TENNESSEE NATIONAL WILDLIFE REFUGE
Paris, Tennessee

ANNUAL NARRATIVE REPORT
Calendar Year 1988

U.S. Department of the Interior
Fish and Wildlife Service
National Wildlife Refuge System

REVIEW AND APPROVALS

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Refuge Manager — Date: 1-24-89

Refuge Supervisor — Date: 3/23/89

Regional Office Approval — Date: 4/6/89

INTRODUCTION

Tennessee National Wildlife Refuge was established on December 28, 1945, by Harry S. Truman, President of the United States, who signed Executive Order No. 9670, designating the area for use by the Department of the Interior as a wildlife management area for migratory birds and other wildlife. On December 29, 1945, the Department of the Interior and the Tennessee Valley Authority entered into agreement with respect to the lands that were to be reserved and used as the wildlife refuge. The establishment of Tennessee Refuge in Benton, Decatur, Henry, and Humphreys counties was undertaken to further the purpose of the Migratory Bird Conservation Act (45 Stat 1222) and be in the public interest.

Tennessee National Wildlife Refuge lies within the Tennessee River Valley with Kentucky Lake being the dominant feature of the refuge. Three separate units make up the 51,358 acres; Duck River Unit with 26,738 acres, Big Sandy Unit with 21,348 acres and Busseltown Unit with 3,272 acres. Headquarters for the Tennessee Refuge is in Paris, Tennessee, but a sub-headquarters exists on all three field units.

A distance of as much as sixty air miles separates the three units of Tennessee National Wildlife Refuge. Lands now managed by the refuge were among the tracts purchased by the Tennessee Valley Authority in the construction of Kentucky Dam and the subsequent impoundment of Kentucky Lake. However, the Tennessee Valley Authority reserved all rights on flood control, navigation, and power production. Kentucky Lake has an annual water fluctuation which is exactly backwards for good waterfowl management. Normal summer pool is 359' MSl with a drawdown to 354' MSL during the winter months. At times, this water fluctuation turns out to be a "manager's nightmare" when operating for waterfowl. The Tennessee River just happens to run north in this part of the country and it takes a newcomer awhile to catch onto the phrase "up south" when referring to the refuge gradient.

The primary habitat types on Tennessee Refuge are 25,179 acres of rivers, streams and water, 18,800 acres of various timber (primarily upland hardwood), 3,000 acres of farmland, 3,254 acres of seasonally flooded basins, and 764 acres of miscellaneous lands. The 5,762 acres in Duck River Bottoms (within the TVA diked area) has consistently been the "hub" of the refuge and supports an above average quantity of both waterfowl and eagle use days.

Tennessee National Wildlife Refuge was established primarily as a resting and feeding area for waterfowl and other migratory birds. Waterfowl utilization in recent years has varied between 16 and 24 million use-days in a single year. During the past ten years, geese have peaked at 110,000 and

ducks have peaked at more than 350,000. In addition to waterfowl, Tennessee Refuge hosts a sizeable population of bald and golden eagles, with a peak recorded in 1986 of 92 birds.

Historically, Tennessee Refuge is located within a flavorful area. The Chickasaw Indians were the dominant tribe in this locale and many remnants of their presence still remain, such as pottery fragments, arrowheads, kitchen middens, flint fragments and other relics from their culture. Nearly all of these remnants are found along the shoreline of the Tennessee River. Steamboats once used the river for transportation of commodities and many boat landings still bear the names established and recognized by the river traffic of more than 100 years ago. Log structures are nearly a thing of the past although a few remnants can be found on and around the refuge. The Civil War left its mark on Tennessee Refuge as control of the river traffic became vitally important to both the Union and Confederate forces.

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B. CLIMATIC CONDITIONS

Looking back over the year, climatic conditions have truly impacted the refuge and its management. We were plagued by droughts, flooding, and heavy wind/storm damage. In fact, the weather pattern hasn't been normal in this area for several years.

January started the year off with heavy rains. The rains, especially on the Big Sandy Unit, caused damage to dikes and roads, necessitating much maintenance and repair work.

During the spring we count on rainfall and in fact, normally prepare for flooding. This year continued a fourth year of a drought cycle which we were hoping would end. It not only continued, but worsened, as the drought began much earlier. In previous summers, the drought did not take its toll until late July, August, and September. However, this year we started getting below normal rainfall and the beginning of the drought as early as April. At one point in time, during March, the ground was so dry and hard that some of the farmers could not even plant.

Normally the second half of the year is when we would have our driest weather. However, in July we experienced close to four (4) inches of rainfall. During July, the Tennessee Valley Authority opens its gates on Kentucky Dam, beginning to drain Kentucky Lake from its summer pool to its winter pool, a change of five (5) feet (359' to 354' MSL). The heavy rains brought the lake levels back up to the summer pool level of 359' MSL. TVA decided to maintain the lake at summer pool for an extended period of time to improve water quality, for power generation, and to let the lake serve as a reservoir. Although this had many benefits, it severely impacted our management options at Duck River Bottom. We were unable to gravity flow drain some of our impoundments and had to let two (2) feet of water remain in many of our impoundments that normally would be dry.

The months of September through December received above average rainfall, impacting farmers being able to combine or harvest some of their crops. In fact, some crops were not harvested due to flooding. On a positive side, the heavy rains brought water levels higher than normal and provided more availability of food for waterfowl on an earlier schedule. On the negative side was the fact that in some impoundments, up to two (2) feet of elevation of moist soils/crops were lost.

December finished out the unusual year with several severe thunderstorms with accompanying wind, tornado, and hail damage. Temperatures were above normal most of the month and the collision of the warm fronts with cold fronts out of the north created the violent weather.

MONTH	TEMPERATURE LOW	TEMPERATURE HIGH	RAINFALL	SNOWFALL
January	0	63	6.08	7.25
February	5	72	8.28	7.00
March	20	82	2.36	
April	32	84	1.59	
May	38	92	3.20	
June	42	104	T	
July	54	104	3.68	
August	48	102	4.00	
September	52	92	9.08	
October	30	76	5.10	
November	24	71	8.97	
December	12	66	8.05	1.05
TOTAL			60.39	15.75

Average yearly rainfall for this part of the State is around 44 inches. Looking at the chart, we would see much above average rainfall total. This, however, is very misleading for two reasons. First of all, as previously mentioned, we were in the fourth year of a drought which severely impacted crop yields and farming in general, during spring and early summer. Secondly, heavy rains experienced during the latter part of the year were much heavier where our rain gauge was located on the Duck River Unit. Several surrounding counties, and the Nashville area wound up the year with a deficit total of sixteen (16) to eighteen (18) inches below normal average rainfall.

C. LAND ACQUISITION

3. Other. During the year, refuge personnel were asked to look at several parcels of land in West Tennessee foreclosed by the Farmers Home Administration and available for possible acquisition by the Service. On May 11, Acting Manager Mark Musaus was asked to assist Doug Winford with Ecological Services in Cookeville and Biologist Don Orr in looking at a 93 acre tract of land near Trezevant, Tennessee. This tract is approximately thirty (30) miles from Paris, located on the Obion River and close to future planned acquisition and development by Tennessee Wildlife Resources Agency. The Service had already identified this tract as having wetland value and had placed deed restrictions on it. The refuge review was to determine what land management options were available and whether to pursue "caretaker status" to begin management as soon as possible. Although the tract had potential for moist soil management and the planting of trees

for a small green tree reservoir, there was a question as to whether flooding would impact adjoining property. A rough plan was made of possible management/development that could be done on this tract and Ecological Services initiated action to acquire the land in "caretaker status".

On August 31, Mark Musaus again met with Doug Winford and Marvin Nichols from nearby Hatchie Refuge to visit three more FmHA tracts in the Bolivar/Savannah, Tennessee, area. One of these tracts, near Crump, Tennessee, encompasses 440 acres of bottomland area. When first looked at on the map, the tract held much promise as it was near the Tennessee River and in bottomland areas. An on-site reconnaissance of the area revealed that the fields in question were too high to flood and were not of the best quality soils. It would probably be very difficult to get a cooperative farmer to work at this location. The potential for the bottomland hardwoods to be flooded was possible but the previous owner said that flooding had been reduced considerably with the construction of the Tennessee TomBigbee Waterway. Waterfowl habitat would be available during the time periods of heavy rains and flooding of the two creeks that coursed through this tract, but only when the water was out of its banks. The decision was, therefore, made to place deed restrictions on the property and to look at this area as an easement.

In discussions later on in the year with TWRA personnel, we learned of their interest in both of these tracts, the primary reason being that they had management areas already present or planned in both of these locations. These tracts would be better served to benefit wildlife and the waterfowl resource in particular under their administration.

D. PLANNING

2. Management Plans. Several plans were reviewed and revised during the year. At the beginning of the year, the prescribed burning fire plan was updated and submitted for review and concurrence. After addition of smoke management parameters and guidelines to be followed, the plan was approved and prescribed burning actions performed later in the year.

After reviewing our outdated hunt plan, we decided to rewrite this plan completely. The plan was submitted along with a new Section 7 Evaluation and a letter of concurrence from the State. The plan was reviewed and signed off as approved at year's end.

In November, management plan notebooks were received and a table of contents listing all plans appropriate for this station listed and sent to the Regional Office.

Action was also taken in November to update our animal control plan to include several predator species that impact waterfowl banding operations.

5. Research and Investigation. On February 4, Dr. Leigh Frederickson with the Missouri Co-op Unit accompanied Dr. Olaf Pehrrson, who was from Finland, on a tour of Duck River Bottoms. During their visit they observed our waterfowl banding operations, and collected precise measurements on 36 mallard ducks. These exact measurements took almost six hours to complete. Dr. Pehrrson is analyzing several mallards along the Mississippi Flyway to compare the difference in both body size and bill of domestic versus wild mallards. He has done a similar study in Finland and found that the native wild gene pool has been degraded through a mixing with the domestic mallards in that country. It was very evident in the few birds studied at this station that there was a difference in bill shape and length with both short and stout versus long and narrow bills observed. The long and narrow bill is believed to be the more natural shape of the wild birds that historically fed in natural wetlands and moist soil areas. Domestic mallards, on the other hand, have developed stouter and shorter bills adapted to feeding on whole and cracked corn fed them continuously in their diet.

E. ADMINISTRATION

1. Personnel. At the beginning of the year, Manager Carrell Ryan was requested by the Regional Office to help coordinate and prepare plans for future wetland development on various refuges in the Region. This involved both details to Atlanta and trips to several refuges to look at proposed development to determine costs, manpower and equipment needs, and time involved. Working with Refuge Supervisor John Oberheu, requests were sent to all refuges in the Region to provide proposed development if monies were available. After review in the Regional Office for a first cut and then on-site review and planning later on, a series of development plans was developed for work for the remainder of the fiscal year.

On March 13th, Carrell was detailed to serve as the supervisor and head of a roving moist soil development team that would work on-site doing the proposed impoundment/wetland development on various selected refuges.

The most involved and time consuming development was the very first project at Lower Hatchie Refuge, part of the Hatchie Cluster. This work began in late March and lasted eight weeks with the development of several miles of dike and small rice levees. From there the team went on to complete work at

PERSONNEL

1. Carrell L. Ryan, Refuge Manager (In-Charge), GM 13, PFT
2. Mark J. Musaus, Refuge Manager (Assistant), GS 12, PFT *
3. Lawrence J. Masters, Outdoor Recreation Planner, GS 11, PFT
4. Edward E. Britton, Refuge Manager (Assistant), GS 9, PFT
5. Carl E. Dowdy, Biological Technician, GS 8, PFT
6. Dorothy G. Easley, Refuge Clerk, GS 6, PFT
7. Jerry B. Armstrong, Refuge Law Enforcement Officer, GS 7, PFT
8. Eddie V. McKissick, Biological Technician, GS 6, PFT
9. Truman C. Robertson, General Maintenance Mechanic, WG 11, PFT
10. William T. Cherry, Maintenance Worker, WG 8, PFT
11. John R. Travis, Maintenance Worker, WG 6, PFT
12. Joe D. Merrell, Maintenance Worker, WG 6, PFT
13. Craig R. Bitler, Wildlife Biologist, GS 5, PFT (EOD 9/25/88)
14. Roy E. Brown, Refuge Law Enforcement Officer, GS 6, PFT (Transferred Wheeler NWR 3/20/88)

* Detailed to Acting Manager while Manager Ryan assigned to wetland development team.

88-19-15. The 1988 YCC crew...Pay day - what deductions? (LJM)

Wapanocca, Overflow, and Wheeler Refuges and to develop Tribble, a Farmers Home tract that would become a part of the Yazoo Complex.

Most of the work was accomplished at the various refuges by a roving team that involved equipment operators from various refuges as well as people at the host refuge. In addition, dozers, draglines, and other equipment were loaned to the host station as needed. Biological Technician Carl Dowdy assisted Carrell Ryan for the entire six month time period the team was on the road, assisting in all development. Maintenance Worker John Travis was temporarily detailed six weeks to assist in the dike construction work on Lower Hatchie Refuge. In addition, the refuge dragline was used the entire time period at Lower Hatchie and one of our TD-15 dozers was used throughout the spring and summer at various refuges.

Most of the roving team's work came to a temporary halt the end of September due to a lack of funds and the end of the fiscal year. However, Manager Ryan continued in his detail, beginning in October, helping to review proposed development at other stations for fiscal year '89. By year's end, plans were finalized and monies set aside for a crew to begin development of wetland habitat once spring weather came.

On March 13th, Assistant Manager Mark Musaus was detailed to the Manager's slot in Carrell's absence, for the remainder of the year.

In early March, Refuge Law Enforcement Officer Roy Brown was selected for a similar position at Wheeler Refuge in Decatur, Alabama. He transferred on March 28th. The vacancy created with his transfer was filled by converting Biological Technician Jerry Armstrong to the Refuge Officer series.

One vacancy still remained with the changing of jobs by Jerry Armstrong. We decided to fill his vacancy with a biologist position. Paper work was initiated in May to advertise for the position, with request made to be able to select from both an OPM certificate and a list of eligibles through the "green sheet" process. The OPM certificate had many qualified candidates on it but few with any waterfowl experience. We felt that the biologist position should have experience in the area of waterfowl since this is our primary focus at this station. We were pleased to find several qualified candidates on the list of eligibles from the green sheet. In August, Craig Bitler with the Denver Wildlife Research Center in Laredo, Texas, was selected to fill the wildlife biologist position. He entered on duty September 26, 1988.

In late August, a request was made from the Regional Office for Outdoor Recreation Planner Larry Masters to assist in

fighting fires out West. His previous experience in administrative support the year before, in Atlanta, made him amply qualified to assist in several positions. On August 24, he reported to the Clover/Mist fire in Yellowstone as an incident dispatcher. He continued to serve on this fire for a total of five weeks. His first week was spent at a fire base camp, sleeping in a pup tent, and basically, forwarding messages back and forth between the base camp and the fire teams on the fire line. After the first week, he was moved to park headquarters in Mammoth Hot Springs and provided the luxury of a motel room. He volunteered to work the midnight shift and assisted in several dispatcher roles.

Several performance special achievement awards were issued to staff members during the year. A performance award was given to Messrs. Carl Dowdy, Terry Cherry, Joe Merrell, John Travis, and Eddie McKissick for their work the previous year in clearing and bringing to grade, the new maintenance site. In addition, they made an entrance road to both the maintenance site and a proposed new headquarters site at a considerable savings of $400,000 to the Government.

A special achievement award was given to Larry Masters for his work in supervising and administering the YCC program for the previous summer.

At year's end, several performance awards were given in conjunction with performance evaluations for the 1988 fiscal year. Monetary awards were given to Messrs. Carl Dowdy, Ed Britton, Jerry Armstrong, and Mark Musaus.

One special performance award of note was given to Refuge Clerk Dorothy Easley. This award was a quality step increase for outstanding work throughout the year. Dot not only handled all the administrative and clerical duties of the refuge with minimal supervision, but took on the task of tracking funds, preparing purchase orders, cutting travel vouchers and complicated time and attendance forms for the staff members assigned to the moist soil development team. Without her extra effort, neither of the operations, the refuge nor the moist soil development would have gone as smoothly as it did.

We had a few staff members that encountered physical problems requiring time off for recuperation. Maintenance Worker Terry Cherry had experienced chest and stomach problems requiring several tests and days off during both the spring and early winter. Maintenance Worker Joe Merrell experienced what doctors believe was a light stroke while working on the refuge. He continued to experience severe headaches and further testing revealed extremely high blood pressure levels.

He was out for several days at different times of the year, adjusting to blood pressure medication.

All in all, it was a busy year with many activities on the part of the refuge staff. We finally were able to get to our full complement of thirteen (13) staff members. However, this really does not reflect the work during the year due to the details of Carrell Ryan, Carl Dowdy, and John Travis and illness on the part of some of the staff members. Through extra effort on everyone's part, we were able to see much accomplished not only for the refuge but for wetland development on other refuges in Region 4 and for the wildlife resource as a whole.

2. Youth Programs. The Youth Conservation Corps (YCC) program began with recruitment of enrollees on March 4. Since there was no money in the station budget for a Camp Director, Outdoor Recreation Planner Larry Masters handled the responsibilities of recruitment, enrollee selection, and operation of the camp for eight weeks. Recruitment efforts were directed at the communities near the Duck River Unit-Camden, Waverly, and McEwen - because of transportation problems experienced by enrollees from prior years who lived at greater distances.

The drawing for enrollees was held at the State Employment Office in Paris, with the selection of four males and four females, with eight alternates as well. An orientation meeting was held for potential enrollees at the Duck River subheadquarters on Saturday, May 21. One enrollee declined because he did not have a ride to work (he had no good explanation for accepting the job, knowing he did not have transportation) but an alternate was selected with no difficulty.

Camp began on June 13, with a major project - removing vegetation from the duck trap. Other projects completed during the summer included cutting and removing lots of willow brush from dikes, pouring concrete logs for boat ramps, removing beaver dams from water control structures, assisting with construction of the new pole barn, renovation of the Fairview Cemetery and cleaning of other cemeteries on the refuge, maintenance of structures, maintenance of vehicles (washing and waxing), and trapping and banding of wood ducks, along with a few teal and mallards.

One personnel problem was experienced by a female enrollee-she became angry with the male providing her transportation and chose to resign rather than resolve the difficulty. The summer was completed with no injuries other than the usual poison ivy, minor strains, sprains and blisters that come with going to work after school is out.

Camp closed on Friday, August 5, with a field trip to Hatchie Refuge, to give the boys and girls a chance to see a different type of operation - and a free day.

3. Other Manpower Programs. On June 22, Miss April Britt began work in the refuge office under a JTPA appointment. She was assigned to assist Ed Britton in the cataloging of bands, compiling of old refuge narratives and other projects as assigned.

4. Volunteer Program. The volunteer program at this refuge is not a large one due to the logistics and complexity of many of our refuge operations. In addition, many of the people that inquire about volunteering on the refuge primarily want to assist in helping to band birds or to get special access into closed areas to observe waterfowl in particular. We do, however, have several volunteers that don't hold highly visible duties but yet play an important role at this station. The majority of volunteers are individuals that live in private dwellings or residences, adjacent to refuge lands and access areas/boat ramps to Kentucky Lake that are all on the refuge. They volunteer in helping to maintain these access points, picking up litter and notifying us of any problems or potential problems. They help to mow some of the areas to provide visibility and reduce many safety hazards. One volunteer provides detailed information on climatic conditions, providing temperature and rainfall measurements each month. Other volunteers assist at deer check stations or in banding waterfowl.

One particular volunteer activity is worth highlighting. In early June we realized that an osprey that had been using one of our artificial platforms and had been nesting for several weeks, had abandoned the nest. The bird incubated the eggs for four weeks, then suddenly left. The local electric cooperative donated the use of one of their trucks with a bucket that could reach fifty (50) feet in the air, but it would not get us to the nest which was approximately 65 feet in the air. From up on high in the bucket, with use of a mirror, we were able to determine there were three eggs in the nest. We were able to enlist the services of the operator of the power utilities truck. He came back a few days later, on his own time after work, and climbed the 65 foot pole to retrieve the eggs. Without his assistance we would not have been able to retrieve the eggs and have them sent off to Patuxent for analysis.

A Public Lands Day program was set up to honor volunteers working in various Federal facilities in several counties in West and Middle Tennessee. Refuge staff members were actively involved in this Public Lands Day program and names of

volunteers working at this station were submitted for possible awards. All of the volunteer names submitted received certificates of appreciation from the Public Lands Day task force as well as one of our volunteers receiving a special award and plaque for volunteer work performed in 1987 in censusing shorebird populations on the refuge.

5. Funding. The following table lists the last five year funding levels at Tennessee Refuge.

Fiscal Year	ARMM/Rehab	Other	Base Funding	Withdraw/ Add/on-RO	Total
1984	60,000	42,600 (Carryover)	403,000	-10,000	475,000
1985	70,000 Large 30,000 Small	-	425,000	+10,000 +24,000 (PU)	574,900
1986	70,000 Large 10,000 Small	26,900 PCS/Salary 23,900 Adv. Planning 2,000 Fire Money	454,900	-700 +16,200 (PU)	603,200
1987	23,000 Large 73,700 Small	7,200 YCC 2,000 Contaminant	390,200	+58,000	554,100
1988	-	9,500 YCC 1,000 Fire Money	329,000 Oper. 139,000 Maint.	-10,000 FERS Red. +6,000 Maintenance +1,500 PCS +6,000 Tractor Repair-EOY	482,000

This year's table shows an increase in base funding to begin the year but all the other columns reflect losses from previous years. This year, we received no money to cover any types of ARMM or rehab funding.

Monies shown under the add-on or withdrawn column do not really reflect the total picture. Money given at the end of the year to cover repair of the TD-20 dozer was actually for repair of a tractor assigned to Hatchie Refuge. This particular tractor was used in the mobile forces development effort and the repair work was done by a contractor near

Paris. Being under the supervision of Carrell Ryan, the monies were given to this station to pay for the work.

In addition, we took a cut in funding through salary savings to help defray the increased FERS costs to the Region. The salary savings came when Roy Brown transferred and we delayed in filling the vacancy for a biologist until the end of the year. Add-ons did help us to cover some of the moving expenses for our refuge biologist position as well as to purchase a rice levee plow. The maintenance money add-on was specifically designed to acquire this plow, permitting rotational use on refuges in this district and by the mobile forces team.

Monies appropriated for the year enabled us to maintain our refuge operations in good shape the entire year. We were able to continue our moist soil program at Duck River with some fine tuning and the ability to rehabilitate Impoundments No. 3 and portions of No. 10 to provide better habitat for wintering waterfowl. In addition, we were able to devote more time to the other two units, trying to work on recommendations provided by our waterfowl review in December of 1987 and to provide additional access and moist soil diversity at both Big Sandy and Busseltown Units.

We again hosted a summer YCC program with funding from the Regional Office strictly used to cover enrollee salaries. We again opted this year to let one of the refuge staff (ORP Masters) supervise the program and the day to day YCC operations. The refuge picked up the cost for any equipment and any other funding needs for construction projects and maintenance.

6. Safety. We are pleased to report that this year's safety record was a vast improvement over 1987. We had one reportable accident by a staff member on October 12. Maintenance Worker Joe Merrell injured his hand while assisting in the assembly of a recently acquired levee plow. Joe's hand evidently got caught between one of the gangs and the frame. The injury did not cause problems at first, but by day's end became swollen and very stiff. A doctor's examination revealed no broken bones but that the hand was severely bruised.

ORP Larry Masters attended a two day defensive driver training course held in Paris. He was unable to participate in a course offered to the entire staff the previous fall due to a detail to assist the Forest Service.

In August, it came to our attention that there were several old wells that could pose a danger to hunters using the Big

Sandy Peninsula. These wells were filled in with several loads of gravel to prevent any accidents.

There were several accidents involving the using public on the refuge. The first accident occurred in February, involving a fisherman fishing in the Tennessee River within the boundaries of the Duck River Unit. The fisherman got his motor caught in a trotline net and the engine stalled. Heavy winds turned his boat over. The man was rescued but he incurred serious injury from exposure to the cold water and the wind while in the Tennessee River.

The second reported accident occurred in April when a fisherman was using Impoundment No. 1. Another bass boat came by at a high rate of speed and swamped the smaller boat. The individual was thrown from his boat and suffered injuries and shock. Refuge law enforcement staff stepped up efforts to monitor speed of boats and a statement was posted and identified in refuge brochures notifying boat operators to restrict their speed to provide safe conditions for others.

We were also notified or came upon four separate car accidents involving members of the public, driving on refuge roads. One involved teen age boys driving in a hazardous fashion, running off the road and colliding with a large tree. The vehicle was totalled and two of the boys sent to the hospital for serious injuries. The second accident involved a vehicle that was abandoned but found in a slough off of the access road along Interstate 40, where it crosses Tennessee River on the refuge. The third accident involved two individuals driving in a closed area on refuge dikes in a reckless manner. In attempting to speed and round a curve, the driver lost control, running off the dike and into Impoundment No. 7. The individuals were spared serious injury or death when the vehicle was prevented from being completely submerged when it ran up against one of our water level gauge posts. The final accident involved a vehicle that, again, was driving in a closed area. The occupants attempted to drive around a cable, got stuck in mud and got the vehicle so hot, trying to free it , that it caught on fire and burned up. The vehicle was abandoned and later determined to be stolen from a used car lot near Dyersburg, Tennessee.

Safety meetings were held each month, covering a wide variety of topics including safety regulations, proper gear to be worn during aerial censusing, boating safety, hazardous chemicals, proper handling of hand tools and proper wear of safety equipment, fire extinguishers, and waterfowl banding operations. Particular safety memos sent to the office were discussed. In particular were two that were noteworthy for our station - danger in attempting to start a John Deere tractor by jump starting across the solenoid and the

memorandum discussing fire shelters and their deployment on the Brewer fire.

One reportable incident of note occurred during a plant identification workshop held at Tennessee Refuge in September. One of the participants, Craig Bitler, who came on board as Refuge Biologist later on in the month, but who was detailed to the workshop from his agency in Texas, contracted Lyme's disease from a tick bite during the workshop. He was able to identify the swelling around the tick bite upon his return to Texas. He quickly sought medical attention. They concurred on the diagnosis and administered tetracycline. He has had no symptoms or problems since that time.

7. Technical Assistance. Several requests were made throughout the year for refuge staff members to provide technical assistance. On May 23 through 27, Refuge Manager Ryan travelled to Bosque del Apache National Wildlife Refuge to assist Dr. Leigh Frederickson in conducting a moist soil management workshop for Region 2 Service personnel.

During the summer, a group of individuals formed the Kentucky Lake Wood Duck Association in Camden, Tennessee, with the intent to build several hundred wood duck boxes and erect them on Kentucky Lake. They requested technical guidance on box design, location, and placement for these boxes in establishing a long range program. Acting Refuge Manager Mark Musaus attended several of the meetings and answered many of their questions.

Manager Carrell Ryan participated in a two day meeting at Land-Between-The-Lakes to see if a joint venture proposal could be developed to create waterfowl habitat on LBL lands. Several agencies were represented, with Carrell being asked to provide technical assistance on feasibility and costs.

8. Other Items. The proposed construction of a new headquarters and maintenance facility at the Duck River Unit continued to draw a lot of attention at the beginning of the year. On January 6 and 7, Assistant Director Marvin Plenert and Supervisor John Oberheu met with Mr. Johnny Fuller (and some of his hunting partners) who owns a series of pits adjacent to the refuge on a point of land called Fuller Hill. The proposed headquarters site location with a beautiful overlook of Duck Rivers Bottoms is adjacent to Mr. Fuller's pits. He was strongly opposed to the proposed development. Their concerns were expressed during that meeting and a decision was made that alternative sites would be looked at for the headquarters location.

On February 22 and 23, Assistant ARD Phil Morgan, Supervisor John Oberheu, Todd Rainwater, and Richard Mattison from the

88-24-4. These folks log the old fashioned way...they earn it. We permitted access across refuge for two different property owners to get to their timber. The other owner chose a large timber company and big machinery. This way does minimize damage. End result for us - a good access road into a remote part of the refuge.(LM)

88-26-2. The Duck River Bottom was the site for a moist soil plant identification workshop. (MJM)

Regional Office travelled here to look at the proposed headquarters site and to consider alternative sites for the headquarters location. They toured the Duck River Unit and the most likely alternative site was determined to be the parcel of land next to Breeden Road, the main entrance to the unit, which was recently auctioned off. Other areas along the refuge boundary at Duck River were also to be looked at for headquarters site potential.

The State wildlife resources agency, TWRA, has expressed their interest in trying to see a new site located for the headquarters building. They expressed interest in trying to locate a willing seller. Although new sites were identified, as of this date, no further action has been taken on a headquarters building.

During July, the refuge received two requests from a private individual, Mr. Maurice Byrd, and from Graham Lumber Company to both use the old logging road on the east side of the Duck River Unit. Both parties had tracts of timber they planned to harvest but requested use of this old road to enable easier access to the tracts for their hauling of timber. After reviewing the requests and looking at the area in question, on site, we decided to issue a special use permit to both parties and charge a fee. Both parties agreed to reseed the road and block it off at the completion of their projects. Both permittees were very agreeable to the conditions of the permit and have cooperated fully. One benefit from the permit is that we now have a good road available for use on this portion of the refuge, previously inaccessible.

During August, the refuge was requested to host a plant identification workshop at the Duck River Unit. On August 31, Assistant Manager Ed Britton met with Wildlife Biologist Don Orr to identify potential wetland sites in Duck River Bottoms for the upcoming workshop. On September 6, the course leader, Dr. Mohlenbrock, from Southern Illinois University arrived and was shown the sites representative of the various habitats on the refuge for plant identification. On September 7 and 8, the wetland plant identification workshop was held on the Duck River Unit.

In October, several staff days were spent trying to develop good projects for consideration in the Partners for Waterfowl program. We met with extension agents from both Henry and Benton Counties along with an extension agent from Jackson, Tennessee, also involved in developing habitat management programs on private lands. Several areas were looked at that held potential but many of these had several problems. The area that held the greatest promise was found to be within TVA easement land. We set up a meeting with TVA personnel out of the Paris office and extension people to look at the

88-11-9. The source of some of the dirty air we have just north of the Duck River Unit. (LJM)

88-O-1. Mobile team at work on "Tribble FmHA" tract. Made excellent addition to the Yazoo Refuge Cluster. (CLR)

feasibility of development within these easement properties. Normally any areas impounded within easement lands require a charge for loss of water storage by the landowner as well as a requirement that water be removed the day after waterfowl hunting season ends. The requirement to remove water severely impacts the opportunity to provide moist soil habitat since water would be removed in mid-winter. After discussions with TVA personnel in Knoxville, the decision was made that,on a case by case basis, easement lands could be permitted to have the wetland development without the stipulation to dewater as long as the landowners were working under an agreement with the Fish and Wildlife Service. A charge for loss of flood storage would still be imposed, however. When we seemed to have this issue resolved, we learned that a decision was made in the Regional Office to conduct no work on Federal lands and at first, these easement lands were considered to be under Federal ownership (TVA). However, further review decided that these easement lands did not meet the criteria of Federal lands, since they were owned by private landowners. About the time that most of the issues were resolved, the problem of lack of funding and budget cut backs entered the picture. At this point, we have not pursued any further "PARTNERS" projects because of lack of funding and the probability that numerous projects would be possible if it were made available to various easement owners.

In a combined joint venture and "Partners" project with the newly formed Kentucky Lake Wood Duck Association in Camden, Tennessee, we delivered 1,000 board feet of rough cut cypress that we had purchased for wood duck boxes, to be built by volunteers and students at the Benton County Vocational Technical Schoool in November. One hundred boxes were constructed and picked up by refuge staff to be erected on the refuge early in 1989. In addition, we travelled to Memphis Supply Depot to pick up surplus aluminum sheeting for the fabrication of predator shields. Some of the sheeting was provided to the Wood Duck Association for their use in the erection and protection of boxes. Time was spent during the month working with the groups present, drafting a letter of guidance to each cooperator in the wood duck box erection and monitoring program. We plan to continue to work closely with this group and hope to encourage a sister group to be formed in the Henry County area so that a network of boxes can be constructed and placed throughout Kentucky Lake and some of its tributaries.

During November, we traditionally close several portions of the various refuge units to public use of any kind to promote waterfowl sanctuary. This involves both marking off roads and portions of Kentucky Lake with the use of buoys. In the past, we have attempted to monitor public use and impact and not close until there was a verified disturbance. This year, we

identified, through the CFR, all the areas that could possibly be closed, including all of the Duck River Bottoms. We realized early in November that possible impacts could develop and therefore closed Impoundments No. 1 and 6, which had not previously been closed, at the beginning of the month.

In prior years, we had closed roads in Duck River Bottoms by posting them "closed" but we felt this was not adequately keeping people out. Beginning this year, we erected posts and cables to close Lawrence Creek Road and the upper portion of Duck River Bottom near the Waverly pump station. These new cables provided quite a challenge for some and will be further detailed in the law enforcement section of the narrative.

For most of the year, we seemed to roll along with few complaints or congressionals. This quickly changed in November when word was received that several hunters were discontented with our management of the Big Sandy Unit, in particular, the west side or Elkhorn/Britton Ford area. One very vocal individual was very concerned about the decline in goose numbers and reasoned that the decline was due to our mismanagement "in this area". Assistant Manager Mark Musaus was invited to speak or rather to answer questions at banquet of the Henry County Chapter of Ducks Unlimited in November, concerning our management on this particular section of the Big Sandy Unit. Within a week, a followup visit was made to the refuge office by this individual to meet with Managers Ryan and Musaus. He requested information concerning waterfowl numbers at both the Big Sandy and Duck River Units as well as monies allotted for each unit over the last several years. His contention was that all monies allotted for the refuge were being devoted strictly to the Duck River Unit with a tremendous increase in waterfowl there at the expense of the waterfowl at the Big Sandy Unit. We later learned this individual was hiding a tape recorder on his person and recording our conversation. This was later played back to a secret meeting of disgruntled hunters living in the Henry County area. They have made several attempts to have the refuge managed their way. Several phone calls to Manager Ryan have suggested he start "packing his bags". At this writing, we have not met with these interested individuals but a meeting is to be set up once waterfowl hunting season is over. Unfortunately, this is not the first time we have responded to concerns on the west side of the unit and we will probably continue to respond to complaints as they develop. This particular area in question is a difficult area to manage due to the small amount of lands that we actually have that can be managed, the increasing development of the surrounding area for residential use and enjoyment of the lake, as well as the increasing number of hunt clubs being established adjacent to the refuge line. In this past year, we have also been impacted by high lake levels as well as three years of drought

conditions that have severely impacted the farming program there.

During December, we were notified by the local TVA office in Paris of two congressionals that they had received concerning our shoreline policy on the west side of the Big Sandy Unit. This is the same general area as the individuals complaining about our waterfowl management program. Although we have yet to receive copies of the congressionals, the constituents involved are concerned about their attempts to beautify the west side of Kentucky Lake area where they live but their inability to do because of the refuge shoreline policy guidelines. These constituents would like to have the refuge lands between their houses and the lake be cleared or be used to put in water fountains, nicely sodded lawns, and other attractive developments to make the area more scenic.

On December 16, Carrell Ryan met with TWRA Director Gary Myers in Nashville to discuss several items of mutual concern, including waterfowl management, the North American Waterfowl Management Plan, and joint venture possibilities to develop waterfowl habitat on private lands along the Kentucky Lake/Tennessee River system.

F. HABITAT MANAGEMENT

1. General. The Duck River Bottom area of Duck River Unit is the heart of habitat management on Tennessee Refuge. The bulk of outputs are achieved within this 6,000 acre site that includes twelve (12) impoundments and over thirteen (13) miles of dikes. Our moist soil program within these impoundments contains over 3,000 acres of water managed between elevation 354' and 361' MSL. A sixty-one (61) acre green tree reservoir is also managed. Interspersed throughout the moist soil units are 1,300 acres of cropland. The coordination between these two programs (moist soil and farming) provides an excellent combination of natural and agricultural foods for waterfowl. We continue to annually winter record numbers (over 300,000) of waterfowl since the 1984 completion of dike construction and initiation of water management.

Habitat management at the Big Sandy Unit consists of water management on fifty (50) acres of moist soil within three (3) impoundments. Within these impoundments there are also forty-one (41) acres of uplands that can be flooded. Although the impoundments are small in size, they have provided dramatic waterfowl concentrations. Local residents have commented favorably on the increase of waterfowl at this unit. Many days of dozer work were conducted to clear several areas along the shoreline and drains of willows and shrubby growth. Waterfowl response to this area was immediate and favorable.

88-27-19. Wild millet grows as tall and surrounds this corn field. Good diversity. (MJM)

88-0-6. Yellow nutsedge grown in-between the corn rows. No herbicides are used on the refuge share or corn. More yield from moist soil plants than from corn. (MJM)

During November and December, the lake levels were two to three feet above normal, covering mud flats and sand bars normally available for geese. The birds using the Big Sandy Unit area, instead flocked to the area we cleared to take advantage of the loafing areas, proximity to feed, and the ready source of grit

Habitat management at Busseltown Unit consists of water management on 300 acres of moist soil within two (2) impoundments. Upland areas totalling 570 acres are cooperatively farmed and twenty (20 acres are managed as hayland.

Composition of the total refuge habitat types is as follows:

*	Wetlands	4,000 Acres
	Water (open and unmanaged)	25,179 Acres
	Forest	18,800 Acres
	Green Tree Reservoir	61 Acres
	Administrative Lands	258 Acres
	Hayland	169 Acres
	Pasture	309 Acres
	Other Grassland	336 Acres
**	Browse	264 Acres
	Cultivated Crops (cooperative farming agreements)	2,898 Acres
	TOTAL	51,358 Acres

* 746 acres of wetlands are included in the cultivated crops acreage.

** 180 acres of farmland were double cropped.

2. Wetlands.

Duck River Bottom.

In 1984, we completed the construction of twelve (12) impoundments within the Duck River Bottom, and 1988 marked the third year of full water management capabilities. The primary objectives of water management are to provide diverse waterfowl habitat and make these aquatics accessible to waterfowl. In order to understand water management constraints on Tennessee NWR, Kentucky Lake water management must be explained. Kentucky Lake surrounds the refuge and has an annual fluctuation "bassackwards" for good waterfowl management. Normal summer pool is 359' MSL with a drawdown to 354' MSL during the winter months. These outside levels reduce water management capabilities within the impoundments.

88-3-21. Mark Musaus with Dr. Leigh Frederickson and Associates and Dr. Olaf Pehrrson from Finland. Dr. Frederickson studied our moist soil management and assisted Dr. Pehrrson in a study of mallard characteristics. (LJM)

88-0-3. Gaylord Memorial Laboratory researchers working on the "Expert" system for evaluating moist soil seed production potential. (EEB)

88-0-7. Cattails: Now you see them...(CLR)

88-0-8. Now you don't! It's easy as 1-2-3.
(CLR)

88-0-11. Step No. 2. Flood the area with one to three feet of water for a two/three week period and then dewater. (CLR)

88-0-12. Step No. 3. Wait for the moist soil plants to grow and shallow flood as needed. (CLR)

88-0-9. Step No. 1. Disk the cattails and allow to dry. (CLR)

88-0-10. Allow for one to two week drying period and then disk again in opposite direction with another one to two week drying period. (CLR)

When the Kentucky Lake levels are high, the refuge impoundments are at their lowest level. When Kentucky Lake is at its lowest level, the refuge water levels are the highest.

Our water management scheme is to have a late spring drawdown to expose low lying habitat areas. Shallow flooding is then initiated as needed, to stimulate the growth of moist soil species (sedges, smartweed, millet) and/or to control the growth of undesirables (cocklebur, Johnsongrass). Duration and depth of shallow flooding depends on water tolerance and height of desirable species involved. In the fall, incremental flooding of the impoundments is implemented to coincide with waterfowl concentrations and their utilization of natural foods. The entire water management scheme is controlled by gravity flow, and many prayers are said for rainfall during the proper time and amount.

The production of natural foods within the impoundments is mapped annually and disking of individual units is conducted on a four year rotation. Disking is important for disturbance to soil and sets back succession by improving the production of dormant aquatics. In 1988, each impoundment was surveyed by walking every possible location available and mapping each vegetative zone and its waterfowl food value within the unit. This method resulted in many, many miles being walked but the actual time it took to complete the survey was about the same as using the older line transect method. The mapping of vegetational zones on a scale map provided a direct management tool for future water level manipulation and soil disturbance schedules.

Gaylord Memorial Laboratory research personnel conducted data collection for their "Expert" system - a computer program that includes the determination of moist soil seed production potential from simple plant measurements in the field. The "Expert" system will be tested over the next three years on a variety of moist soil plants. A quarter-meter pressured plot is located and all of the seed heads within the plot are counted. This number is then entered into the computer program and a seed production potential identified. This is an important first step that may lead to a simple method for field calculation of entire biomass production potential for moist soil plants. Many moist soil plants provide seeds, green browse, and tubers. A good stand of moist soil plants should produce approximately 1,200 pounds/acre (excellent stands, over 2,000 lb/ac). If you compare this quantity to an acre of corn under a cooperative farming program (75%/25% share) at a yield of 80 bushels/acre, then the refuge would only receive one-fourth of the corn produced (80 bu/ac x 56 lb/bu = 4,480 lb/ac x 25% refuge share = 1,120 lb/ac) which equals 1,120 lb/ac. If you have 100 acres available for management, and can either cooperatively farm or manage for

88-0-4. "Blooming smartweed and other goodies" in Unit I, "I think we found the moist soil smorgasboard" (MJM)

88-0-5. Rice levees provide shallow water flooding in a moist soil unit...immediate response. (MJM)

moist soil - a quick calculation shows that you would receive 28,000 lb. of corn or 120,000 lbs. of moist soil plants. Moist soil management does require water control and mechanical manipulation. It is a cost effective and productive management technique available to the waterfowl manager.

A severe drought occurred for the third consecutive year. The drought combined with the extreme heat of the summer resulted in very high water temperatures with low dissolved oxygen levels in the Kentucky Lake reservoir. Due to these conditions and their association with die-offs and disease in fish and shellfish, TVA held the lake levels high (to 359' MSL) through December. This restricted our capabilities to drain water from Duck River Bottom into the lake system.

During 1987, 37 miles of rice levees were constructed with the levee plow and laser plane. Due to extreme drought conditions during May 1988, water never accumulated behind the low levees. Vegetation responses to the shallow flooded areas will be reported next year.

Due to drought conditions, the gates at the Duck River pump station were opened from June 17-20. It was anticipated that one foot of water would enter Impoundmenmt No. 1, however the total was two feet of water. This water level (357.05' MSL) provided water cover over the majority of land area in No. 1. Since TVA did not release water from the reservoir in August, as planned, we were caught with approximately one and one-half feet of water higher than planned. The resulting vegetation was a dense stand of smartweed in the deeper areas (3 ft.); and a mixed stand of wild millet, nutsedge, and other preferred moist soil plants in the shallow areas.

Waterfowl utilization of the moist soil units was exceptional. Whereas, large numbers of waterfowl would concentrate in refuge agricultural areas, they would leave these areas as soon as the grain was eaten up. However, in the moist soil sites, the waterfowl concentrations used the natural foods on a daily basis throughout the entire season. Black duck concentrations were more prominent in the moist soil plants than in flooded agricultural areas. An added benefit is the diversity of habitat available. After identified moist soil units have been eaten out, the impoundment is then dewatered (about mid-February) to expose mud flats. There is tremendous waterfowl utilization (particularly Canada geese) on these mud flats.

A monthly water quality monitoring program began in March 1988 in the Duck River Bottom impoundments. Monthly tests are conducted on pH, temperature, conductivity, turbidity, sulphate, phosphate, nitrate, and alkalinity. In addition, we

conduct semi-annual (January and July) testing of aluminum, copper, zinc, nickel, manganese and chromium. A total of sixteen (16) water samples are collected and analyzed monthly. There were no unusual concentrations detected during the 1988 testing.

Several acres of willow removal was conducted in Impoundment No. 10 to improve waterfowl access to wetland areas. Goose use in this reclaimed area was tremendous.

Busseltown Unit

Work was initiated on the Busseltown Unit to develop moist soil areas on that unit. Two concrete culverts located under the road on the unit were identified as having potential to impound several acres of water if a control structure could be fabricated. The refuge staff first poured a foundation and then made wing walls to create 24 inch and 36 inch stop log structures. Although only a small amount will be flooded, there is an opportunity now to create some diversity (moist soil) in the croplands.

Two areas on the Busseltown Unit that had willows removed in June, were disked during July to promote preferred growth of moist soil plants.

3. Forests. Timberlands on Tennessee Refuge total 18,861 acres, mostly consisting of long narrow strips along the hilly shoreline. Nearly all of the woodland is oak/hickory climax with a limited amount of conifers scattered throughout the area. Included in this figure is approximately sixty-one (61) acres of bottomland hardwoods that we have been able to flood to create a green tree reservoir at the Duck River Unit.

An updated timber management plan has been in the planning stages for the last six years. In 1987, Area Forester Clyde Stewart visited the area and several recommendations were proposed. The most significant proposal was to provide openings in the 6,000 plus forested acres on the Big Sandy Peninsula. These openings would improve nesting and cover habitat for turkey and benefit deer, as well as other wildlife species. The openings are to be created by clear-cutting small tracts, approximately ten (10) acres in size. Thirty (30) of these openings were proposed and were to be scattered throughout the forest. Forester Stewart contacted several lumber companies in the area, and Westvaco showed interest. A January 1988 meeting was conducted with Westvaco representatives. Westvaco personnel toured the Big Sandy Unit to observe what type of hardwood we had available and determine whether it was feasible to conduct timber operations there. They felt that a timber harvest was possible the way

we would want it - thirty to forty (30 to 40) ten acre clear cuts scattered throughout the Peninsula. The final decision at the end of the day was that hardwood management was possible to provide a diversity of habitats there at the Big Sandy Unit, but that with higher priorities of wetland management and higher duties for several of the personnel, that no timber operations would be considered in the foreseeable future.

Since 1975, the refuge has had a cooperative agreement with the Tennessee Department of Conservation, Division of Forestry, to establish an area for planting seedlings of mixed hardwood species for timber and wildlife habitat for experimental purposes. Original seedlings planted were black walnut, sycamore, and yellow poplar. During the record high water years of 1983 and 84, these experimental sites were flooded and caused significant damage to many of the tree species. In 1985, additional tree species were planted, such as green ash and bald cypress in an effort to produce more flood tolerant trees. There was no new planting activity in 1988 on this long term project. Growth measurements were taken on the bald cypress plantings. Future plantings will be more concerned with bottomland hardwood species, such as cherrybark oak and green ash.

4. Croplands. Table 1 summarizes the 1988 cooperative farming program on Tennessee NWR. Eleven (11) cooperators farmed a total of 2,898 acres. The 1988 growing season experienced extreme drought conditions and yields of corn, milo and soybeans were greatly reduced. The Service share of row crops is normally twenty-five (25) percent which is left in the field for waterfowl use. Approximately 1,400 bushels of ear corn and 1,200 bushels of kernel corn were harvested for use in waterfowl trapping/banding operations.

1988 was the second year that our refuge farmers participated in the USDA Acreage Reduction Program (ARP), a set-aside program to reduce grain (corn and milo) crops. Three of our farmers took advantage of this government subsidized program and set aside a total of 178 acres (151, 14, 13 respectively). We required all set-aside land to be put in winter wheat for goose browse, and we require that set-aside fields be rotated annually. These two provisions have decreased our costs for planting goose browse and prevented set-aside fields from becoming neglected and unproductive.

Winter wheat was again heavily browsed by geese this year, whereas, in 1985 and 1986 there was very little use made of the wheat. Winter conditions were extremely mild. Refuge staff force account farmed fifty (50) acres of wheat.

We have water management capabilities to flood the majority of our corn, therefore, very little knocking down is conducted. The bushhogging of corn is becoming a thing of the past due to the increasing establishment of hunting clubs adjacent the refuge boundary. A positive aspect of the increasing number of hunting clubs along our boundary is that they are developing and managing waterfowl habitat at a considerable expense. Flooded agriculture crops, moist soil management, and provision of winter browse has greatly increased on adjoining private hunt clubs.

TABLE 1. Summary of 1988 Cooperative Farming Program on TNWR

	Big Sandy	Duck River	Busseltown	Total
Row Crop Permits	4	6	1	11
Row Crop Acres	530	1,510	594	2,634
Corn Acres	159	766	404	1,329
Corn-Bushels/Acre	50	90	30	avg.67
Soybean Acres	371	744	-	1,115
Soybeans-Bushels/Acre	23	32	-	avg.29
Milo Acres	-	-	190	190
Milo-Bushels/Acre	-	-	5	avg. 5
Winter Wheat Acres	17	185	62	264
Total Acres Farmed	547	1,695	656	*2,898

* 180 Acres of farmland was double-cropped.

Considerable time was spent on the Big Sandy Peninsula trying to rehab the shoreline adjacent to some of our farm fields. This area had grown over in rank growths of tall willows and time was spent trying to doze these willows into piles. Work conditions were too wet and the dozer unable to get to all areas. We cut the willows down with a chain saw. This, along with some planting of winter wheat, has dramatically improved this area for waterfowl use with immediate results. Most of the geese using the Big Sandy Unit at the beginning of the season were found in this general area where they had better access to food.

The drought conditions made it an extremely hard year for refuge cooperative farmers. Two farmers conducted daily irrigation for approximately six weeks. The drought stressed corn was impacted by a blight and beans and wheat were then attacked by corn ear worms (beans) and army worms (wheat). A fourteen (14) acre wheat field (refuge share) was completely eaten in three days by army worms. The comparatively good stand of wheat (5 inches tall) did not grow back, despite rains immediately following the eat-out.

We received 1,150 bushels of wheat from our cooperative farmers. Approximately 300 bushels of wheat were provided to Cross Creeks Refuge for their station's winter wheat planting.

5. Grasslands. Over sixty (60) percent of the grasslands is used for haying and grazing and are mowed one or more times annually for weed and brush control. Practically all the grassland is found on highly erodible soils, primarily Class IVe and reclaimed VIe lands. Most areas are fertilized annually by permittees in amounts sufficient for long term maintenance of sod. Bushhogging is usually conducted annually in grassland areas that are not under haying/grazing to improve and attract waterfowl, turkey, deer and quail to these areas.

6. Other Habitats. None to report.

7. Grazing. There were four (4) special use permits issued in 1988 for grazing. This was the second year that a special use fee was in effect. In previous years, the grazing program was conducted under the cooperative farming program. Grazed lands totalled 309 acres and ranged in size from three (3) acres to 198 acres. Due to the marginal quality of land, an $8.00/acre fee was charged. A total of $2,472.00 was collected. A total of 145 cattle and 1,158 AUM was permitted.

8. Haying. There were four (4) special use permits issued in 1988 for haylands. This was also the second year that a special use fee was in effect for haying privileges. In previous years, the haying program was conducted under the cooperative farming program. The haylands totalled 169 acres and ranged from twenty (20) to seventy (70) acres in size. Due to the marginal quality soil in these lands, only $8.00/acre was charged. A total of $1,352.00 was collected from special use fees, with 240 tons of hay harvested. In addition to the fee, the permittee must maintain soil requirements and cut the hay prior to the fall arrival of waterfowl. The permits are issued on an annual basis.

9. Fire Management. All national wildlife refuges in Tennessee entered into a formal cooperative agreement for fire management with the State of Tennessee, Department of Conservation, Division of Forestry, in 1983. This agreement includes forest fire detection, prevention, suppression, and prescribed burning services. Under the Cooperative Agreement, the State can be paid for actual services performed.

There were two small fires on refuge lands in June. While combining wheat at the Sulphur Well/Elkhorn area, the refuge cooperator's combine caught on fire. It not only totalled his combine, but set the wheat field on fire as well. Fortunately, due to the quick action of the farmer, he was able to disk around the area and limit the fire to one acre of wheat stubble. Without that quick action, the entire area may have been set ablaze. In addition, there was a fire that occurred off refuge lands at the Russwood Shores subdivision,

created by fireworks. The fire burned the individual's back yard as well as burning a small area of adjacent refuge lands.

The first ever prescribed burn plan was approved and initiated in 1988. A summer burn within a moist soil unit was attempted without much success. The June 21 burn was attempted during extreme drought conditions, but the unit contained predominately asters and would not carry a fire. A total of three acres were burned. Vegetative response to the burned area after shallow flooding was predominately moist soil plants.

Three additional prescribed burns were conducted in December with a total of 65 acres burned. Water levels were too high in the impoundments to obtain a desired burn. Waterfowl utilization responded favorably to the newly opened areas after shallow flooding. The prescribed burn did open up the shrubby underbrush areas along the impoundment peripheries and cleaned roadsides for better waterfowl observation.

Maintenance Worker John Travis received basic fire training in order to qualify him to fight fires, on station.

10. Pest Control. The control of pest plants continues to be one of the most difficult and expensive items associated with farming. Our extensive cooperative farming program (2,898 acres) requires that we permit farmers to use a variety of approved herbicides if they are to continue on a profitable basis.

Fifteen herbicides were applied by eleven farmers to 2,898 acres of crops and included 1,115 acres of soybeans, 1,329 acres of corn, 190 acres of milo and 268 acres of wheat. Herbicides used included; Lasso - 643 acres; Atrazine - 1,395 acres; Treflan - 408 acres; Basagran - 248 acres; Fusillade- 1,086 acres; Roundup - 20 acres; Harmony - 300 acres; Sevin- 12 acres; Blazer - 188 acres; Scepter - 68 acres; Canopy - 536 acres; Classic - 676 acres and Poast - 140 acres.

Insectiband pesticide was utilized by one grazing permittee for fly control. The pesticide was used as a "back-rub" for cattle, and was not applied to the soil.

Cattail has become a serious menace and will play an important role in future pest control programs. Impoundment No. 3 had a heavy stand of cattail in Spring 1988. Beginning May 15, the impoundment was pumped to its lowest level (354.35 MSL on June 17). The cattail was disked, allowed to dry for one week, disked again in the opposite direction, allowed to dry for one week, and then shallow flooded (357.24 MSL, at gauge, on July 15). On July 17, the water was again drained out of Impoundment No. 3 to a level of 355.62 MSL on August 29. This

manipulation resulted in a solid stand of preferred moist soil plants (millet, sedges, etc.). Waterfowl use within the impoundment was the highest ever recorded. There were only a few cattails that grew back in the impoundment. In other impoundments, there were 54 sites of small cattail patches that were treated with Rodeo. Each site was flagged and will be evaluated in 1989.

Alligatorweed was identified growing in the impoundments at Duck River Bottom. Alligatorweed covered 4.2 acres of water area in Impoundments No. 1, 2, 5, 10, and 11. Due to the late date (September) it was discovered, a decision was made not to attempt chemical control but to wait and see if the winter icing and freezing resulted in control.

A major flood occurred the last week of December. Our observations to date, indicate the flooding probably spread the alligatorweed to other impoundments. Large mats of alligatorweed were uprooted and floated across the dikes. During the high water, many hours were spent floating/raking these large mats of alligatorweed out of the newly infested impoundments. Many thousand pounds of mats were pulled out of the water and piled on the graveled dike to allow drying, freezing, and killing. The debris was so thick that a Reliant station wagon actually got stuck and had to be pulled out of the pile of alligatorweed. (Where is a camera when you need one?) An intensive chemical control program for alligatorweed in planned for 1989.

Coffeeweed (Sesbania) was identified in July 1988, in Impoundments No. 1, 2, 3, 7, and 9 at Duck River Bottom. Over 1,200 plants were removed by hand during the summer. It was found growing in a corn field, in the moist soil units, in gravel, and in three feet of water. An intensive chemical control program for coffeeweed is planned for 1989. Unfortunately, the Kentucky Lake Reservoir is infested with both the coffeeweed and alligatorweed, therefore we anticipate a continuing future problem due to river flooding into the impoundments.

12. Water Rights. The City of Waverly, Tennessee, pumps domestic water from Duck River on Tennessee Refuge. The pump station operates with negligible known impacts to the refuge.

12. Wilderness and Special Areas. The 578 acre Britton Ford Research Natural Area is the only designated natural area on Tennessee Refuge. It encompasses Sulphur Well Island and approximately 300 acres of the wooded portion of Britton Ford Peninsula.

Twelve Indian mounds have been identified on the refuge. In addition, there are numerous areas along the refuge shoreline

where Indian artifacts and relics are found. These areas are well known to local artifact collectors and present a challenge to law enforcement efforts.

Another historical site is Mount Zion Church and cemetery located on the old 23rd District (Big Sandy Unit). A local group holds an annual reunion on the Fourth of July weekend, which has been traditional since the 1940's. Minor roof repairs to the church were completed by refuge staff.

G. WILDLIFE

2. Endangered Species. Bald eagles continued to prosper on the refuge throughout the year. Although peak numbers were down from the previous year's record of 92, the average sightings during the winter were around 60 eagles. Sixty-nine eagles were observed during the week of January 8, including 25 adult bald, and 40 immature bald.

The best news was not numbers but in terms of nesting. We were quite concerned that an eagle that had been shot within a mile of the only active nest on the refuge was one of the adult breeding pair. This did not prove to be the case as the nest was again active in springtime, raising one young to flight stage.

During the middle of March, we contracted a flight to aerial census all three units of the refuge to try to locate any new eagle nests. Several pairs of eagles were observed, primarily at the Duck River and Big Sandy Units and we had hopes that additional nesting activity had taken place. A total of seven eagles were observed including three at Duck River, two at the Big Sandy Unit and two on the Tennessee River between the two units. No nests were found except the active nest near Eagle Creek.

In addition to the active pair at Eagle Creek, we observed several bald eagles throughout the summer. Both an adult bald (white head only) and an immature bald eagle were observed perched in one of the cypress trees in the great blue heron rookery. A pair of eagles was observed on the Big Sandy Peninsula up until the middle of March and then disappeared. One adult bald was later seen in the same area in June.

The year ended on a high note as a pair of eagles was observed beginning to build a nest in Impoundment No. 9 in the Duck River Bottom. They were believed to begin building a nest around December 27th and continued through the remainder of the year.

The one low note for eagles during the year was the report of a second bald eagle that had died during that winter on the Duck River Unit of the refuge. As mentioned before, the first eagle had been shot by an unknown person approximately one mile off the refuge. On February 19, a State wildlife officer contacted Roy Brown concerning reports of a dead bald eagle floating in the Tennessee River below the New Johnsonville pump station. On February 20th, Roy and Jerry Armstrong located the bird, hung in a trotline, off of one of the islands in the Tennessee River. The immature bald eagle evidently became entangled in the line in attempting to catch one of the bait fish.

Golden eagle numbers remained approximately the same during the year. Two adult golden and two immature golden eagles were observed in Duck River Bottom both during January and February and then again in December of the year.

During the last four years, an osprey pair has nested in the Duck River Bottom, primarily using a nest they rebuild each year in Impoundment No. 2. Two summers ago, the birds made several nest attempts in various trees in the Bottom, but never laid any eggs. This year, the pair returned in March and began using a feeding platform in Impoundment No. 3, along Breeden Road. This was the last nest attempt from the previous year. The pair remained active around the nest and the female was observed in incubating posture for four weeks. However, on May 4, the nest appeared to be abandoned after 27 days of incubating. No reason could be given for the abandonment and no new nesting attempts were observed. In fact, only one of the birds was observed during the next couple of weeks.

We attempted to retrieve the eggs but were unable to reach them with a bucket truck from the local power company. The operator of the truck volunteered to come back, on his own time, and climb the tree to retrieve the eggs. On June 14, the individual climbed the pole and retrieved three eggs from the nest. Two of the eggs appeared full with one feeling almost empty. In transport, the empty egg cracked, revealing a small amount of material that was cooked from the intense heat. Contact was made with Don Shultz in the Regional Office and after several weeks, we were notified that the eggs would be sent to Patuxent for examination. In November, we received results of the analysis done on the birds, at Patuxent. The analysis revealed one of the eggs to have a one-third developed chick that appeared to be normal. Other parameters given did not indicate a problem with pesticides or egg shell thinning.

3. Waterfowl. Waterfowl numbers continue to increase each year on the refuge. In January of this year, we reached a new

88-0-2. The new waterfowl trap really works great. (CLR)

88-1-21. Some Canada geese are reluctant to leave. A large number of birds knocked the "slow-down" netting from its attachment to the top of trap down to top of post...This net helps to eliminate the "burnt out" flights throughout the trap. (CLR)

88-3-10. Several races of Canada geese visit Tennessee Refuge...P39U benefitted from the moist soil. (LJM)

88-7-13. Yes Phil, it is a black duck! We had four guesses as to its sex...two of which, we had never heard of. (CLR)

all time high with a total of 343,400 ducks and 49,000 geese observed on all three units. The primary duck species using the refuge were mallard - 275,000+, black duck - 39,000+, widgeon - 8,600. The majority of the waterfowl began leaving in February with several thousand still remaining on into March. We were very pleased to find that the west side of the Big Sandy Unit, the Elkhorn/Britton Ford area, was heavily used by ducks during March. During the first week of March, up to 5,000 ducks and over 3,000 Canada geese used the area, holding the largest concentration of any of the three units. We kept the closed area intact as long as the birds were using the area, causing many complaints by fishermen eager to get their crappie beds out.

During the summer, we noticed several pairs of mallards on all three units, in particular, at the Duck River Unit. Several broods of mallards, blacks, and a few goslings were seen during the summer.

During the fall migration, we noticed that we had a larger number of birds earlier than in previous years. We feel this was a combination of having both water and food for the birds that were leaving the drought stricken areas in the mid-west. In addition, heavy rains in normally dry September and October raised water levels ahead of schedule and above preferred depths. Checking with other refuges and State management areas revealed that those areas that had a combination of food and water, really picked up on the birds early in the year. We seem to have greater than normal numbers of blue wing and green wing teal, widgeon, gadwall, and pintail during the fall migration. By the end of November, we had over 200,000 ducks using the various units and by the end of December we were pushing 306,000 ducks.

Canada goose numbers were a different story. They were down compared to previous years, both early in the year and during the fall migration. During January, the peak was 49,000 geese, dwindling down to 37,000 in February. Although ducks flocked to the refuge quickly during the fall migration and continued to build up, we really did not get any significant numbers of geese until December. Approximately 3,000 geese were observed during October, building to 35,500 in December. We feel the lack of cold weather had been the major factor in keeping the geese farther north during the fall.

During April, we received 25 of the wood duck boxes designed by Frank Belrose and Ducks Unlimited. These were boxes that had been recommended at a recent wood duck symposium held in St. Louis, Missouri. Thirteen were placed on the Big Sandy Unit, either in small refuge ponds that had wood duck activity or along Bennett's Creek. The remaining twelve boxes were erected in Duck River Bottom, scattered throughout the

88-30-14. The birds fill the sky above a moist soil impoundment. (CLR)

88-3-7. Give me a quick count! (CLR)

various impoundments. A check of the boxes in September revealed that only one of the boxes on the Big Sandy Unit had been used. It appeared that the nesting was probably a second nest attempt as only three eggs were laid, with two young exiting the box and one duckling still left in the nest. None of the boxes on the Duck River Unit had been used. While checking the boxes on the Big Sandy Unit, seven additional boxes made out of cypress, that had been there for years were also examined. Every box had been used with clutches averaging nine to eleven eggs. The interesting fact was, that out of the seven clutches, only three hatched. Four of the boxes were abandoned. Most of these eggs were close to hatching when the hens abandoned the box. We are at a loss to explain this, unless extreme temperatures caused abandonment. In addition, most of the boxes were heavily infested with dirt dauber nests.

4. Marsh and Water Birds. Changing from a heavy farming operation to emphasize moist soil management has evidently encouraged use of the area by sandhill cranes. In January, four sandhill cranes were observed using the Duck River Bottom. In December, 26 sandhill cranes were observed at the beginning of the month, flying over the refuge shop. These birds were observed continuously throughout the remainder of the month in various impoundments in the bottoms.

The great blue heron rookery in Impoundment No. 10 in Duck River had a new peak for the number of active nests. A total of 323 nests were counted at the peak with 307 of them active. A May census revealed that of the 307 nests, 174 averaged two young per nest, with adults still incubating 71 other nests. The remaining 62 nests had adults present on the nest but no young were seen nor was there any evidence of incubation.

One interesting sighting was the building of a new nest completely outside the rookery. The nest was built in a cypress tree one-quarter mile from the active rookery. Although one adult was observed in incubating posture, no young were ever observed in the nest.

Upwards of 5,000 cormorants used all three units during the month of October. This is a significant increase compared to sightings the last few years.

Late in the summer of 1987, during the construction of small rice type levees, several black rails were flushed from the moist soil impoundments. This year we submitted a study proposal to determine the population and habitat preferences of the black rail, using available non-game funding. Although the study was not funded, we were requested to try and determine if the birds were again present this summer and if documentation could be made for future funding. In addition,

88-27-3. Copperheads object to moist soil management. (MJM)

88-22-14. Purple martins gathered near the great blue heron rookery for a pit stop. (LJM)

a professor from nearby Murray State University was very interested in this particular bird and also conducted some night censuses to try to locate the birds. Our initial census was on April 27, playing tapes of the rail and listening for a response. Unfortunately, no documented calls were made by rails during any of the censuses conducted by Dr. White nor refuge staff during the summer. We feel that the birds are present although we have no idea as to numbers. We may have to try different censusing techniques or more frequent censuses. With a full time biologist now on board, we hope to do some more intensive censusing during 1989.

5. Shorebirds, Terns and Allied Species. As impoundments were dewatered in March and April, large areas of mud flats and shallow water areas were exposed providing excellent feeding opportunities for numerous shorebirds. Yellow-legs, snipe, and various sandpipers were the most common birds observed on these mud flats.

Pace Point, which is the northernmost point of the Big Sandy Unit, is known as one of the best places to observe shorebirds during the fall migration during late August and September. This area, in fact, has been nominated to be included in the shorebird reserve program as an international area. We normally see several hundred birds of many different varieties at Pace point. This year, however, was an exception due to much higher than normal lake levels. Kentucky Lake was two to three feet above normal pool for September, completely covering the mud flats and exposed shoreline that the shorebirds normally used.

6. Raptors. Several species of raptors utilize the refuge throughout the year. The most common species are the red-tailed hawk and northern harrier. One particular raptor that brings many requests to try to observe is the short eared owl which is observed during the winter months, usually in the upper bottoms of the Duck River Unit.

In early December, refuge staff noticed a migration of hawks, using the Duck River Bottom, unlike any previous observations. The staff could travel the various dikes, spotting red-tailed and red-shouldered hawks about every 100 yards. There were literally several hundred hawks throughout the bottoms that stayed for a couple of days before moving on.

10. Other Resident Wildlife. Recently hired Biologist Craig Bitler initiated an informal coyote study in Duck River Bottoms. Calling upon his previous work on a coyote study with USDA, he conducted a scat/diet study of coyotes. During October, the diet was primarily persimmons (68%). During November, the diet changed to a mixture of mammals (36%), persimmons (35%), and waterfowl (12%). During December, the

88-7-5. Trick is to keep the ducks out so you can catch geese. Less stress on the birds caught in the trap than the ones caught under the cannon net. (LJM)

88-1-3. Now all we have to do is band them. We will raise one side of the drive pen enough so that we can band the birds on the left leg as they go by. (LJM)

diet contained 63% mammals, 15% waterfowl, 6% persimmon, 6% unknown, 5% vegetation, 3% corn, 1% grasshopper, and 1% snakes.

16. Marking and Banding. The refuge staff experienced one of the most successful banding efforts during the winter of 1987-88. Although we initiated baiting our banding slopes where we use cannon nets, we only fired a net one time. Most of our efforts concentrated on our large swim-in trap built the previous summer. We knew we could attract the ducks but we did not know if we would be able to trap Canada geese. We found that we had to use two different trapping strategies- one for ducks and one for geese. For ducks, we could keep the funnels narrow and flood the trap. We could bait with shell corn. None of this worked, however, for the geese. In order to draw the geese, we had to dewater the site, open the funnels wide, and bait, using only ear corn. Once we found the secret to enticing the geese, we concentrated on banding them and found that ducks would also still come into the trap.

We banded up until the end of February, winding up with a record number of birds banded. Totals included; 1,240 geese, 6,664 mallards, 1,655 black ducks, and a few incidental birds including snow geese, widgeon, and wood ducks. In addition to quotas on the geese, mallards, and black ducks, we also had quotas on the collaring of geese and efforts to take blood samples from 100 black ducks. We removed most of the interior of an old travel trailer used in YCC operations for use in banding on inclement days. We were able to set up stations inside the trailer to attach the collars (keeping the glue warm) and areas to be able to take wing and body measurements. The affinity of the birds for the trap, the use of the banding trailer, and the close proximity of the banding site to the refuge shop and operations in general, enabled us to band these large numbers relatively easily and with low total costs for banding.

In June, we again used our swim-in trap to try to band wood ducks. We shallow flooded the trap and began to attract the birds by month's end. When the pre-season banding period ended, we finished with a total of 600 wood ducks banded. Incidental species banded included; mallards, blue wing and green wing teal.

We attempted in October to try to band early migrating geese, using the swim-in trap. However, we had very little success, with a low number of birds on the refuge and the birds that were present utilizing our moist soil areas.

Throughout the months the geese were present, we routinely censused the birds for neck collars. For the winter of 1987-

88-1-17. Good mix of mallards, blacks, and Canadas. (CLR)

88-8-2. We occasionally get some "crazy mixed-up" birds, but not quite this bad. (CLR)

88-5-16. Carrell presented a group award to the Duck River maintenance crew. (MJM)

88-2-16. All hands, including clerk, Dot Easley helped band ducks. (LJM)

88, we observed collars through February. A total of 858 collars were observed. The primary colors observed were blue and white and orange and white. Additional colors observed were yellow and black, red and white, and white with black letters. As geese began to build up in late November, we again turned our efforts towards trying to observe neck collars. By year's end, a total of 336 neck collars were identified.

H. PUBLIC USE

1. General. Visitation to the refuge continues to grow a little each year, with fishing still being the most popular form of outdoor recreation enjoyed on the refuge. Wildlife observation, and just driving around the refuge to see what there is to see, also rate high with our visitors.

2. Outdoor Classrooms. Students - On January 27, Johnny Lumpkin, ninth grade teacher at Briarwood School in Camden, brought his class to the refuge for a first-hand wildlife experience. After watching a demonstration by refuge staff of aging, sexing, banding and neck collaring of Canada geese, the boys and girls had an opportunity for getting into the act, banding mallards. It was the first time for many of them to handle live, wild birds and they were most excited at the chance to do so. After completing the banding, the group took a tour of the Bottoms, where they saw several eagles, deer, squirrels, great blue herons and a myriad of waterfowl.

On November 28, Mark Musaus and Ed Britton conducted a program and refuge tour for a wildlife management class from Murray State University in Kentucky. The students had a project to develop a management plan for a twelve hundred acre site along Blood River, and were seeking information on moist soil management. Twenty-two students were present for the three hour program.

4. Interpretive Foot Trails. The Chickasaw Wildlife Trail was renovated by the YCC camp again this summer. Removing downed limbs, cutting back the brush, painting benches and clearing around the old homesite took most of three days, but the area shone when they were through.

5. Interpretive Tour Routes. The Self-Guiding Auto Tour Route around the Big Sandy Peninsula receives several thousand visitors each year; most are fishermen, but a lot of people enjoy the drive, with a chance to see some wildlife, Mount Zion Church, the old cemeteries, Lashlee Spring, and other sights along the way. Severe rains in January caused extensive damage to the road near the Lashlee Spring, requiring extensive repair.

88-20-1. Coop farmer Ken Barlowe's new John Deere combine had a fuel leak and caught fire while in use. (J8A)

88-3-1. Carl Dowdy shows the school group how to band mallards. (LJM)

6. Interpretive Exhibits/Demonstrations. A total of ten off-site programs were presented during 1988, to a variety of schools and civic organizations. The most ambitious effort was the refuge exhibit set up at Paris Landing State Park for Public Lands Day, on September 10. About 15,000 people toured the exhibit area that day, which also included displays from other refuges, the Corps of Engineers, the Tennessee Valley Authority, and several State agencies. The evening climaxed with a free concert featuring John Hartford and Louise Mandrell.

7. Other Interpretive Programs. Two video tapes were placed in use during the month of November. The "Take Pride in America" tape featuring the Oak Ridge Boys was received in one-half inch VHS format which cannot be used by regular commercial stations, but it was used by the public television station at Murray State University. The tape describing the Service's crack-down on waterfowl violators was used by Channel 8 in Nashville in conjunction with their outdoor recreation program.

Several tours to view waterfowl and/or eagles were conducted during the year. All were successful, despite the occasional non-cooperation on the part of the weatherman. The heaviest rain on a tour day was experienced during November when portions of a combined group from the Alabama and Tennessee Ornithological Societies toured the Big Sandy Unit and the Duck River Unit. The tours were part of a week long outing for the group, which also included visits to TVA's Land Between the Lakes and Cross Creeks Refuge.

The refuge receives lots of unrecorded use by organized groups taking advantage of wildlife and waterfowl observation opportunities. For instance, the refuge was a featured attraction for a group of Democratic senators that had a conference at Paris Landing State Park in late autumn, then took a tour of the Big Sandy Unit as part of their visit to the area. Land Between the Lakes (LBL), a part of the Tennessee Valley Authority, and Paris Landing State Park, hosted an event called "LBL Winter Weekend" that also included conducted tours of the refuge. Evidently such activities are conducted throughout the year, adding greatly to the numbers of visitors enjoying the refuge.

8. Hunting. The hunt coordination meeting with the Tennessee refuges and the Tennessee Wildlife Resources Agency (TWRA) was attended by Mark Musaus and Carrell Ryan at Reelfoot Refuge on February 9 and 10. Several changes were discussed and problems hashed out, but discrepancies still had to be resolved prior to issuance of the refuge's hunt brochure.

88-26-3. Our exhibit for the Public Lands Day celebration held at Paris Landing State Park, September 10, 1988. (LJM)

88-4-1. 'Grandpaw Jones' volunteered to do a videotape asking people not to shoot eagles. ORP Larry Masters asked to participate in this video shot in Nashville to answer questions on bald eagles. (LJM)

The drawing for the spring turkey hunt was held on March 11. The hunt corresponded to the first two weekends of State season. As near as we could determine, only four out of the 25 successful applicants hunted opening weekend and one turkey was taken.

The revised refuge hunt brochure was submitted to the Regional Office in draft form in May. Sweeping changes were incorporated in the brochure; the biggest difference is the fact that the brochure, when signed, was to function as a permit for small game and archery deer hunting. Unfortunately, the brochure had not been received by opening day of squirrel season - August 27; this presented refuge staff with an opportunity for many hours of public contact with inquiring hunters.

Squirrel season had a light turnout of hunters and relatively few squirrels taken, although there were plenty of squirrels. The limit had been reduced from ten per day to six, by TWRA, and most hunters had no trouble getting a bag limit.

Archery deer season began on September 24; heavy rain fell the first two weekends, resulting in few hunters out and very few deer harvested.

The drawing for the muzzleloader deer hunt was held on October 3. A total of 1,615 applications were received for 315 permits; 175 permits were issued for the Duck River Bottom, 100 for Busseltown and 40 for the Britton Ford/Sulphur Well Island area. Hunt dates were October 21 and 22. The hunt had a two deer limit, but few hunters took two, with a total of 66 deer reported as harvested.

The drawing for the gun deer hunt was held on November 1. As always, interest was keen and several hopeful entrants were in the office early to observe the drawing and to "help" if possible. The first gun hunt was held on November 11 and 12, on the Duck River Unit South of Interstate 40; 75 permits were issued for each side of the river. Of the 52 deer taken, the heaviest weighed 120 pounds field-dressed, the largest rack had 8 points, and the oldest was over six and one-half years of age. The Big Sandy Peninsula deer hunt was held on December 9, 10, and 11, with 150 permittees participating. Only 52 deer were taken, but all of those were in good to excellent condition. The largest deer taken was a 10-point buck that field-dressed at 171 pounds; the oldest was five and one-half years of age.

A two deer limit (instead of one deer) was initiated this year in an attempt to increase the number of deer harvested and to improve the quality of the hunt. In past years, many successful hunters got their deer a few minutes after daylight

on opening day and were ready to go home. Their hunting companions frequently had to pack up and go, or be left behind. By having the chance at a second deer, it was hoped that more hunters would be encouraged to stay longer and give everyone in the party a greater opportunity to collect a deer. Only a very small number of hunters got two deer, but not many left early in the hunt. However, deer harvest was not increased significantly over previous years.

Raccoon hunting on the refuge began on November 4, coinciding with the opening of the State season, and ran for ten days. Heavy rains the first two nights resulted in very light hunter turnout and raccoon harvest, and very little 'coon hunting was done for the remaining eight nights.

Hunting on Tennessee Refuge is regarded by most locals as good to excellent. The Big Sandy deer hunt is one of the best in the state, and a chance to hunt there is eagerly sought by several thousand sportsmen each year.

9. Fishing. Still the most popular form of recreation on the refuge, fishing attracts hundreds of thousands of visitors each year. The Crappiethon and several bass and sauger tournaments, originating near the refuge and spreading onto refuge waters, attract fishermen from far and near. Commercial fishing and the collection of mussel shells by diving or toe-digging is an important source of income for many people living near the refuge. Tennessee River catfish is regarded as a delicacy far and wide.

Reports of "diseased" or injured catfish are still common among commercial fishermen in the area. Water pollution is blamed by some as the source of the problem; others say that the fact the fish are killed electrically is the reason the fish appear bruised and battered. Water quality in the Tennessee River is a matter that concerns everyone, and constant monitoring by various State agencies, as well as TVA, has not identified a point source of pollution that could be eliminated and return the water to its former pristine condition. Much as the locals want a "quick fix" to the problem, a solution evidently lies in the future.

In an effort to accommodate ever increasing numbers of fishermen, both the West Sandy and Old Mill Landing boat ramps were widened and the parking areas enlarged.

10. Trapping. One volunteer, Gary Owens of Big Sandy, has been attempting to control nuisance beavers that have been plugging up some water control structures on the Big Sandy Unit. His success has been marginal.

88-9-21. Widening of the West Sandy boat ramp during low lake levels. (LJM)

88-10-24. Fishermen wouldn't wait till we finished before they started using the ramp. (LJM)

11. Wildlife Observation. Driving through the refuge to see the waterfowl and eagles during the winter months, and looking for deer all year long, are extremely popular activities on Tennessee Refuge. The Elkhorn/Britton Ford area is only a few minutes away from Paris, and most evenings find lots of folks on refuge roads, just looking for what there is to see.

17. Law Enforcement. Refuge officers made 127 cases this year, exceeding last years total by thirteen (13). The major violations remained the same - trespass and camping violations. Due to the severe drought and State's ban on fires, we strictly enforced the prohibition of open fires on the refuge, making several cases. One area that did drop considerably from the previous year was in waterfowl violations. Makes us wonder if we are getting better or if the violators are getting smarter. The breakdown of refuge cases is as follows:

Violation	No. of Cases
Trespass (Closed Area)	33
Camping	26
Open fires	21
Motor vehicles (all)	18
Fishing	10
Waterfowl	6
Artifact collecting	4
Mowing/clearing on Refuge	3
Hunting (small game)	2
Boating	1
Littering	1
Discharging fireworks	1
Possession of controlled substance	1
TOTAL	127

We continue to have problems on the west side of the Big Sandy Unit, enforcing our shoreline policy. Adjoining neighbors continue to mow and clear portions of the refuge to improve their view of the lake and enhance property values. We have cut back on the permitted mowing and made some prosecutions on those not in compliance.

The judicial dividing line for law enforcement cases on the refuge is the Tennessee River. Violations committed on the east side of the river go to Nashville, Tennessee, while violations on the west side go to Memphis, Tennessee. We have problems with both courts. In Nashville, we do not have good cooperation with the U.S. Attorneys but the judges understand wildlife problems and our objectives. In the western district, it's just the opposite. We have pretty good cooperation with the U.S. Attorney, but regardless of the

violation, one judge in particular, only fines those found guilty, one dollar and court costs. This does not make for much of a deterrent.

Expanding on this problem is the fact that one refuge trespass violation still has not been resolved since the summer of 1987. A house/barbecue stand adjacent to the refuge on the Duck River Unit set up a satellite dish on the refuge. While investigating this we found a portion of the building and a commercial beer sign were also illegally on the refuge. After contact with the owners and their refusal to remove the items in question, we decided to prosecute. The Assistant U.S. Attorney assigned the case made contact with the owners of the property, but not the refuge. He decided not to prosecute criminally saying instead it was a civil matter. After months of working through the Regional Solicitor to request civil prosecution, the U.S. Attorney's office in Nashville refused to handle the case. As the situation remains stalled, we continue to be frustrated. The owners smile pretentiously every time they see us and a dangerous precedent has been set regarding refuge encroachment in an already heavily developed area.

In previous years, when we have closed portions of the refuge during the winter for waterfowl sanctuary, we have just posted them closed. We would make several cases each year, on individuals found behind the closed areas. We knew, however, that others were not caught and felt the most equitable solution was to erect gates at the entrances to the closed areas. This evidently, provided some unique temptations for some members of the public.

On November 7, approximately a week after closing Lawrence Creek Road in the Duck River Bottoms, Bio Tech Carl Dowdy found that the road had been obviously driven on the night before. There was evidence of a vehicle that had done "wheelies" and spun out all over various sections of the dike. To his surprise, he found the vehicle in Impoundment No. 7. Evidently, the driver of the vehicle and a cousin had come in from the upper end, driven several dikes, "joy riding" and came to our gate at the southern end of Lawrence Creek Road. Evidently, they turned around and on their return trip, rounded a curve too fast, lost control of the vehicle and plunged into the impoundment. They were spared loss of the vehicle and possible death or severe injury by the fluke occurrence that their vehicle was pinned against our water level gauge post.

Approximately two weeks later, while heading up Lawrence Creek Road for a waterfowl count, we again encountered another vehicle by the gate at Lawrence Creek Road. This time, a driver and possible riders, after driving several dikes in the

closed area, decided to try to drive around the cable and got stuck in the mud. In their attempts to free the vehicle they got the engine so hot it caught the vehicle on fire. The fire was so hot that all VIN numbers on the door and dash were completely burned up. With the assistance of Tennessee Highway Patrol investigators, we were able to locate a VIN number under the frame. This vehicle was discovered to be stolen from a used car lot near Union City, Tennessee, three days prior to being found on the refuge. We were unable to find any clues to identifying the occupants of the vehicle. The Tennessee Highway Patrol is still investigating the incident and theft.

Refuge law enforcement personnel attended the forty hour refresher training in Quincy, Florida, during the March and May sessions and the requalification at the Henderson, Tennessee, Fraternal Order of Police Range in October. Refuge Officer Armstrong attended additional training for the 1802 Series personnel in the Region in August, also held in Quincy, Florida.

Messrs. Britton, Musaus, and Armstrong attended a meeting in Nashville with the new Senior Resident Agent Tom Warton, Special Agent Dave Cartwright and personnel from Cross Creeks, Hatchie, and Reelfoot Refuges. This was Tom's first visit to Tennessee as SRA and this was an opportunity to discuss mutual problems and learn of law enforcement's mandates and priorities for fiscal year 1989. One of the problem areas discussed included the backlog of outstanding warrants for individuals failing to appear in court. Although it was planned for a team of agents and refuge officers to work together in early September to serve these warrants, further contacts with the Marshalls service proved to be beneficial as they initiated attempts to serve the warrants. In addition, at the meeting, the possibility of a task force to tackle winter waterfowl violations was discussed. At the request of Agent Cartwright, Refuge Officer Jerry Armstrong spent several days accompanying him in the western portion of Tennessee looking at potential problems and identifying areas to work during the opening weekend of duck season.

The refuge staff made considerable improvements to the pistol range behind the shop at the Duck River Unit. Utilizing the refuge dragline and dozers, we made a much higher bank and backstop for the range, making this area much safer. Utilizing available surplus property and excellent skills of our maintenance staff, we were able to fabricate "pepper poppers" and falling plates in addition to the stationary targets. This enabled our officers to practice various firearm drills to improve accuracy, speed and shooting ability under stress. We hope, in the future, to add turning targets and concrete walkways.

19. Concessions. As usual, Cuba Landing Marina provided plenty of excitement for the refuge staff during 1988. The contract for continued operation by Mr. Billy Goff was re-issued, incorporating a substantial increase in his annual fee (from $150.00 per year to $1,200.00) and an increase in his fee on gross receipts from one percent to five percent. Although he agreed to these terms when the contract was negotiated, he has tried to have the fees reduced. His gross has increased from $107,800.00 in 1984, the year he moved from Sugar Tree to Cuba Landing, to $304,200.00 this year. Mr. Goff has completed his boat dock expansion project, but still has lots of concrete covered styrofoam floats stacked up near the parking lot.

At the request of the concessionaires, a boat launch fee of $1.00 was initiated at both Cuba Landing and Mansard Island this year. Several of the people who live near Cuba Landing complained when the fee was begun, but there are other launching areas nearby if they do not wish to patronize Mr. Goff. Chuck Woods, at Mansard Island, erected signs that designated his operation as a U.S. Fee Area (in an effort to put the blame on us), but took them down as soon as requested.

Other problems surfaced at Cuba Landing during the year. Visitors complained that Mr. Goff had shot water snakes near his concession barge. He did not deny the charge, and stated that he would continue to do so. A letter from the Regional Office warning him to remove all firearms from the concession area has evidently been obeyed; at least we have had no further complaints and no firearms are in evidence.

The consumption of beer by visitors in the picnic area near the boat dock is also a matter of concern. Alcoholic beverages may not be consumed on the premises, which has been interpreted as meaning the concession barge where the beer is actually sold. No problems of excessive consumption of alcohol in the parking lot or picnic area have been reported, but some teetotalers in the area are offended by the sight of a beer bottle on the picnic tables near the marina.

The Office of the Inspector General found several discrepancies in the operation at Cuba Landing. Poor accounting practices and unreported income, as well as a generally unbusiness-like way of running the place, were the main comments in the report. Mr. Goff got a new cash register to improve his accountability, and paid his one percent fee on an additional $45,700 of income he had not reported to us through the years.

In general, the operation at Cuba Landing has improved over the past couple of years. The barge has been rehabbed with

vinyl siding and the quality of general maintenance and clean-up is better. Mr. Goff has been trying to sell his interest for some time. He suffered a heart attack on December 15 and underwent cardiac bypass surgery later in the month. He would really like to sell out and retire, but he has not advertised his place for sale nor has he listed it with any realtors; he wants to save the fees involved, but his limited efforts to do it by himself have been of no avail.

Mansard Island caused us some concern early in the year. The concessioner dug a series of ditches, some on his property and some on the refuge, in an effort to improve drainage of what he stated to be seepage water near his motel cabins. One of his ditches crossed a septic tank and drain field, and the effluent appeared to contain sewage. Jimmy McClure of the Henry County Health Department, and Larry Masters investigated the incident. Mr. McClure suggested other ways to handle the water rather than letting it run across the refuge and into Kentucky Lake. Mr. Woods filled in his ditches and resodded the area. He was cited under 50 CFR 27.51, disturbing plants and animals, and forfeited collateral in the amount of $50.

I. EQUIPMENT AND FACILITIES

1. New Construction. After several years of intensive construction efforts to build dikes in the Duck River Bottoms, followed by work at the other two units - Big Sandy and Busseltown, we can finally see the light at the end of the tunnel. Efforts were devoted more towards management, rehabilitation and investigating results of management techniques. In addition, we had three of our staff members actively participating in construction of wetland impoundments at other refuges in Region 4. Manager Ryan headed up a mobile team that designed and constructed impoundments on several refuges. Assisting in the construction effort, were Biological Technician Carl Dowdy and Maintenance Worker John Travis. In addition, we had on loan to other refuges throughout the spring and summer, our refuge dragline, TD-15 dozer, and other smaller equipment.

One project that we did complete during the year, on the refuge, was the new pole barn at our new maintenance site at Duck River. The open storage facility was basically erected during 1987. However, during the summer, we initiated the pouring of a concrete floor for all eight bays. It took several pours, but a concrete floor with a surrounding apron was finished, force account, by the middle of summer. We finally have an excellent storage area with a good solid floor, capable of supporting all of our heavy equipment.

88-24-14. Chuck Woods at Mansard Island wanted the public to believe we were the "bad guys" who wanted to charge the fee. (LJM)

88-18-23. This is an excellent way to retrieve the eggs from an abandoned osprey nest. (MJM)

88-2-5. The new pole shed under force account construction. The only way to obtain this facility. (LJM)

88-2-8. Roofing the new pole shed. Savings to the Government of many dollars. Do NOT suggest using 12" square treated post...each weighs over 1,000 pounds. (LJM)

2. Rehabilitation. Several projects were worked on during the year to rehabilitate and improve both refuge operations and public use facilities on the refuge. During February, while lake levels were still low, we initiated the rehabilitation of the West Sandy Landing on the Big Sandy Unit. Work here involved the addition of a second boat ramp and expansion of the existing parking lot. This is one of our more heavily used public access areas during the spring fishing frenzy, with vehicles coming from several surrounding states and counties in addition to the locals that use this part of the lake. YCC enrollees had made several concrete logs as one of their summer projects the year before. Approximately 65 logs were hauled to the West Sandy Landing and set in place and welded together adjacent to the existing boat ramp. After the second ramp was completed, several loads of gravel were hauled in to provide all weather access at this location.

During March, we added a second boat ramp at the Old Mill Landing in Duck River Bottoms. This too, is a popular access point throughout the year, especially during the winter time. During the winter months, this is the closest access to one of the best sauger fishing areas in West Tennessee as well as being the last access area to freeze during extremely cold weather. Since it does receive heavy traffic, we decided to both add a second ramp and expand this parking lot. Again, the use of concrete logs placed together and welded, was used.

Another rehabilitation project involving the north shore of the Big Sandy Peninsula was begun during March and continued throughout dry periods the remainder of the year. Over the last several years, rank growth of trees have sprung up along field borders and the refuge shoreline. We felt these trees made the individual farm fields smaller and less accessible for use by waterfowl. We began over by the Lashlee Springs drainage, clearing both the drains and the shoreline. Spring rains forced us to stop as some areas were pretty wet. We continued work during the summer and also on into the fall, working our way around all of the field edges. This work paid off with immediate results in early fall, as Canada geese began using these areas for the first time in several years. At a time when lake levels remained high in early fall, the cleared area along Culpepper Creek provided both grit and better access to some corn and wheat fields. This was the prime area geese used for the first few weeks in late October and November.

In late March, we also initiated work on clearing out blockages in Cub Creek on the Busseltown Unit. This was our effort to cooperate in a project being done by the West Eight Association under the guidance of TVA. West Eight is a group of eight counties along the Tennessee River that is trying to

88-15-12. Opening Cub Creek to navigation and better stream flow was flusterating at times. This was a cooperative effort with TVA, the West Eight Association and private landowners to clear Cub Creek of blockages along their boundary.(LJM)

88-15-18. The road to the proposed visitor center/office site near Fuller Hill needed a lot of gravel. (MJM)

improve stream quality and reduce flooding of farm lands. Through efforts of all adjoining landowners to the various creeks, work was initiated to clear the creeks of blockages, downed trees, and trees that may fall in the near future. A request was made last year that the refuge undertake work on its portion of the creek. As time and manpower permitted, we initiated this work, while water levels were at their lowest point. Using a cable and small crawler tractor, we were able to pull out most of the large trees and limbs that had fallen into the creek. It also took a lot of muscle as several large blockages were involved, including the removal of large logs. An approximate two mile stretch of Cub Creek, beginning at the refuge boundary and heading towards the river, was cleared.

Several smaller rehabilitation projects were performed during the year. One project involved the reworking and grading of a farm access road on the Big Sandy Peninsula that, through erosion, had become inaccessible. Several portions of the tour route road on the Big Sandy Peninsula were re-graveled as well as one of the boat ramps to permit better access by the public. A new entrance sign was erected at Duck River Bottoms to replace an old one that was stolen. The new signs are square and modifications had to be made to the old stone base to conform to the new sign.

Using our levee plow, we redid all of our low levees on the Duck River and Busseltown Units. Several of these levees had been washed out due to heavy rains in December, 1987, being the first rains to truly fall on the area and blowing out small portions of some levees.

Protective screens were installed on one of our TD-15 dozers, using fire money allocated to this project. In addition, refuge staff members fabricated a guard on the blade to protect the engine from limbs when working in brush and timber.

This dozer was then transported to the Busseltown Unit for habitat renovation work there. Several rows of trees were cleared along some of our moist soil sites to provide better access for waterfowl from the river to these moist soil areas.

As mentioned in the law enforcement section, work was done to rehab the pistol range at the Duck River Unit.

During the refuge inspection in late July, several eroded slopes along the tour route on the Big Sandy Unit were identified for rehabilitation. In October, using the TD-15 dozer present on the unit, the eroded areas were resloped, fertilized, seeded and covered with wheat straw.

88-21-1. Pouring concrete floor in pole shed. Big improvement to our maintenance program. This could become our new office. (LJM)

88-28-5. The new metal targets add a great deal of interest (challenge) to the firing range.(LJM)

Several wildlife openings on the Big Sandy Peninsula that had not been managed in several years, were bushhogged to remove invading saplings. We now, again, have a series of small wildlife openings in the early successional stages, scattered throughout the Big Sandy Peninsula to provide additional habitat diversity.

3. Major Maintenance. The white shop building at the Duck River subheadquarters was rehabed to provide additional storage. This building, for many years, was used as a one bay automotive shop and all purpose building. Enclosing one of the bays of our older pole barn enabled us to use this old shop building for storage. The inside of the building was reworked with many of the cabinets and shelving being relocated to our new shop. We built racks at the far end to better store and have better access to our supply of tires. In addition, we made shelves to store and keep in one place, our fire cache. Iron bars were fabricated and attached to the outside of all the windows to provide additional security of this closed storage building.

Strong winds during the month of March moved two sections of roofing off of the pole barn at the Big Sandy Unit. Refuge staff straightened the bent sections out and renailed them to the roof. At the same time, they renailed the other sections of the roof, that over the years, due to hot temperatures, had seen many of the roofing nails back out from the wood trusses.

One of the refuge grazing permittees at Eagle Creek requested that cattle guards on the refuge be cleaned out. Using YCC labor, these guards were cleaned out and some welding work performed to maintain the guards and keep young calves from getting out.

Two water control structures in the Duck River Bottoms required maintenance repair work during the year. A leak was discovered in the collar of the first and second joint on No. 3 gate or pipe (36 inch) and a 24 inch pipe in No 8. These leaks were repaired without affecting water management as planned.

The roof of the historic Mount Zion Church was also renailed. Over the years, several of the overlapping pieces of tin had come loose and were in danger of blowing off.

A large beaver plug was removed from a culvert in a creek that drains into the west side of the Big Sandy Unit near Sulphur Well Landing. This plug was backing water up on private property as well as beginning to erode the gravel road crossing this creek. While in the area removing the plug, we took the opportunity to cut a small ditch and lay a 12 inch

plastic culvert in a curve that tends to back up water and cover most of the road during heavy rains.

Maintenance work in the form of additional gravel and grading was done on several sections of roads after heavy rains caused minor erosion and washouts. In addition, we hauled gravel to several low spots on dikes in the Duck River Bottoms that tend to flood during heavy rains.

Routine grading was performed on all three units throughout the year. All slopes of the refuge impoundments were mowed periodically during the summer.

When you have equipment, and you use it, you can count on down time and the need for maintenance and repairs. Most refuge vehicles and heavy equipment required attention during the year. There were several pieces that were more noteworthy than others. The Ford Ranger assigned to the Busseltown Unit required extensive repairs during the first few months of the year. Before it was over, we had repaired a broken fly wheel, overhauled the torque converter, replaced U-joints, major repair of the transmission, and front end work. One of our John Deere 4440's required extensive repairs of the clutch and Hi-Lo transmission. This work had to be done on contract. Both our GMC and International Harvester stake/dumps required extensive engine repairs. The International was the more costly of the two, requiring a complete engine overhaul.

4. Equipment Utilization and Replacement. Early in January, we were informed that Chattahoochee Fish Hatchery was in desperate need of a 4x4 pickup for use during the winter weather in the north Georgia mountains. Their 4-wheel drive vehicle needed repairs that were too costly to fix and it would be several months before a new vehicle that was on order would be delivered. They requested the use of any vehicles that were available or identified as trade-ins in Region 4. We had a 4x4 Dodge pickup identified as a trade-in and had no problems loaning the vehicle to the hatchery. A couple of days were spent repairing the steering and front end sections of the truck in order to make it road worthy for transport to north Georgia.

A camper type trailer used over the last several years as a mini-office for YCC operations was completely gutted inside to make it available for use in our banding operations. Some counter space was left to hold boards for measuring geese. The remaining area was left open to be able to accommodate the aging, sexing, weighing of geese, and the application of neck collars, in warm conditions away from the winter elements. TVA would not permit the construction of a permanent facility in the Bottoms where the area is subject to flooding. This trailer allows easy transport to our swim-in trap site and was

especially helpful during the inclement weather in January and early February.

Several vehicles that had been ordered in FY 86 and 87 were finally received during the year. These included a 1988 Dodge maxi van which will be used to provide refuge tours as well as transport staff members to training or other assignments. Two S-10 Blazers arrived during the summer. One was used to replace a Ford Ranger with high mileage driven by the Refuge Law Enforcement Officer. We had experienced costly repairs on it earlier in the year and were facing more of the same. In this vehicle, we installed both a mobile radio as well as a sheriff's high band radio and siren/loud speaker system. Another Blazer was used to replace a pickup with high mileage that was not fuel efficient. The final vehicle received was a new 4x4 diesel pickup. We outfitted the bed with several storage compartments and fabricated a new diesel tank in order to make it a roving shop truck, available for use in making repairs in the field.

The refuge John Deere 350 crawler tractor with backhoe was loaned to Hatchie Refuge for several projects there.

A new Amco levee plow was ordered and received during late summer for use in moist soil development. The plow was made available for use elsewhere in the district and region as part of the Mobile Forces Team effort and for use in creating low levee impoundments.

A new Savin copier arrived at month's end to replace the worn out copier in use. We felt very pleased in that we received permission to take advantage of a special low offer on a brand new Savin model, although it was rated for use at a rate higher than our needs. Savin copiers have always carried a good name and have been well received at other stations. This does not seem to hold true with the Savin Model 7230. We have been very disappointed with both its quality of reproduction and its general working mechanics. In the first two to three months that we had it in use, several repairs were required in order to improve copy quality.

During early summer, we initiated efforts to screen property at some of the military bases. In particular, we made several visits to the Defense Supply Depot, located in Memphis, TN. We were able to pick up several items that were needed for refuge projects, including pipe for wood duck box placement, aluminum sheeting for predator shields, steel for use in fabricating our pistol range targets, an Eimco dozer with ripper, and several tools to help in the shop. In addition, we were able to pick up some cold weather gear for use in the field during banding operations. We have been pleased with the cooperation on the part of personnel at the Supply Depot

and the ability to pick up only items that we need and not having to take entire lots that would be of no value.

During the summer, we were notified of the availability of several camper trailers at a base outside of Atlanta. We froze a sixteen foot camper trailer for use as a deer check station and in refuge law enforcement operations.

With the advent of a new position, a wildlife biologist, we decided to have that position assigned to the Duck River Unit. The nature of that position required additional office space for year round use. The trailer at the subheadquarters there at Duck River was modified slightly to permit use of a full office for the biologist. In addition, an air conditioning unit was purchased to cool the trailer during the summer months.

6. Energy Conservation. We continued, during the year, to down-size our fleet wherever possible, providing smaller vehicles that, hopefully, are more fuel efficient than the large gas hogs they replaced. Unfortunately, we continue to find that some of the Chevrolet pickups that we receive, do not match the EPA ratings. All the vehicles received with the exception of the large maxi-van are improvements on the energy consumption on the vehicles they replaced.

Due to the nature of the lay out of the three separate units and the headquarters in Paris, logistics often times strains one's imagination for the wisest use of vehicles. However, as often as possible, we tried to conserve energy through the car pooling of staff members to the various units when assignments were to the same area.

J. OTHER ITEMS

1. Cooperative Programs. Refuge staff were involved in several cooperative efforts with other agencies during the year. As previously mentioned, one involved work with TVA and the West Eight Association to clear blockages in Cub Creek located at the Busseltown Unit. Another cooperative effort involved participation in the Keep America Beautiful program and National Public Lands Day program in September. Working with TVA, Corps of Engineers, National Park Service, Tennessee Department of Conservation, and several other agencies, a program with emphasis on volunteerism and taking pride in public lands was developed for the middle and West Tennessee area. During the summer, we again cooperated with the U.S. Forest Service in the placement and monitoring of gypsy moth traps at both marina concessions on the Duck River and Big Sandy Units.

The refuge again participated in hunt coordination meetings with the Tennessee Wildlife Resources Agency during the year. We worked closely with TWRA personnel, both in terms of migratory bird law enforcement and in wetland management and waterfowl surveys.

Since we own very little land in fee title, and property ownership is in the Tennessee Valley Authority hands, we cooperate with TVA throughout the year on subjects of mutual concern. The local headquarters for TVA in this area is in Paris, approximately one block from the refuge office, so we are able to get questions answered and discuss items with each other quickly. Matters of mutual concern involve public use of refuge and TVA lands, shoreline policy and associated development, unauthorized uses of the refuge, and public comments or complaints. During the summer, we also mowed the outer TVA dike in the Duck River Bottoms in cooperation with TVA.

In cooperation with law enforcement personnel and TWRA, our sixteen foot camper trailer was loaned to them for a special undercover assignment in East Tennessee.

In early summer, we were notified by the Tennessee Department of Transportation that extensive repairs were going to be required for the Interstate 40 bridge that crosses the Tennessee River on the Duck River Unit. They planned to work within their right-of-way on the refuge, but planned to place a culvert and build a road crossing a drain to several back-water sloughs on the west side of the river. They requested our review and concurrence and in doing so, we suggested that we work in cooperation to take advantage of the culvert and road to install a water control structure. This structure would enable water management capability on approximately 200 acres of impounded water, thereby providing moist soil capability in an area several south miles south of Duck River Bottoms in a stair step between there and the Busseltown Unit. Their initial response was agreement subject to approval of their overall rehabilitation plan. By year's end, no decision had been made on the final construction work.

2. Items of Interest. On January 7, Dr. Leigh Frederickson and two personnel from Denver Research Center toured the Duck River Unit to observe moist soil impoundments and the water management program. They toured several wetland management areas in an effort to develop a computerized program to aid in moist soil management in the future.

On January 15, Larry Masters went to Nashville to assist with the videotaping of Grandpa Jones, of Grand Ole Opry and Hee-Haw fame, for a 30 second public service announcement on the subject "Don't Shoot Eagles". Don Pfitzer and Dan Searcy,

from Atlanta, had made the arrangements, which included a trip to the Cumberland Wildlife Rescue Center, to tape injured eagles, then to Brentwood, a Nashville suburb, for taping Grandpa and a recovering eagle.

On January 21, Wheeler Refuge Manager Tuck Stone toured the refuge to observe our moist soil impoundments and learn our water management program. Also on that day, personnel from TWRA visited the bottoms to take both video and still pictures of waterfowl.

On January 22, District Biologist Don Orr and Dr. Don Rusch from the University of Wisconsin, toured the Duck River Bottoms. Dr. Rusch is handling the study of all the neck collaring census information being done throughout the flyway. He was able to observe, first hand, our swim-in trap and banding operations, as well as our management program.

On February 4, Dr. Leigh Frederickson, Dr. Olaf Pehrrson, and two graduate assistants from the University of Missouri, Puxico, toured Duck River Bottoms and conducted an informal study analysis of several mallards trapped that morning.

On February 9 and 10, a hunt coordination meeting for refuges in Tennessee and TWRA personnel was held at Reelfoot Refuge.

On February 22 and 23, Messrs. John Oberheu, Phil Morgan, Richard Mattison and Todd Rainwater toured the refuge, looking at the proposed headquarters site, inspecting the recently constructed pole shed at Duck River, and viewing the west side of the Big Sandy Unit in relation to our shoreline policy.

On March 14 and 15, Assistant Manager Mark Musaus attended a Tennessee Wildlife Society meeting held at Tech Aqua, field station at Tennessee Tech University.

On April 10, Messrs, Musaus and Britton attended the Kentucky/ Tennessee Eagle Team meeting held at Cross Creeks Refuge.

On June 13, Assistant Manager Ed Britton attended a one day aquatic pest plants workshop hosted by Tennessee Valley Authority.

On September 7 and 8, the refuge hosted a two day wetland plant identification workshop on the Duck River Unit. The course was led by Dr. Mohlenbrock from Southern Illinois University. Several sites, representative of the various habitats and wetland vegetation on the refuge, were visited and many practical tips were offered for easy field identification of the various plants.

On October 19, Messrs. Ryan, Britton and Bitler attended the Kentucky/Tennessee Eagle Team meeting held at Cross Creeks Refuge.

On December 13th, staff members Britton, Bitler, Easley and Musaus attended a three hour computer course providing an introduction to DOS.

On December 19, Messrs. Ryan and Musaus gave a tour of the Duck River Bottoms to several TWRA Commissioners and State personnel.

Credits. The narrative report written this year was a cooperative effort. Contributors were: Sections A,B,C,D,E,G,I and J - Mark Musaus; Section F - Ed Britton; Sections E.2-4 and H - Larry Masters; Section H-17 - Jerry Armstrong. The entire report was reviewed by Carrell Ryan and typed by Dorothy Easley.

K. FEEDBACK

In writing this section, we close the book on another busy year. I guess the older everyone gets, the quicker the years seem to go by. Such was the case in 1988. Looking back, we feel good about the accomplishments in managing the resource for wildlife and the efforts made to promote the North American Waterfowl Management Plan, both on station and cooperating in promoting some of the goals in Region 4. Several of our staff members were detailed to assist in wetland development at other stations. In addition, several pieces of heavy equipment were loaned to help accomplish this work. This meant staff members "back home" had to make the extra effort to pick up the slack and maintain refuge objectives and priorities. We have paid the price, however, in terms of equipment use. Equipment loaned (TD-15, dragline, low-boy) were old and worn from previous development at this station. The many additional hours of use has only speeded up the need to perform major maintenance and repair. Winter flooding this year has damaged several dikes on the Duck River Unit, necessitating major repair. We are saddled not only with coming up with monies to do the work force account but pay for major rehab on several pieces of the loaned equipment before we begin.

In spite of a positive year, we did experience a few problems. The main "gripe" on the part of the refuge staff concerned pay. We had two situations in which individuals did not receive increases in salary or overtime pay for several weeks. The first situation involved staff members detailed to work on the "Mobile Forces" team effort that spent up to six weeks putting in an extra 20 to 30 hours a week but not receiving their allotted overtime pay. It took some supervisory skills to keep these employees motivated, working long hours and being away from home, but not see the overtime show up in their pay check for eight weeks.

The second problem involved AUO. Refuge Officer Jerry Armstrong was approved for administratively uncontrollable overtime in late March but due to several problems, we understand, between payroll, personnel, and Denver Finance Center, Jerry did not see the first AUO money in his check until late September. The problem was compounded by a cut in pay. Prior to receiving AUO, Jerry received premium pay for working Sundays. When he went on AUO his schedule was changed and Sunday was made an off day. The very first pay period this new schedule went into effect, the premium pay was dropped and that money taken out of his check. In addition, in processing the AUO paperwork, the SF-50 was cut showing him as working in Atlanta, Georgia - and Georgia state tax was taken out. Jerry was forced to take out a personal loan to

cover everyday expenses due to a greater than $60 cut in pay for six months.

The last point is just a perception. Over the last ten to fifteen years, there have been many changes in the Fish and Wildlife Service. We have seen our agency grow from a small "outfit" to a very diversified organization with many challenges and objectives. What has seemed to suffer, however, is the sense of family and common goal that everyone shared. It seemed to be like one big family. One had a greater sense of being part of a large group, nationwide, working together. As times have changed, as we become more diversified, and as costs escalate, we seem to be cut back to smaller and smaller groups. We run more like a bureaucracy where it is just a job and people are just another number or another complaint. Somehow, we need to get back to the sense of better communication - that everyone's job is important with the resource being the highest priority.

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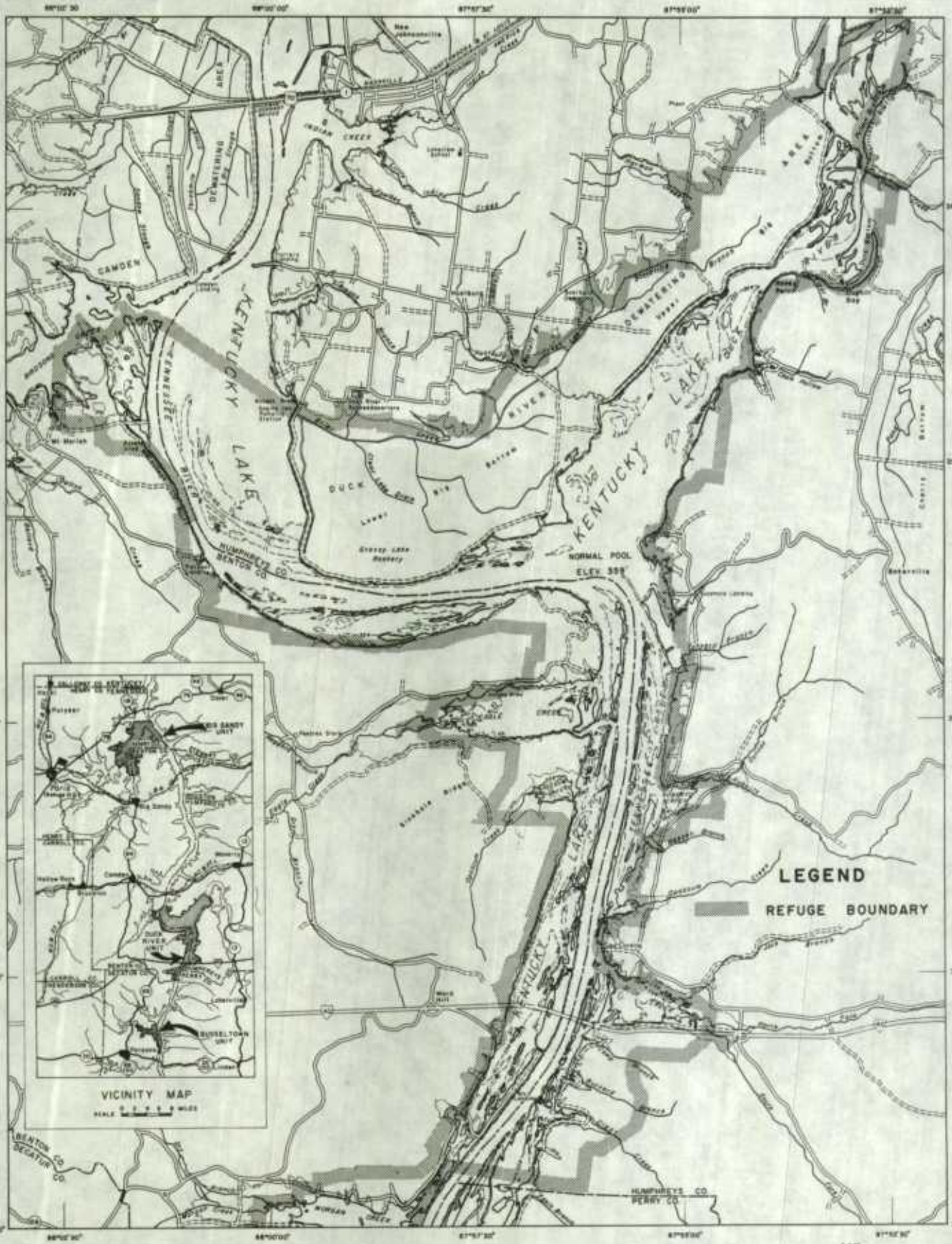
TENNESSEE NATIONAL WILDLIFE REFUGE

DUCK RIVER UNIT

BENTON, DECATUR, HENRY, HUMPHREYS, AND PERRY COUNTIES, TENNESSEE

UNITED STATES
DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE



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ATLANTA, GEORGIA FEBRUARY, 1964

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TENNESSEE NATIONAL WILDLIFE REFUGE

BUSSELTOWN UNIT

BENTON, DECATUR, HENRY, HUMPHREYS, AND PERRY COUNTIES, TENNESSEE

UNITED STATES
DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

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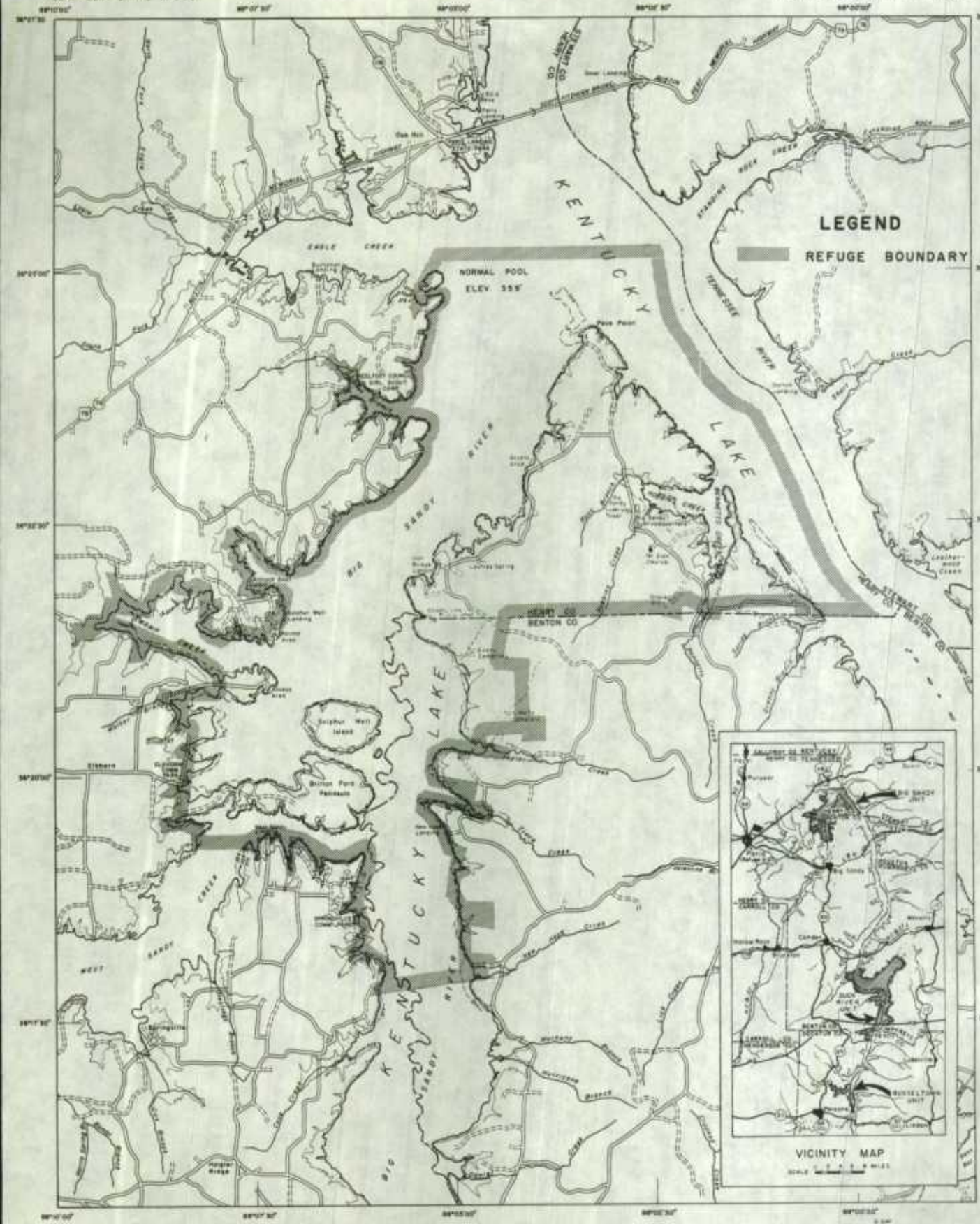
TENNESSEE NATIONAL WILDLIFE REFUGE

BIG SANDY UNIT

BENTON, DECATUR, HENRY, HUMPHREYS, AND PERRY COUNTIES, TENNESSEE

UNITED STATES
DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE



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For More Information

Contact:

Refuge Manager
Tennessee National Wildlife Refuge
P.O. Box 849
Paris, Tennessee 38242
Phone: (901) 642-2091

DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
RF-42620-1 - December 1985

TENNESSEE
National Wildlife Refuge

Black Duck

Enjoy Your Visit

Visitor Hours - Public use areas are open daily during daylight hours except as modified by refuge hunting regulations. Camping is not available.

Wildlife Observation & Photography - Visitors are encouraged to use designated refuge trails and auto tour routes. The routes are over improved gravel roads. Visitors should contact refuge headquarters for road and water conditions. Visitors are encouraged to bring binoculars, cameras and field guides to more fully enjoy Tennessee's wildlife.

Hunting - Is permited for deer, squirrel, raccoon and turkey on a limited basis. A separate hunting leaflet is available from refuge headquarters.

Fishing - Is permitted year-round. The heron rookery is closed to all entry, and some portions of the refuge are closed seasonally to provide sanctuary for waterfowl.

Group Programs - Special group programs and guided tours are available for schools, clubs and similar groups by advance notice. Educational groups are always welcome to use the refuge for environmental study.

Artifacts - Searching for and removing objects of antiquity are prohibited.

Firearms - Firearms are prohibited on the refuge except during the authorized hunting season.

Signs Protect Visitors and Resources

Millions of people visit national wildlife refuges every year. Millions! The impact of humanity descending upon refuges, if not regulated in part, can degrade these wildlands. Signs grant or restrict certain activities to provide optimum freedom for visitors while also protecting the refuge from undue human abuse. Please respect all refuge signs whenever you see them as you travel around the refuge.

This sign delineates the refuge boundary. The refuge is behind this sign.

This area is closed to all motor vehicles.

This area is closed to ALL entry. No hunting or sightseeing is permitted. No roads or trails are open to the public.

All the Main Ingredients

Combine 25,000 acres of water, 19,000 acres of woodland and 5,000 acres of farmland and pasture and many of the main ingredients necessary for a wildlife refuge are present. Tennessee National Wildlife Refuge possesses all of these and more encompassing over 50,000 acres along 80 miles of the Tennessee River. Established in 1945, in cooperation with the Tennessee Valley Authority (TVA), Tennessee Refuge is administered by the U.S. Fish and Wildlife Service as an important resting and feeding place for migratory waterfowl each fall and winter.

Winter Home for Wildlife

Each fall and winter over 150,000 ducks and 75,000 Canada geese arrive at Tennessee Refuge for protection and a winter food source. Of the 23 species of ducks using the refuge, mallards are by far the most numerous followed by wigeon, black ducks, and blue winged teal. Wood ducks are also common and are the only species to nest in any appreciable numbers.

Farming for Wildlife

Since few wildlife foods are available outside the refuge, a supplemental farming program provides food and cover for the thousands of visiting ducks and geese. More than 5,000 acres are farmed each year with corn, milo, soybeans and winter wheat.

Additional food is provided by flooding shallow ponds with the proper amount of water to foster the growth of various natural aquatic waterfowl plant foods. This practice is referred to as moist soil management and is designed to support the greatest number of birds.

With this combination of natural and agricultural environments, waterfowl populations survive the harsh winter months in good health for breeding season.

Breeding Ground for Wood Ducks

The colorful wood duck is found in large numbers in the bottomland hardwood forests of the refuge. However, in other parts of the country wood ducks are struggling for survival with loss of habitat caused by stream channelization, drainage programs, agriculture, forestry, and industrial development.

Unlike most other ducks, the "woodie" is a tree nesting duck. They prefer a hole in a hollow tree, much like a woodpecker. Unfortunately, natural tree cavities are scarce and the refuge supplements these with artificial nest boxes to help ensure a healthy population. Several hundred wood ducks are raised each year on Tennessee Refuge.

Birdlife Abounds

A series of hoarse guttural croaks announces the approach of a great blue heron across the marsh. Nearby, a pair of ospreys feed their young in a large crude nest of sticks atop a baldcypress tree. The flooded impoundments benefit a variety of wading birds as well as the waterfowl. The bright blue back and chestnut breast of the Eastern bluebird is a common sight in refuge fields and along roadsides year-round. American robins, Carolina chickadees, tufted titmice and other songbirds also reside on the refuge.

A Paradise for Fishermen

is found year-round in the waters of Tennessee Refuge, particularly Kentucky Lake. In early spring, crappie fishing here is among the best in the nation. Later in the season, bass and catfish provide sport for thousands. Even in mid-winter a few intrepid fishermen will be found on the lake after sauger.

Wildlife - Abundant and Diverse

When you visit the refuge, whether on foot, from a boat, or in a car, keep your eyes open for the multitude of wildlife species that make their homes on Tennessee National Wildlife Refuge. White-tailed deer, squirrels, skunks, raccoons and opossums are common; though seldom seen, muskrats, beavers and minks are present in significant numbers.

Endangered Species

including the Southern Bald Eagle, find a haven of safety on the refuge. Once theatened with extermination throughout the southeast, the bald eagle once again nests on the refuge.

Wildlife in a Changing World

The increasing urbanization of our country makes refuges even more important as sanctuaries for wildlife. When the ducks and geese return, they are assured of a resting place for the winter that satisfies all of their needs for food, water and freedom from disturbance.

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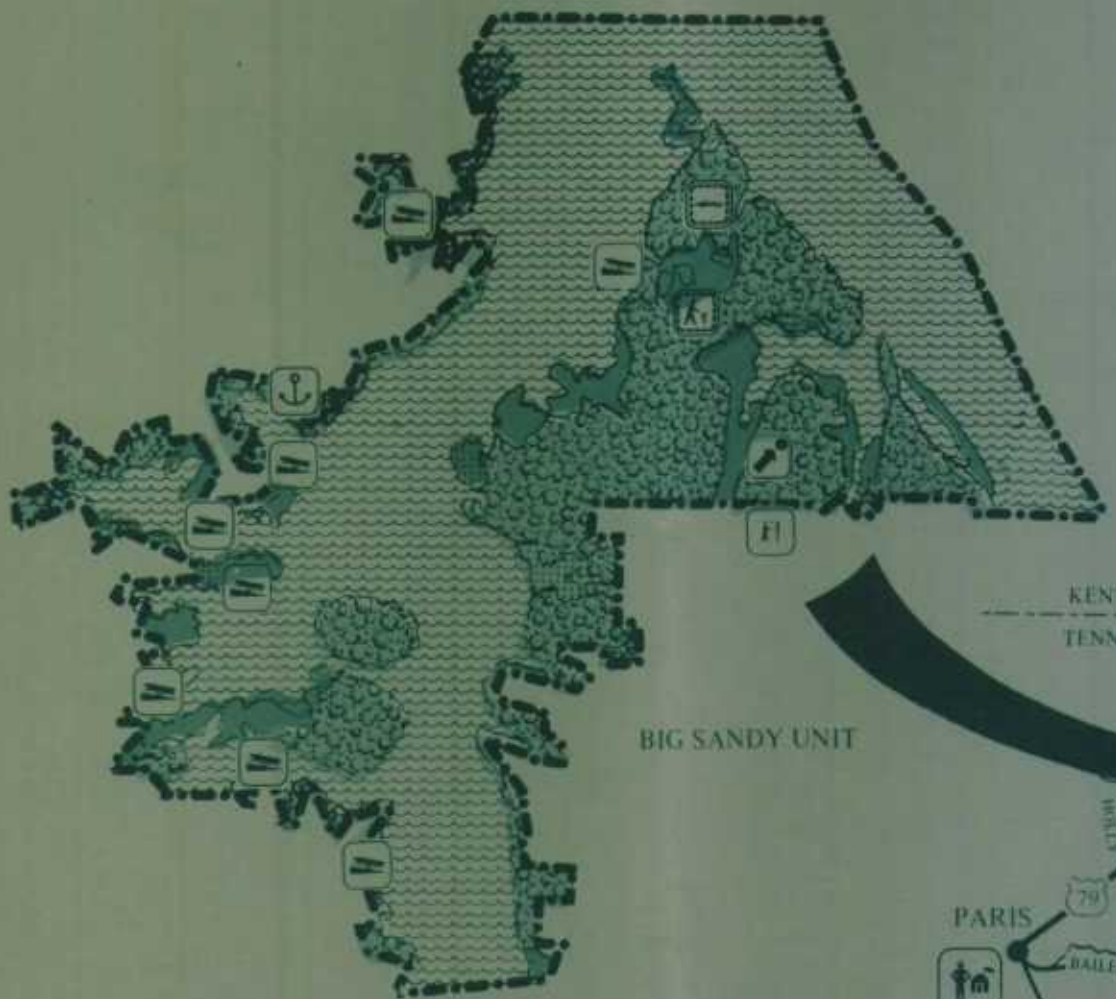


LEGEND

- NATIONAL HISTORIC SITE
- VC VISITOR CONTACT POINT
- BOAT ACCESS

ENNESSEE

ONAL WILDLIFE REFUGE

WILDLIFE FOOT TRAIL

HEADQUARTERS

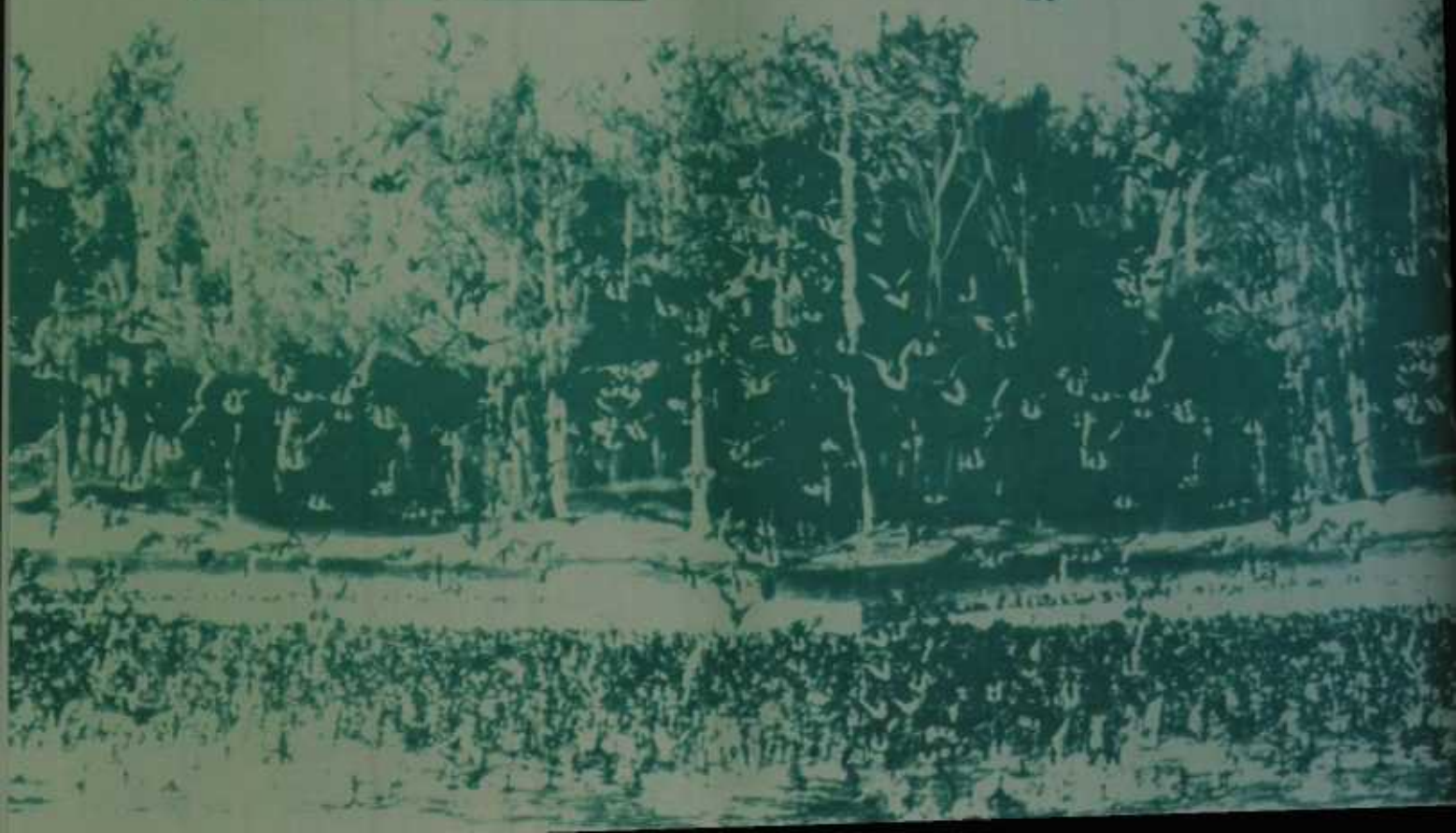
REFUGE BOUNDARY

HABITAT

LAKE

AGRICULTURE

FOREST




DUCK RIVER UNIT
HUMPHREYS
PERRY
LINDEN
MILES

Tennessee National Wildlife Refuge

General Information

Loons • Grebes • Pelicans • Cormorants • Herons and Bitterns • Swans, Geese, and Ducks

Vultures • Hawks • Eagles • Osprey • Falcons • Rails, Gallinule and Coots • Plovers • Snipe and Sandpipers • Gulls and Terns

Doves • Cuckoos • Owls • Goatsuckers • Swifts • Hummingbirds • Kingfishers • Woodpeckers • Kingbirds • Flycatchers • Phoebes • Pewees • Larks • Swallows

Jays • Crows • Chickadees • Titmouse • Nuthatches • Creepers • Wrens • Mockingbirds and Thrashers • Thrushes and Bluebirds • Gnatcatchers • Kinglets • Pipits • Waxwings • Shrikes • Starlings • Vireos

Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare

Tennessee National Wildlife Refuge, containing 51,000 acres, is situated on TVA's Kentucky Lake in central-western Tennessee. The refuge has three units, all superimposed on lands and waters of the Tennessee Valley Authority. Established in 1945, the refuge is

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Tennessee Refuge headquarters are in Paris, Tennessee. All three units — Big Sandy, Duck River, and Busseltown may be reached on all weather roads. Excellent birdwatching locations are found on all three units along improved refuge roads open to public travel.

This leaflet lists 226 species of birds that have been identified on Tennessee Refuge by refuge personnel and visiting birdwatchers. Seasonal abundance of each species is noted as follows:

Sp — Spring (March-May)
S — Summer (June-August)
F — Fall (September-November)
W — Winter (December-February)

a — abundant
c — common
u — uncommon
o — occasional
r — rare

- **Nests on Refuge**
* **Endangered Species**

General Information

Loons • Grebes • Pelicans • Cormorants • Herons and Bitterns • Swans, Geese, and Ducks

Vultures • Hawks • Eagles • Osprey • Falcons • Rails, Gallinule and Coots • Plovers • Snipe and Sandpipers • Gulls and Terns

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Grosbeaks • Finches • Sparrows and Buntings • Rare

	Sp	S	F	W
Common Loon	O		O	O
Horned Grebe	U		U	U
• Pied-billed Grebe	C	U	C	C
White Pelican	O		O	
Double-crested Cormorant	U		U	U
Anhinga	U	U		
• Great Blue Heron	C	C	C	C
• Green Heron	C	C	C	
• Little Blue Heron	U	C		
Cattle Egret	U	U	R	
• Great Egret	C	C	C	O
Snowy Egret	R	R	R	
Black-crowned Night Heron	U	U	U	
Yellow-crowned Night Heron	U		U	
• Least Bittern	U	U	U	
American Bittern	U		U	
Wood Ibis	O	O		

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____	Canada Goose	a	a	a	a
____	White-fronted Goose			r	r
____	Snow Goose	u		u	o
____•	Mallard	a	a	a	a
____	Black Duck	a	r	a	a
____	Gadwall	c		c	c
____	Pintail	a		a	a
____	Green-winged Teal	c		c	c
____	Blue-winged Teal	c	c	c	o
____	Cinnamon Teal	r		r	
____	American Wigeon	a		a	a
____	Northern Shoveler	c		c	c
____•	Wood Duck	c	c	c	c
____	Redhead	u		u	u
____	Ring-necked Duck	u		c	c
____	Canvasback	u		u	u
____	Lesser Scaup	c		c	c
____	Common Goldeneye	u		u	u
____	Bufflehead	c		c	c
____	Oldsquaw	r		r	r
____	Black Scoter			r	r
____	White-winged Scoter	r		r	r
____	Ruddy Duck	c		u	u
____	Hooded Merganser	c	u	c	c
____	Common Merganser	u		u	u
____	Red-breasted Merganser	u		u	u

Loons • Grebes • Pelicans • Cormorants • Herons and Bitterns • Swans, Geese, and Ducks

Vultures • Hawks • Eagles • Osprey • Falcons • Rails, Gallinule and Coots • Plovers • Snipe and Sandpipers • Gulls and Terns

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Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare

	Sp	S	F	W
Turkey Vulture	C	C	C	C
Black Vulture	C	C	C	C
Goshawk				r
Sharp-shinned Hawk	O	r	O	r
Cooper's Hawk	U	U	U	O
Marsh Hawk	C	O	C	C
Rough-legged Hawk				r
Red-tailed Hawk	C	O	C	C
Red-shouldered Hawk	C	C	C	C
Broad-winged Hawk	O		O	
Golden Eagle	r		O	U
Bald Eagle	r		U	U
Osprey	U	U	U	r
Peregrine Falcon	r		r	r
Merlin	U	r	U	U
American Kestrel	U	r	U	U
Bobwhite	C	C	C	C
Turkey	U	U	U	U
King Rail	U	U	U	
Virginia Rail	O		O	
Sora	U		U	
Common Gallinule	O	O	O	
American Coot	C	U	C	C

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____ Semipalmated Plover	u	u	u	
____ Killdeer	c	c	c	c
____ American Golden Plover	o			
____ Black Bellied Plover		o	o	
____ American Woodcock	o		o	o
____ Common Snipe	c		c	c
____ Upland Sandpiper	r		r	
____ Spotted Sandpiper	u	u	u	
____ Solitary Sandpiper	c	c	c	
____ Greater Yellowlegs	c	c	c	o
____ Lesser Yellowlegs	c	c	c	r
____ Pectoral Sandpiper	c	c	c	
____ Least Sandpiper	c	c	c	
____ Baird's Sandpiper		o	o	
____ Semipalmated Sandpiper	c	c	c	
____ Buff-breasted Sandpiper		o	o	
____ Sanderling		o	o	
____ Herring Gull	c		c	c
____ Ring-billed Gull	o		o	o
____ Franklin's Gull	r		r	
____ Bonaparte's Gull	r		r	
____ Forster's Tern	o		o	
____ Common Tern	o		o	
____ Least Tern	c	c	c	
____ Caspian Tern	o		o	
____ Black Tern	o		o	

Vultures • Hawks • Eagles • Osprey • Falcons • Rails. Gallinule and Coots • Plovers • Snipe and Sandpipers • Gulls and Terns

Doves • Cuckoos • Owls • Goatsuckers • Swifts • Hummingbirds • Kingfishers • Woodpeckers • Kingbirds • Flycatchers • Phoebes • Pewees • Larks • Swallows

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Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare

	Sp	S	F	W
Rock Dove	o	o	o	o
Mourning Dove	o	o	o	o
Yellow-billed Cuckoo	r	r	r	
Black-billed Cuckoo	c	c	c	
Barn Owl	r	r	r	r
Screech Owl	u	u	u	u
Great Horned owl	o	o	o	o
Barred Owl	c	c	c	c
Short-eared Owl	r		r	r
Chuck-will's-widow	c	c	c	
Whip-poor-will	c	r	c	
Common Nighthawk	c	c	c	
Chimney Swift	c	c	c	
Ruby-throated Hummingbird	c	c	c	
Belted Kingfisher	c	c	c	o
Common Flicker	c	c	c	c
Pileated Woodpecker	u	u	u	u
Red-bellied Woodpecker	c	c	c	c
Red-headed Woodpecker	u	u	u	u
Yellow-bellied Sapsucker	c		c	c
Hairy Woodpecker	u	u	u	u
Downy Woodpecker	c	c	c	c
Eastern Kingbird	c	c	c	

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____• Acadian Flycatcher	U	U	U		
____ Least Flycatcher		U	U		
____• Eastern Wood Pewee	C	C	C		
____ Horned Lark	O	O	O	O	
____ Tree Swallow	O		O		
____• Bank Swallow	U	U	U		
____• Rough-winged Swallow	C	C	C		
____• Barn Swallow	C	C	C		
____• Cliff Swallow	C	C	C		
____• Purple Martin	C	C			

Doves • Cuckoos • Owls • Goatsuckers • Swifts • Hummingbirds • Kingfishers • Woodpeckers • Kingbirds • Flycatchers • Phoebes • Pewees • Larks • Swallows

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Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare

	Sp	S	F	W
• Blue Jay	c	c	c	c
• Common Crow	c	c	c	c
• Carolina Chickadee	c	c	c	c
• Tufted Titmouse	c	c	c	c
• White-breasted Nuthatch	u	u	u	u

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____ Brown Creeper	o		o	o
____ House Wren	u		u	u
____ Winter Wren	u		u	u
____• Bewick's Wren	u	u	u	u
____• Carolina Wren	c	c	c	c
____ Long-billed Marsh Wren	o		o	r
____ Short-billed Marsh Wren	u		u	
____• Mockingbird	c	c	c	c
____• Gray Catbird	c	c	c	
____• Brown Thrasher	c	c	c	r
____• American Robin	c	c	c	c
____• Wood Thrush	c	c	c	
____ Hermit Thrush	u		u	u
____ Swainson's Thrush	c		c	
____ Gray-cheeked Thrush	c		c	
____ Veery	u		u	
____• Eastern Bluebird	c	c	c	c
____• Blue-gray Gnatcatcher	c	c	c	
____ Golden-crowned Kinglet	u		u	u
____ Ruby-crowned Kinglet	u		u	u
____ Water Pipit	u		u	u
____ Cedar Waxwing	c		c	c
____• Loggerhead Shrike	c	c	c	c
____• Starling	a	a	a	a
____ Solitary Vireo	u		u	
____• White-eyed Vireo	c	c	c	
____ Yellow-throated Vireo	u		u	
____• Red-eyed Vireo	c	c	c	
____• Warbling Vireo	c	o	c	

Jays • Crows • Chickadees • Titmouse • Nuthatches • Creepers • Wrens • Mockingbirds and Thrashers • Thrushes and Bluebirds • Gnatcatchers • Kinglets • Pipits • Waxwings • Shrikes • Starlings • Vireos

Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare Birds

Sp S F W

Black and White Warbler ..... o o o

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____	Worm-eating Warbler	o		o	
____	Golden-winged Warbler	u		u	
____	Blue-winged Warbler	c		c	
____	Tennessee Warbler	c		c	
____	Orange-crowned Warbler	r		r	
____	Nashville Warbler	c		c	
____•	Northern Parula Warbler	c	u	c	
____	Yellow Warbler	c		c	
____	Magnolia Warbler	u		u	
____	Cape May Warbler	u		u	
____	Yellow-rump Warbler	o		o	c
____	Black-throated Green Warbler	c		c	
____	Cerulean Warbler	u		u	
____•	Yellow-throated Warbler	c	u	c	
____	Blackburnian Warbler	c		c	
____	Chestnut-sided Warbler	u		u	
____	Bay-breasted Warbler	c		c	
____	Blackpoll Warbler	c		c	
____	Pine Warbler	u	o	u	
____•	Prairie Warbler	c	o	c	
____	Palm Warbler	c		c	
____	Ovenbird	u		u	
____•	Louisiana Water-Thrush	u	o	u	
____•	Kentucky Warbler	u	o	u	
____•	Yellowthroat	o	o	o	
____•	Yellow-breasted Chat	c	c	c	
____•	Hooded Warbler	c	u	c	
____•	American Redstart	c	c	c	
____•	House Sparrow	c	c	c	c
____	Bobolink	c		o	
____•	Eastern Meadowlark	c	c	c	c
____•	Red-winged Blackbird	c	c	c	c
____•	Orchard Oriole	c	c	c	
____•	Northern Oriole	u	o	u	
____	Rusty Blackbird	c		c	c
____•	Common Grackle	c	c	c	c
____•	Brown-headed Cowbird	c	c	c	c
____	Scarlet Tanager	u		u	
____•	Summer Tanager	c	c	c	

Warblers • House Sparrows • Blackbirds and Orioles • Tanagers

Grosbeaks • Finches • Sparrows and Buntings • Rare

	Sp	S	F	W
____• Cardinal	a	a	a	a
____ Rose-breasted Grosbeak	u		u	
____• Indigo Bunting	u		u	u
____ Dickcissel	c	c	c	
____ Purple Finch	u		u	u
____ American Goldfinch	c	c	c	c
____ Rufous-sided Towhee	c	c	c	c
____ Savannah Sparrow	c		c	c
____ Grasshopper Sparrow	o	o	o	
____ Le Conte's Sparrow	o		o	o
____ Vesper Sparrow	u		u	u
____ Lark Sparrow	o		o	
____ Dark-eyed Junco	a		a	a
____ Tree Sparrow	o		o	o
____• Chipping Sparrow	c	u	c	
____• Field Sparrow	c		c	c
____ White-crowned Sparrow	u		u	u
____ White-throated Sparrow	c		c	c
____ Fox Sparrow	u		u	u
____ Lincoln's Sparrow	o		o	o
____ Swamp Sparrow	c		c	c
____ Song Sparrow	c		c	c

These species are of accidental or casual occurrence, and have been recorded only once or twice:

Red-necked Grebe
Brant
Barnacle Goose
Greater Scaup
Roseate Spoonbill
Sandhill Crane
Black Rail
Purple Gallinule
Whimbrell
Willet
Short-billed Dowitcher
Ruddy Turnstone
Red Knot
Dunlin
Laughing Gull
Caspian Tern
Snowy Owl
Ground Dove

Birdwatchers visiting Tennessee Refuge are asked to look for the following species that should occur on the refuge. If positive observations are made, notify the Refuge Manager, Box 849, Paris, Tennessee 38242.

Least Grebe
Stilt Sandpiper
Long-billed Dowitcher
Saw-whet Owl
Fish Crow
Red-breasted Nuthatch
Philadelphia Vireo
Myrtle Warbler
Northern Water-Thrush
Wilson's Warbler
Canada Warbler
Brewer's Blackbird
Blue Grosbeak
Pine Siskin
Henslow's Sparrow

Grosbeaks • Finches • Sparrows and Buntings • Rare

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Fish and Wildlife Service

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ENERAL PROVISIONS The Tennessee National Wildlife fuge is one of over 425 national wildlife refuges. The primary ective of a national wildlife refuge is to provide habitat for the nagement and protection of all species of wildlife. The harvest urplus animals is one tool used to manage wildlife populations a level compatible with the environment, provide wholesome creational opportunities, and permit the use of a renewable ource.

ENERAL HUNTING PROVISIONS Public hunting is permitt- on all portions of Tennessee National Wildlife Refuge with the ception of those areas designated as "Closed" on the accom- nying map.

mping on the refuge is prohibited.

ehicles must remain on primary refuge roads shown on the ap. Off-road vehicles are prohibited on the refuge. Horses and ules are prohibited on all refuge hunts. Hunters must comply ith all "Area Closed" and "No Vehicles" signs. Bag limits are the me as State with the exception of the muzzleloader and gun eer hunts. Camping on the refuge is prohibited.

OUTH HUNTERS All hunters under the age of 16 must be ccompanied by an adult of a minimum of 21 years of age, who ll remain in sight and normal voice contact with the person upervised. For small game hunts, the adult may supervise no ore than two youths. For big game hunts, the adult may not unt and may supervise only one youth. All hunters born after nuary 1, 1969, must have completed a hunter safety course demonstrated by card or certificate.

MALL GAME HUNTS Squirrel - from the fourth Saturday in ugust until the last Friday in September.
accoon - First ten days of state season. Duck River Bottoms nd Busseltown Unit closed to raccoon hunting. Area south of I- 0 closed November 11 and 12.

IG GAME HUNTS Turkey - First, middle and last weekends state season. First hunt on Saturday and Sunday; others on riday and Saturday. 25 permits for each hunt. Both sides of ennessee River south of I-40 is hunt area.

EER/COYOTE Archery - First three weeks of state season. o additional permit required.

UZZLELOADER - October 21-22. Two deer of either sex, uota hunt. See map for hunting areas.

uck River Bottoms - 175 permits.

usseltown Unit - 100 permits.

ritton Lord Peninsula - 40 permits. (Can hunt Britton Lord Penin- la, Sulphur Well Island, or both.)

GUN - Two deer of either sex, Quota hunts.

Duck River Unit south of I-40 - November 11-12. 75 permits east of the Tennessee River and 75 permits west of the river.

Big Sandy Peninsula - December 9-10-11. 150 permits. See map for hunting area.

Coyotes may be taken during any deer hunt by hunters holding permits, in accordance with State regulations. During gun deer hunts, the refuge will operate check stations where hunters must check any deer taken.

PERMIT PROCEDURES To apply for any of the quota hunts, submit an unaltered, standard-sized (3 1/2 X 5 1/3) USPS postal card with full name and address to Tennessee National Wildlife Refuge, P.O. Box 849, Paris, TN 38242. A separate postal card is required for each type hunt. If there is more than one hunt area to choose from, list the hunt areas in order of preference for which you wish to consider. To apply as a group (maximum of five hunters per group), list all names and addresses on one postcard. Multiple applications for the same hunt will result in all applications being rejected. Incomplete applications will not be considered. A public drawing will be held in the refuge office for each hunt. The dates for submitting applications and the public drawings are listed below. Applications will be accepted only within the dates specified. If a youth wishes to apply for a permit hunt, the name of the supervising adult must be identified on the application.

Turkey Hunts - Apply from February 1 through day of the drawing, the first Monday in March.

Muzzleloader Hunts - Apply from September 1 until day of drawing, October 3.

Gun Hunts - Apply October 1 through day of drawing, November 1.

Successful applications only will be notified within five days of the drawing.

Take Pride in American's Wildlife Resources

Tennessee National Wildlife Refuge
P.O. Box 849
Paris, Tennessee 38242
901-642-2091

Department of the Interior
U.S. Fish and Wildlife Service
RF-42520-6 - August 1988

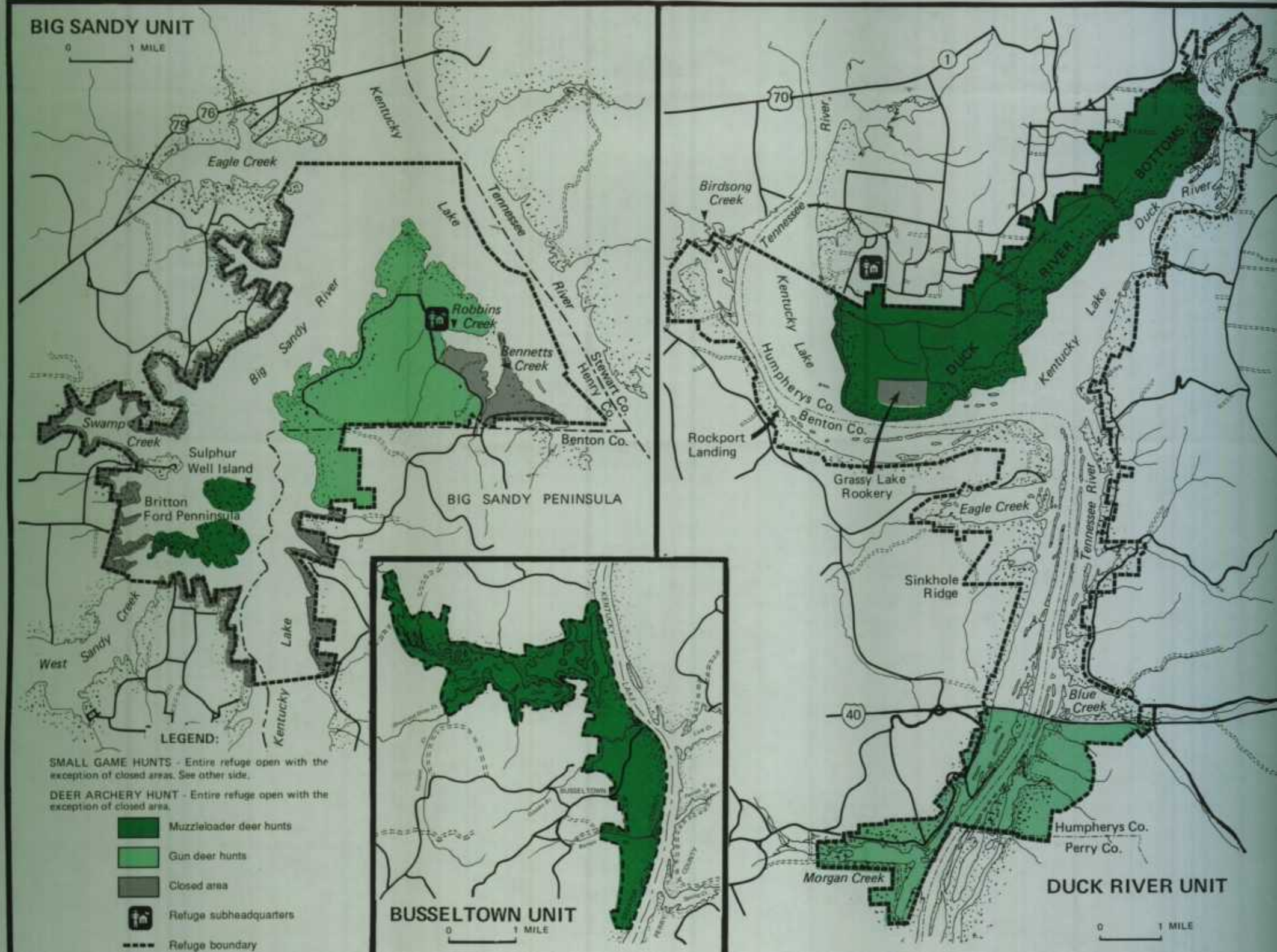
TENNESSEE NATIONAL WILDLIFE REFUGE

1988-89 HUNTING REGULATIONS AND PERMIT

A PERMIT IS REQUIRED FOR ALL REFUGE HUNTS. WHEN SIGNED, THIS BROCHURE IS YOUR PERMIT FOR HUNTING SQUIRREL, RACOON AND ARCHERY DEER

SIGNATURE (VALID ONLY WHEN SIGNED)

TENNESSEE NATIONAL WILDLIFE REFUGE



TENNESSEE
NATIONAL WILDLIFE REFUGE
P.O. Box 849
Paris, Tennessee 38242

GENERAL PROVISIONS

Tennessee National Wildlife Refuge is one of over 400 national wildlife refuges. The primary objective of a national wildlife refuge is to provide habitat for the conservation and protection of all species of fish and wildlife. Sport fishing is permitted at a level compatible with the environment, providing wholesome recreational opportunities, and permitting the use of a valuable renewable resource.

The regulations listed below supplement the general regulations which govern fishing on wildlife refuge areas as set forth in Title 50, Code of Federal Regulations, Part 33. Fishing will be in accordance with applicable state regulations subject to the following Special Regulations.

SPORT FISHING REGULATIONS

As shown on the map, the refuge is composed of three units. Each unit has fishing opportunities available seasonally, both in impoundments and Kentucky Lake. Fishing opportunities, including seasonal restrictions to portions of Kentucky Lake, are as follows:

Big Sandy Unit: Sport fishing is open year-round except for Sulphur Well Bay and Bennetts-Robbins Creek Bay which are closed annually during the waterfowl use season.

Duck River Unit: Impoundment Number One, near the Johnsonville Pump Station, is open year-round. All other impoundments in the unit are subject to closure during the winter waterfowl use season or when eagles are nesting. The great blue heron rookery in Impoundment Number Ten is closed to fishing. The remainder of the impoundment is open to bank fishing only.

Busseltown Unit: Fishing is permitted year-round. All impounded waters are closed from November 1 through March 1.

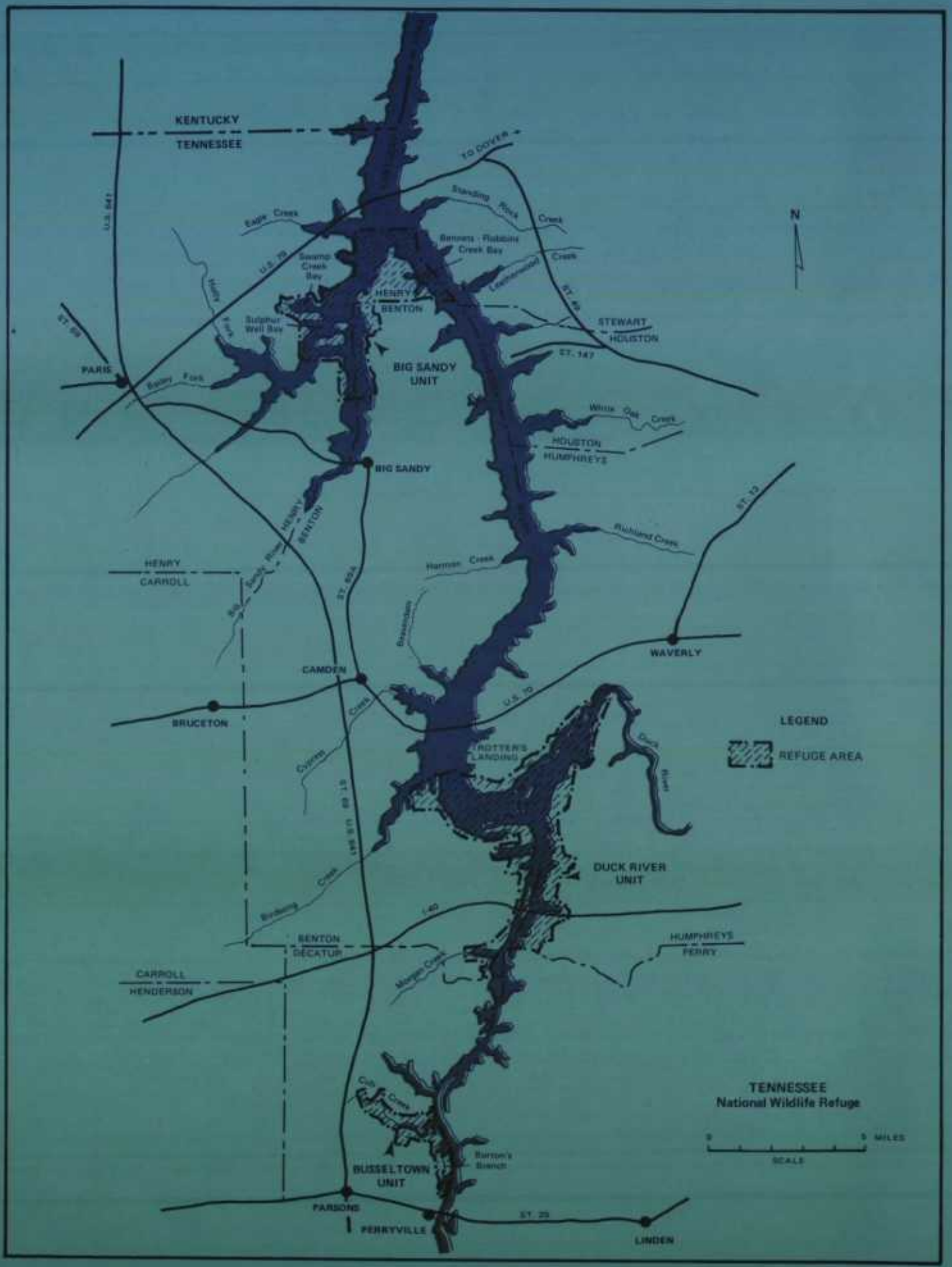
Sport fishing is permitted 24 hours per day except in those areas designated as "Daylight Use Only."

Take Pride in Our Nation's Fishery Resources

DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
RF-42620-7 - February 1987

FISHING REGULATIONS

TENNESSEE NATIONAL WILDLIFE REFUGE


KENTUCKY
TENNESSEE
TO DOVER
Standing Rock Creek
Bennetts - Robbins Creek Bay
Swamp Creek Bay
Sulphur Well Bay
Indian Creek
Eagle Creek
U.S. 641
U.S. 79
ST. 69
PARIS
HENRY
BENTON
STEWART
HOUSTON
ST. 49
ST. 147
BIG SANDY UNIT
White Oak Creek
HOUSTON
HUMPHREYS
BIG SANDY
HENRY
BENTON
ST. 13
Richland Creek
HENRY
CARROLL
Big Sandy River
ST. 69A
Harmon Creek
Beaverdam
WAVERLY
CAMDEN
U.S. 70
BRUCETON
Cypress Creek
TROTTER'S LANDING
Duck River
ST. 69 (US 641)
DUCK RIVER UNIT
Birdsong Creek
I-40
BENTON
DECATUR
HUMPHREYS
PERRY
CARROLL
HENDERSON
Morgan Creek
Cub Creek
Barton's Branch
BUSSELTOWN UNIT
PARSONS
FERRYVILLE
ST. 22
LINDEN
N
LEGEND
REFUGE AREA
TENNESSEE
National Wildlife Refuge
0
5 MILES
SCALE

Pine Vole *(Pitymys pinetorum)*
Southern Bog Lemming *(Synaptomys cooperi)*
Beaver *(Castor canadensis)*
Muskrat *(Ondatra zibethica)*

LAGOMORPHIA

Eastern Cottontail *(Sylvilagus floridanus)*
Swamp Rabbit *(Sylvilagus aquaticus)*

ARTIODACTYLA

Whitetail Deer *(Odocoileus virginianus)*

WATCH FOR THESE

Keen Myotis *(Myotis keeni)*
Gray Myotis *(Myotis grisescens)* Endangered
Small-footed Myotis *(Myotis subulatus)*
Indiana Myotis *(Myotis sodalis)* Endangered
Black Rat *(Rattus rattus)*

NOTES

DEPARTMENT OF THE INTERIOR
U. S. Fish and Wildlife Service
RF-42620-3 January 1980

MAMMALS

Tennessee National Wildlife Refuge

Tennessee National Wildlife Refuge, established in west Tennessee as a wintering area for migratory waterfowl, comprises 51,358 acres in three disconnected units extending 65 miles along Kentucky Lake. Nearly half of the refuge is continuously covered by water. The remainder consists of fertile bottomland, marginal rangeland, seasonally flooded swamps and rolling hills covered with mixed hardwood forests. This varied topography provides habitat for many mammal species.

The following list of mammals includes those which have been observed on the refuge or have been found to exist in the immediate vicinity according to Burt & Gossenheider (A Field Guide to the Mammals, Houghton Mifflin Co., 1964), and records from the Biology Departments of the University of Tennessee at Martin, Tennessee and Memphis State University at Memphis, Tennessee.

MARSUPIALIA

Opossum *(Didelphis marsupialis)*

INSECTIVORA

Least Shrew *(Cryptotis parva)*
Shorttail Shrew *(Blarina brevicauda)*
Eastern Mole *(Scalopus aquaticus)*

CHIROPTERA

Little Brown Myotis *(Myotis lucifugus)*
Mississippi Myotis *(Myotis austroriparius)*
Evening Bat *(Nycticeius humeralis)*
Eastern Pipistrel *(Pipistrellus subflavus)*
Red Bat *(Lasiurus borealis)*
Hoary Bat *(Lasiurus cinereus)*
Silver-haired Bat *(Lasionycteris noctivagans)*
Eastern Big-eared Bat *(Plecotus rafinesquei)*
Big Brown Bat *(Eptesicus fuscus)*

CARNIVORA

Raccoon *(Procyon lotor)*
Longtail Weasel *(Mustela frenata)*
Mink *(Mustela vison)*
Striped Skunk *(Mephitis mephitis)*
Spotted Skunk *(Spilogale putorius)*
River Otter *(Lutra canadensis)*
Red Fox *(Vulpes fulva)*
Gray Fox *(Urocyon cinereoargenteus)*
Coyote *(Canis latrans)*
Bobcat *(Lynx rufus)*

RODENTIA

Woodchuck *(Marmota monax)*
Eastern Chipmunk *(Tamias striatus)*
Eastern Fox Squirrel *(Sciurus niger)*
Eastern Gray Squirrel *(Sciurus carolinensis)*
Southern Flying Squirrel *(Glaucomys volans)*
Eastern Harvest Mouse *(Reithrodontomys humulis)*
White-footed Mouse *(Peromyscus leucopus)*
Deer Mouse *(Peromyscus maniculatus)*
Golden Mouse *(Peromyscus nuttalli)*
Cotton Mouse *(Peromyscus gossypinus)*
Meadow Jumping Mouse *(Zapus hudsonius)*
House Mouse *(Mus musculus)*
Hispid Cotton Rat *(Sigmodon hispidus)*
Rice Rat *(Oryzomys palustris)*
Eastern Woodrat *(Neotoma floridana)*
Norway Rat *(Rattus norvegicus)*
Prairie Vole *(Microtus ochrogaster)*

NOTES

DEPARTMENT OF THE INTERIOR
U. S. Fish and Wildlife Service

Calendar of Wildlife Events

Tennessee National Wildlife Refuge

CALENDAR OF WILDLIFE EVENTS

This calendar is a general guide to seasonal wildlife events. Weather may cause slight variations. Please contact Refuge Manager for more information.

JANUARY. . Waterfowl populations usually peak in early January. Canada geese, mallards, black ducks and wigeon are concentrated on embayments and other protected waters. Bald eagles are most numerous.

FEBRUARY. Herring and ring-billed gulls begin to gather and stage on the Big Sandy Unit. Waterfowl become restless for the return flight northward.

MARCH . . . Crappie season starts in Kentucky Lake. Great blue herons start nesting at the Grassy Lake rookery. Waterfowl begin leaving the refuge in large numbers. An occasional loon may be seen migrating through.

APRIL . . . . Turkeys become active as the courtship season arrives. Catfish and bass fishing peak in late April. Osprey can be seen migrating northward along the Tennessee River. Squirrels become more noticeable in the woodlands as spring erupts.

MAY. . . . . Crappie fishing peaks in early May. Wood ducks begin nesting and some may even bring off broods late in the month. Warblers and other songbirds can be seen migrating through the area. Mayflies hatch late in the month and bluegill fishing improves.

JUNE . . . . . Deer with fawns become more conspicuous. Young great blue herons fill the nests at the Grassy Lake rookery on Duck River Unit. Summer sauger fishing is usually best during this period.

JULY . . . . . The gathering of freshwater mussels normally peaks during mid-summer. Beaver are very active along sloughs and creeks. Owls can be heard late in the evening.

AUGUST. . . Numerous turtles can be seen in Duck River Bottoms sunning on stumps. Shorebird watching is excellent at Pace Point or in Duck River Bottoms. Cattle egrets can be seen in the fields and open areas.

SEPTEMBER. Mourning doves reach their peak this period. The blue-winged teal migration comes in early or mid-month. Canada geese and a few species of ducks begin arriving in late September. Osprey migrate southward for the winter.

OCTOBER. . The fall songbird migration peaks during this period. Bald eagles begin arriving in the area. Monarch butterflies can be seen migrating southward. Some good fall bass fishing is available. The white-tailed deer is most visible at this time.

NOVEMBER. Mallards, black ducks, and wigeon arrive in large numbers. Red-tailed hawks are at the peak of their fall migration. A few golden eagles will move into the area for the winter.

DECEMBER. Waterfowl numbers increase during this period. Bird watching for ducks and geese is excellent. Winter sauger fishing is usually best during late December. Both coots and grebes can be seen throughout the refuge.

VISITOR INFORMATION

Headquarters for the Tennessee National Wildlife Refuge is located at 101 West Blythe Street, Paris, Tennessee. The refuge is divided into three distinct operational areas which are Big Sandy Unit (21,348 acres), Duck River Unit (26,738 acres), and Busseltown Unit (3,272 acres). The 51,358-acre wildlife refuge is superimposed on TVA lands and waters along Kentucky Lake.

Paved roads are available to all three units of Tennessee National Wildlife Refuge. Maps (showing the most logical route to the area you may wish to visit) are available at the headquarters office. There are numerous boat launching ramps on the refuge which provide access to Kentucky Lake.

Overnight accommodations and restaurants are available at Paris Landing, Camden, Paris, New Johnsonville, Waverly and Parsons, Tennessee. Concessions on the refuge include Mansard Island Marina on the Big Sandy Unit and Sugartree Marina on the Duck River Unit. Overnight campground accommodations are available at Sugartree Marina. There are no eating establishments on the refuge.

Refuge visitors are reminded to come equipped when visiting the refuge. Many parts of Tennessee National Wildlife Refuge are isolated and return trips for fishing gear, clothing, food, birdwatching equipment, etc. may prove to be time consuming.

Visitors are also reminded that some areas of the refuge are closed during certain times of the year. Please be observant of signs which state "Area Closed Beyond This Sign". Specific portions of the refuge have been designated for daylight use only and are conspicuously marked.

If additional information is needed before you arrive at the refuge, please write to Refuge Manager, Tennessee National Wildlife Refuge, P.O. Box 849, Paris, Tennessee 38242 or call (901) 642-2091.

DON'T LITTER, HELP KEEP OUR WILD AREAS CLEAN

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

Self-guiding TOUR ROUTE

Tennessee National Wildlife Refuge

BIG SANDY UNIT

Welcome

To make your visit more meaningful a marked route, 10 miles long, has been laid out to show some of the more important features of the refuge management program for waterfowl and other wildlife such as deer and turkey.

As you travel the route you will see numbered markers along the way which correspond to the numbers in this tour guide. A Bird List and general information leaflet about Tennessee National Wildlife Refuge are available upon request at refuge headquarters in the Masonic Temple Building, Blythe Street, Paris, Tennessee.

Tennessee Refuge is composed of 51,249 acres of land and water in three separate units. The Self-guiding Tour Route is located on the Big Sandy Refuge Unit, which is approximately 21,000 acres in size. This unit contains the Refuge's largest deer herd and only turkey flock. White-tailed deer are most easily observed early in the morning or late in the afternoon. The chance of seeing one of these animals at these times is excellent. The majestic eastern wild turkey can be seen occasionally. This largest of our game birds is extremely wary. They can be observed best in the early spring when large flocks gather in the open fields to feed and court. During fall and winter, as many as 15,000 ducks and geese are frequently seen in this area. Large flocks can be seen resting in the lake bays and feeding in protected agricultural fields.

MARKER NO. 1

The main objective at Tennessee Refuge is to provide food and protection for wintering ducks and geese. The fields stretching out before you are planted to corn, grain sorghum, or buckwheat each year by a local farmer. The farmer harvests a portion and leaves a portion in the fields to be eaten by ducks, geese, and native game.

MARKER NO. 2

This small cleared area is a game food patch. Plantings similar to this are scattered randomly throughout all the wooded portions of the refuge. This plot is planted to a mixture of perennial grasses and clovers. Deer and turkey browse these plantings during the fall and winter months.

Young turkeys (poults) feed exclusively on insects for the first few weeks of their life. These small grassy areas are utilized heavily by turkeys for this purpose during summer.

MARKER NO. 3

Mt. Zion Church, established in 1852, is a designated national historic monument. The present building was constructed in 1893 to replace the original log structure. This structure has never been serviced by electricity. Lighting was provided by kerosene lantern. Some of the lantern hangers are still evident. The congregation kept warm with the help of a wood burning "school house" stove. The last regular use of the church ceased in 1945 after purchase of the land by Tennessee Valley Authority. An annual homecoming of former members of the congregation continues to be held here on the church grounds.

MARKER NO. 4

For the next two miles you will be driving through an Eastern hardwood forest. The most common trees are white oak and various species of hickory. Some of the trees are labeled for your information. Hickory nuts are an important food of squirrels. Acorns, especially white oak acorns, make up a large part of the winter diet of deer and turkeys.

MARKER NO. 5

There are three legends concerning the origin of this sink. One story is that it was formed by the same earthquake that created Reelfoot Lake in 1811. Another is that a small meteorite made the depression. The most logical story is that miners in quest of iron ore in the 1920's made the hole.

MARKER NO. 6 - PACE POINT

The land before you is an island or a peninsula depending on the seasonal water level. The land is farmed for waterfowl during some years. On the right flows the Tennessee River and on the left the Big Sandy River. These waters are home to a great variety of fish and other aquatic organisms. Many birds and mammals are associated with the shorelines of the rivers.

MARKER NO. 7 - ROBERTSON POND

This pond was built in 1965 for waterfowl. The structures at the far end of the pool are wood duck nesting boxes. The wood duck or summer duck is the only duck that nests extensively in Tennessee. Wood ducks are tree nesters, using natural cavities and holes. The boxes are artificial nesting cavities created for wood ducks. The metal strips beneath the boxes are shields designed to keep raccoons, snakes, and other predators from destroying wood duck nests.

MARKER NO. 8 - FARMERS POND

This five-acre pond was built in 1966 for wate fowl. Wood duck nest boxes have also been place here.

MARKER NO. 9 - LASHLEE SPRINGS

In the days before the Tennessee National Wild life Refuge was established, a house stood in th small clearing to the left. The spring flows from 2 to 35 gallons of water per minute and was a favorit stopover for travelers along the road. The wate temperature averages 68 degrees during the summe and is somewhat cooler during the winter.

The cleared fields stretching out toward the lak are favorite feeding spots for waterfowl and white tailed deer. A drive along this road late in the after noon will afford you an excellent chance of seein a deer.

MARKER NO. 10

The road to the left runs for one and a half mile and dead ends. You are welcome to drive up an return this way. The road to the right leads to Iro Bridge Landing. Before Kentucky Lake was im pounded, a bridge crossed the Big Sandy River a this point. The area is now a favorite fishing site.

This is the end of the visitor tour route. It is nec essary now to return to the entrance point. We hop you have enjoyed this recreational experience an invite you to return often.