transit for reasonable periods of time. Under field operating conditions, two compartment units operating with water temperatures of 52° F. will carry 160 lbs. of fish.

Estimate of Repairs to Kephart Prong Hatchery
Which are Necessary to Place This Station
In Suitable Condition for Efficient Operation.

These estimates were made by the Fish and Wildlife Service and can be considered minimum.

- I Rock Dam at Power Reservoir - \$200
- II Generator Repairs - \$50
- III Turbine (no estimate available)
- IV Filter Pipe at Reservoir for Hatchery Water - \$200
- V Fire Fighting System - \$1,330
- VI Two-Stall Garage at Superintendent's Residence
 - 1. Re-stain shingles - \$30
 - 2. Replace roofing material - \$86
- VII Superintendent's Residence
 - 1. Replace roofing material - \$240
 - 2. Re-stain shingles - \$70
 - 3. Install rain gutters - \$80
 - 4. Insulation of roof - \$140
 - 5. Weather-strip windows and doors - \$120
 - 6. Window screens - \$30
 - 7. Re-decorate interior - \$250
- VIII Office - Garage Building
 - 1. Replace two sliding doors - \$100
 - 2. Replace roofing material - \$230
 - 3. Re-stain shingles - \$65
 - 4. Repaint interior - \$132
 - 5. Screens - \$16
- IX Hatchery
 - 1. Replace roofing material - \$255
 - 2. Re-stain shingles - \$75
 - 3. Repaint interior - \$140
 - 4. Rebuild one wall - \$300
 - 5. Water supply troughs - \$350
- X Paint and Oil House - \$150
- XI Miscellaneous Items - \$445
 (Repairs to windows, doors, and electrical equipment)