

New Jersey Outdoors

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New Jersey Outdoors

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TRENTON, NEW JERSEY
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NEW JERSEY OUTDOORS CREDO

This publication is dedicated to the wise management and conservation of our natural resources and to the fostering of greater appreciation of the outdoors. The purpose of this publication is to promote proper use and appreciation of our natural, cultural, and recreational resources, and to provide information that will help protect and improve the environment of New Jersey.

FROM THE EDITOR

Spring has sprung. The weather has been almost summery and the water levels and temperatures are perfect for a fantastic Trout Opening Day on April 5, which will be long past when you receive this issue. Water is the key here, and water is the focus for this Spring/Summer issue.

For other information about New Jersey's recreational resources, write or call for the following publications:

- Vacation Kit
- Calendar of Events
- Marinas and Boat Basin Guide
- Beach Guide
- Campsite Guide
- Mini Tours Guide. All the above guides are available from:
New Jersey Division of Travel and Tourism CN 348, Trenton, NJ 08625, (609) 292-2470
- A year-round guide, "State Parks and Forests in New Jersey," in-

vites you to enjoy our state forests, parks, natural areas, marinas, historic sites, and more:

- In keeping with our focus on water, other guides available are "Canoeing the Pinelands Rivers" and "River Recreation in New Jersey." The above brochures are available from:
Resource Interpretive Services
CN402, Trenton, NJ 08625,
(609) 292-2797
- For the more adventurous, a set of 10 waterproof recreation maps (plus canoe safety information) of the Delaware River is available for a fee of \$6.24 1st class; \$5.98 3rd class from:
Delaware River Basin
Commission
P.O. Box 7360
West Trenton, NJ 08628

- A revised "Guide to Wildlife Management Areas" (7th edition) is available from the Division of Fish, Game and Wildlife. This 124-page guide provides maps, directions, and resources available at some 62 areas comprising over 164,000 acres providing wildlife-related recreation for hikers, hunters, anglers, outdoors photographers, bird watchers, crabbers, and so on. The guide is available \$6.50 postpaid from:
Division of Fish Game & Wildlife
CN400, Trenton NJ 08625
- NORTH JERSEY TRAILS—A two-map set is now available by sending a check or money order payable to "TRAILS" to: New York-New Jersey Trail Conference, 232 Madison Avenue #908 New York, NY 10016. The set is priced at \$5.95 plus 60 cents per set for postage.

IN THIS ISSUE

In Spring and Summer much of our recreational activities are water related, so it is appropriate the focus for this issue is water.

And water is what the article titled, *The Navesink: A Promise for the Future*, discusses. The article was written by Cliff Ross, a former DEP/Water Resources employee and the former editor of *Effluents* magazine.

Clean, Cool Water by Helen Lippman Collins chronicles the discovery of the high quality water which led to the building of the Pequest Trout Hatchery at the present location.

Other water quality related articles include: A groundwater cycle illustration prepared by the Wisconsin Department of Natural Resources, and the article titled, *Toward a Cleaner River* by James Gaffney, which discusses the Stony Brook/Millstone Rivers.

May marks the opening of the wild turkey hunting season in New Jersey. Biologist Bob Eriksen, Wild Turkey Project Leader in DEP's Division of Fish, Game and Wildlife, writes about, *White-*

Tails and Gobblers.

Saltwater anglers will be very interested in *New Developments in Artificial Reefs* by Evelyn and DeWitt Myatt, Bill Figley.

Because people and *Our Endangered Beach Nesting Birds* use our beaches at the same time, the birds require some protective wildlife management efforts. Nongame Biologist David Jenkins and Dr. Joanna Burger acquaint us with the Colonial Waterbird Conservation Coalition.

The ride is scenic and the terrain is manageable, so try *Cycling at Great Swamp* by Rosalie Strachan.

A new author, Pequannock native Gary Hayden, a member of the Philadelphia Writers Organization, tells *The Tale of Tripod Rock*. Bruce Scofield, who provided the photographs for this article, is the author of *Circuit Hikes in Northern New Jersey*, published by the New York-New Jersey Trail Conference.

Sari Harrar, a staff reporter for the Burlington County Times, writes about

Turtle Trapper Herb Misner, who has been trapping snappers in the Pine-lands for a half century.

Summer trout anglers will be looking forward to the following article: *The Musconetcong Monster, the Flatbrook Fiend, and other Delights* by Allen G. Eastby, trout fisherman, writer, and historian. Mr. Eastby has written *The Tenth Men*, a historical novel "of civilian and military life in the Hudson Valley during the American Revolution." Publisher is Empire State Fiction.

The Other Gap by Frank T. Dale is about canoeing the Walpack Bend on the upper Delaware.

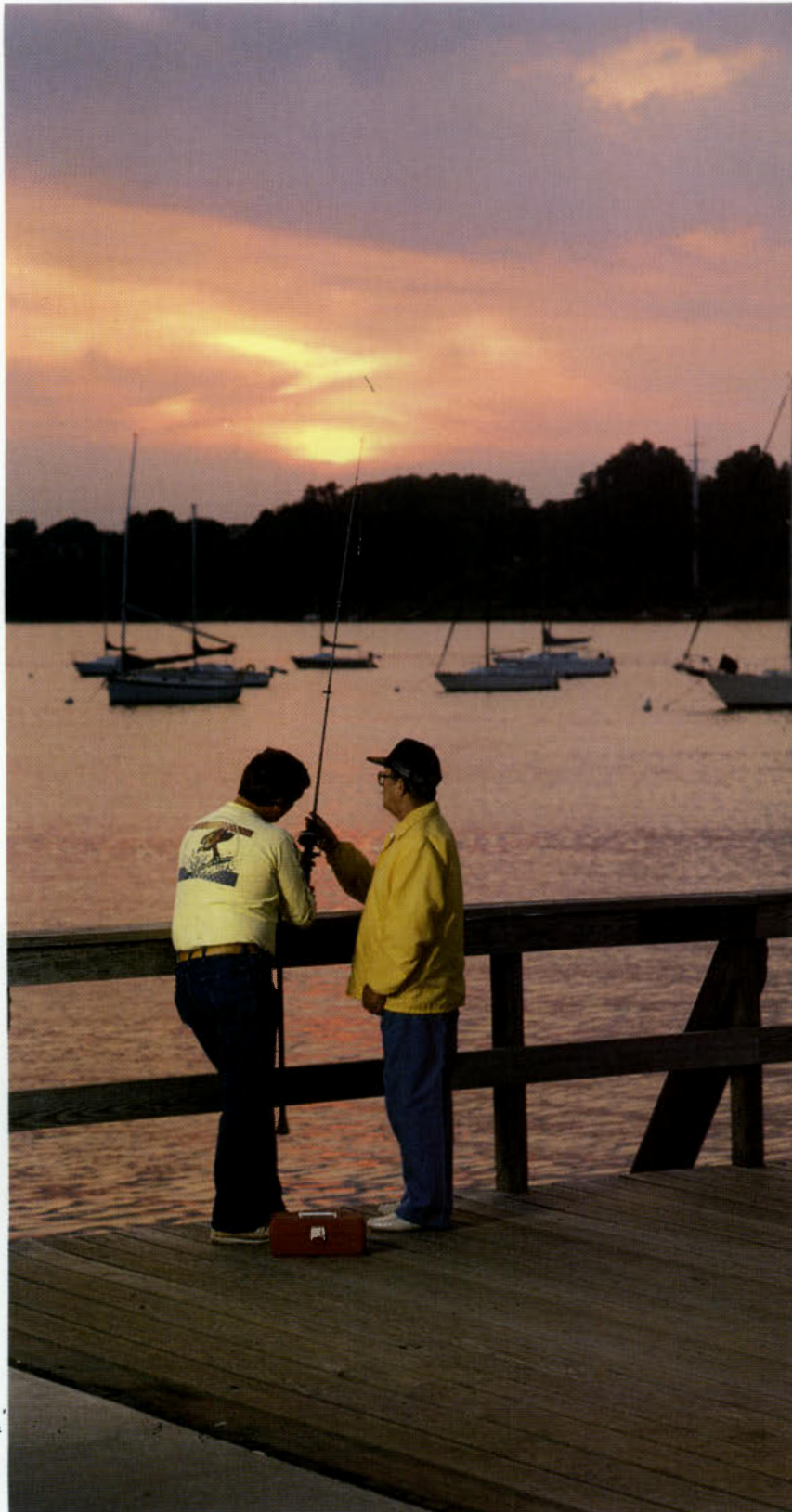
The View from Finn's Point by Paul E. Taylor is just that—viewing the surrounding Salem County countryside from atop the Finn's Point Rear Range Light.

The *Wildlife in New Jersey* feature is *The Catfish Secret* by Bob McDowell.

Steve Perrone

The Navesink: a promise for the future

BY CLIFF ROSS



The Navesink River is moderately clean. Not clean-clean, but improving. You wouldn't eat the softshell or hardshell clams taken from the rich shellfish beds along the bottom of its estuary without first knowing they'd been sanitized for 48 hours in a depuration plant. But after that they're okay.

More than eating Navesink clams is at stake this summer as 13 different government agencies continue their own specialized ways to control pollution—an effort that spans the river's entire length, from the headwaters above the 102-acre Swimming River reservoir in Middletown Township to its estuarine opening to the Atlantic Ocean near Sandy Hook.

"All with one goal in mind," says Robert Scro, a senior environmental scientist with the Department of Environmental Protection's Division of Water Resources. "And that goal is to restore the Navesink's once-rich fisheries and upgrade the plentiful shellfish beds in the deeper waters of its estuary. Once the waters of the Navesink are safe enough for recreational clamming we'll know we have a cleaner river than 25 years ago," Scro maintains. There will also be cleaner water for swimming, for fishing and for boating.

For six years federal, state, county and municipal governments, agricultural and suburban landowners have worked together to restore recreational clamming on the Navesink. Farmers are instituting best management practices to control soil erosion and sediment; municipalities are sampling and monitoring storm sewers to locate sources of bacterial pollution.

And how to do that? "Control bacterial pollution that has been responsible for restricted shellfish harvesting in the river and its 2,290-acre salt water estuary," says Scro.

Scro is outspoken on where a large measure of contamination can be found. "It's a combination of runoff from residential and commercial development and from the agricultural lands and horse farms in the watershed," he says. Whether large or small, horse farmers, he feels, have a responsibility for the proper



storage and disposal of their animals' wastes. The same is true for owners of dogs and cats.

This argument on what bothers the Navesink has its supporters and its critics. Not everyone agrees that the 40 or 50 horse farms in the watershed are a major source of the problem. But Scro's boss, George Horzempa, who heads the Division of Water Resources' Bureau of Planning and Standards says this position "can be well defended by what we've learned from years of monitoring, sampling and analyzing the Navesink, its tributaries and its estuary." Horzempa and Scro supervise the Navesink River Nonpoint Source Pollution Control Project which marshals federal, state, county and local agencies in a multi-disciplinary, approach—combining scientific water sampling, monitoring and laboratory analysis, land use and animal management.

Sidney Johnson, Jr., director of the Monmouth County Health Commission also agrees. "The primary problem with the

Navesink watershed," he says, "is bacterial pollution." In the estuary fecal wastes from livestock and domestic animals, urban runoff and recreational boating impair water quality.

Over the past four years, the Project has worked with agricultural groups—the Soil Conservation Service and the Freehold Soil Conservation District—to obtain information on managing agricultural and animal wastes. At the same time the Colts Neck, Middletown and Red Bank health departments and the Monmouth County Regional Health Commission have taken stream walks, investigated septic system overflow problems, collected surface water samples, and surveyed local animal farms, obtaining field data for a computer simulation that will evaluate the potential pollution hazard of runoff from animal farms.

Regardless of how the experts weigh the causes of the Navesink's pollution, all agree that it is no ordinary river system. No municipal sewage treatment plants empty into its

Far left: Still a favorite fishing area, the Navesink is especially beautiful at sunset. Above: Power boats find wide areas of the river great for racing.

PHOTOS BY DAVE KINGDON

New Jersey State Library



Sailboats sit at quiet anchor.

waters. There are only a few point sources of pollution—a restaurant in Holmdel, a school in Lincroft, and a couple of small industrial operations above the Swimming River reservoir. And all are now under control.

The Navesink watershed, modest in size, encompasses most of Red Bank and Colts Neck, significant portions of Fairhaven, Rumson and Middletown along the banks of the estuary, and minor portions of Holmdel, Marlboro, Freehold and Howell. In the upper watershed, between Freehold and Colts Neck, horse breeding stables, boarding farms and riding schools sit on white-fenced grassy pastures—acres of them—all well-manicured and pretty enough to grace a picture postcard. Here, the Navesink tributaries traverse sparsely populated agricultural areas,—with some horse farms situated only a stone's throw from banks of feeder streams with names like Yellow Brook, Big Brook and Willow Brook.

These are the tributaries that meet to become the Swimming River within the Swimming River reservoir. The largest body of potable water in the Navesink basin, a source of drinking water for some 250,000 people in 23 communities, the reservoir divides the river's upper watershed from its lower and the reservoir dam marks the extent of the river's tidal reaches, the place where the water's salinity changes.

According to the U.S. Department of Agriculture's Soil Conservation Service, about 50 percent of the Navesink's drainage area lies above the Swimming River Reservoir. Over 80 farms—75 percent of all the farms in the watershed and covering 90 percent of all its agricultural land—are above the reservoir. Nearly half of these farms raise or board horses.

The Soil Conservation Service's \$1.2 million "Navesink Watershed Plan" says that cropland tillage and land management practices on the area's 8,600 acres of cropland and 4,900 acres of pastureland, extended even beyond present efforts, could reduce sediment in the reservoir by 1,340 tons a year. And just a little more

Pollution problems in the watershed come from runoff from urbanized areas and agricultural uses of the land.

cooperation from area farms could possibly reduce the phosphorus in the reservoir by 5,190 pounds a year. So says the report.

Below the reservoir, the Swimming River becomes tidal, flowing three miles north and east before emptying into the Navesink estuary at Red Bank. Farm runoff is significant here too, particularly in Pine Brook, Nut Swamp Brook, McClees Creek and Hockhockson Brook. The eastern part of the lower watershed is intensively urbanized while agriculture remains the dominant land use in the western portion.

Such is a profile of the Navesink watershed: a rural landscape with urban areas and a big reservoir—but above all a setting with many productive farms and lots of valuable animals browsing on grassy pasturelands.

According to the Soil Conservation Service's Greg Westfall, the Navesink effort is a major one. "Although farms that are rented on short-term leases can suffer high erosion rates," he says, "there are a number of farm managers cooperating with our voluntary program to improve animal waste management and institute best management practices. We can

Some 250,000 people in 23 communities depend on the Swimming River Reservoir for their water supply.

look beyond the horse farms in assessing the whole problem," he adds. "A number of farms practice clean-till farming, excellent weed control. But there are still many lacking permanent long-term conservation practices such as terracing, and waterways in the fields to help reduce the potential for gullying that leads to erosion," he says.

Well-sampled and well-tested, the Navesink's river/estuary system holds a promise of restoration when all the pieces of the Pollution Control Project come together. In 1979 an effort was first made to identify and control non-point sources of bacterial pollution. Extensive monitoring has continued, clearly aimed at finding out the extent of the horse farm factor and of the urban stormwater factor.

In 1985, the Red Bank health department undertook a sampling project to try to determine the effects of urban stormwater runoff on the Navesink. "We sampled 75 to 80 storm drains," says health officer Fred Richert. "At pipe ends draining into the river at the end of each street and at storm drainage pipes on riverfront buildings."

"First we took samples on dry sunny days. Then we went back after a heavy rain to find out how much higher the bacterial densities might be when runoff flushed through the pipes with strong flows," recounts Richert.

What they found out in Red Bank was that most typical street runoff had heavy fecal coliform counts that could be blamed on domesticated pets.

At about the same time on the other side of the river, Middletown health department official Harry Huber and an aide were walking the banks of the Navesink, doing the same thing, but finding far fewer drainage points.

"There are some large horse farms, and maybe 10 to 15 big residential estates," Huber says. "We found no failing septic systems." Huber sampled a two-mile stretch of the Navesink wherever there was a catch basin or a drain entering the river.

Fred Richert and the Red Bank health department will be back this summer looking at the storm drains that showed the highest bacterial coliform densities in the 1985 samples. Richert explains that the public works department will flush these drains right down to their discharge points into the river. "We'll be looking at sediment and associated bacteria that have accumulated over the years," he says. "We'll see what kind of readings we get when we return for more samples, under dry and wet conditions. Then the DEP project director can compare the results to the readings a year ago."

So much for urban runoff.

No more upbeat in the efforts to restore the Navesink to better days is the experience of the Department of Environmental Protection's Division of Fish Game and Wildlife. According to Bruce Freeman, head of the Marine Fisheries Administration, striped bass stocked in the upper reaches of the river since 1984 are "growing at an exceptional rate. We'll be stocking more stripers from July through October this year," adds Freeman. "We want to build up a brooding stock, that critical mass that's needed for successful spawning." The Navesink has plenty of grass and sand shrimps, the kind of food the fish need to survive. "Just what they like to eat," he smiles.

Cleaning up the Navesink means that people who are part of the problem must also be part of the solution.



"To the striped bass," Freeman says, "the Navesink was once a favored spawning ground, a place where a striper fisherman could find a little bit of heaven. So much so that fingerlings taken from its water 100 years ago and transported by train to California established what is today's outstanding West Coast striped bass fishery. (See *New Jersey Outdoors*, March/April 1985).

In winter, ice boaters skim over the frozen river.

Freeman smiles at the thought of a new spawning ground for that favorite of saltwater fishermen—the fabulous stripers! And he hopes this non-migratory Brookneal strain will again make the Navesink its home port.

Things worth remembering about the Navesink today: There are clams being dredged from the estuary floor that people are eating with relish. These clams are sanitized in a depuration plant.

Says the DEP's Bob Scro, "If we can get the responsible management agencies and the public to implement the necessary cleanup measures, recreational clammers will once again be able to dig in the estuary's rich shellfish beds." But, he cautions, "If recreational clamming is to be reinstituted in the Navesink, those of us who are part of the problem must also be part of the solution."

Clean Cool Water

BY HELEN LIPPMAN COLLINS



DIVISION OF FISH, GAME & WILDLIFE

One summer day more than a decade ago, a visitor to New Jersey's Pequest Valley spotted a farmer working in his cornfield. Nothing unusual about that. What struck him as odd was the way the corn was planted. Instead of forming banked contours to prevent rainwater from washing away the soil, the farmer had planted his crops in straight, flat rows.

Although a heavy rain had recently fallen on the valley, the visitor noticed that the land was firm and dry. "Where the heck did all that water go?" he wondered.

To geologist Frank Markewicz, this was no idle question. Those straight cornrows were the first indication that he may have found exactly what he was looking for—an abundant source of water.

Markewicz, then employed by the New Jersey Geological Survey, quickly drove down to the Pequest River, which begins near Newton and empties into the Delaware River at Belvidere. There, jets of water sprang from the ground, confirming his hunch that there was a vast store of water beneath the surface. Pulling off shoes and socks to walk along the riverbed, the geologist felt spurts of clear, cold water.

Having devoted many weekends to the search for a place to build a new fish hatchery, Markewicz was elated. He had just discovered one of the richest natural resources in the state, and the site that would become a breeding ground for hundreds of thousands of fish.

The Pequest River Valley, which lies in Sussex and Warren counties, has a funnel-like formation and a unique geological history that explains its plentiful water supply. Surrounded on the east and west by granite walls which meet at the south end of the valley along Route 46 in Buttzville, the 110-square-mile watershed converges into a skinny passage-way only about 300 feet wide. Rainwater that has infiltrated the fertile valley piles up underground as it waits to pass through the natural dam the granite outcropping creates. There, a huge natural basin collects it.

"The Pequest River," says Kurt Powers, supervisor of the new Pequest Trout Hatchery

that sits atop this remarkable store of water, "runs vertically as much as horizontally. It forms a vast reservoir under the ground."

Besides being plentiful, Pequest water is pure thanks to the Valley's geological make-up. The bedrock is dolomite, a porous rock that traps the water and neutralizes it. Overlaying the limestone is a layer of sand and gravel, debris left behind 10,000 years ago when the Wisconsin Glacier—the last to sweep through this area—churned up everything in its path. The sand and gravel, says the Hatchery's naturalist Laurie Pettigrew, filter out the water's impurities as it seeps into the aquifer. Because the water comes from beneath the ground rather than the surface, Pettigrew continues, it is free of pollutants such as salt from the road, oil from cars, or run-off from farmers' fertilizers.

High Tech Fish

Today, the Pequest Trout Hatchery and Natural Resources Education Center occupies the northeast portion of a 1500-acre state-owned tract of land that spans the communities of Oxford, Liberty, Mansfield, White Township and Independence, just a few miles down the road from the old fish nursery in Hackettstown. Although warm-water species such as catfish and striped bass are still raised at Hackettstown, both the quality and the quantity of its water has diminished as developers have built up surrounding areas. Today, the three-quarters of a century old center lacks the clear, cold water that trout need to thrive.

In contrast, the high-tech Pequest facility, completed in 1982, is one of the most modern in the country. Electronic monitors maintain water temperature at an ideal 50°F, keep a close watch on Ph level, and make sure the pumps are in working order. Human contact with the trout is kept to a minimum, and the fish are treated to only the most ideal growing conditions.

By any measure, the Pequest operation is a success: Its employees toss some 700,000 rainbow, brook and brown trout into New Jersey's

Above: A steady supply of cold, clean water fills these raceways where trout fingerlings mature to stocking size.

210 public lakes, rivers and streams each year. What's more, the fish are growing in such abundance that a fall stocking has recently been added to the hatchery's standard spring-time stocking schedule.

The trout have their beginnings in the broodstock building, where nearly 3,000 two- and three-year-old fish produce about one million eggs each year. Since fish eggs are always fertilized externally, hatchery workers strip females of their eggs and remove sperm from the males. Because trout will not spawn in captivity, egg and sperm unite in the cold laboratory atmosphere of a plastic bowl.

When the eggs are fertilized, they incubate in stacks of trays, in crowded quarters, each containing 40,000 eggs. After 35 to 40 days, inch-long fry appear. The tiny trout are placed in troughs and put on an automatic, round-the-clock feeding schedule.

Recycled Waters

Months later, when the trout are several inches in length, they are moved outdoors into a series of mile-long raceways that will be their home for nearly a year. In late March, when they have grown to 11 inches in length, the fish are vacuumed into pumps that suck them up at a rate of 1,000 pounds per minute. From there, the trout are loaded into trucks and deposited to their final home in the wild.

"We're basically a put-and-take operation," says Powers. In most streams, there is very little holdover; the fish are put in one day and taken out by an angler soon after.

Recreational fishing in the state, the main reason for having a hatchery, brings \$35 million in revenue into New Jersey each year, and offers the state's 200,000 licensed fishermen and their 150,000 children a total of 7.5 million days of fun. Although licenses last all year, and are good for a variety of freshwater fish species, trout fishing is prohibited for a few weeks in late March to give hatchery workers a chance to stock the lakes and streams.

At Hackettstown, by the time the search for a new hatchery site had begun in the 60's, the decreasing water supply was making it harder and harder to keep New Jersey's anglers happy. Having spent thousands of dollars on a search for a new location, New Jersey's Division of Fish, Game and Wildlife had little money left by the time Markewicz discovered the Pequest Valley. To test the watershed's resources, he and another geologist used old perforated 50 gallon drums and decrepit pumps to hand-craft a simple measure of the water's abundance. The stringent requirement for a new site, Markewicz remembers,

was that water from the aquifer had to be ready at a rate of 4,000-5,000 gallons per minute. When the results of his test came back, the retired geologist recalls, "the reading was exactly 5,548 gallons per minute." Perfect.

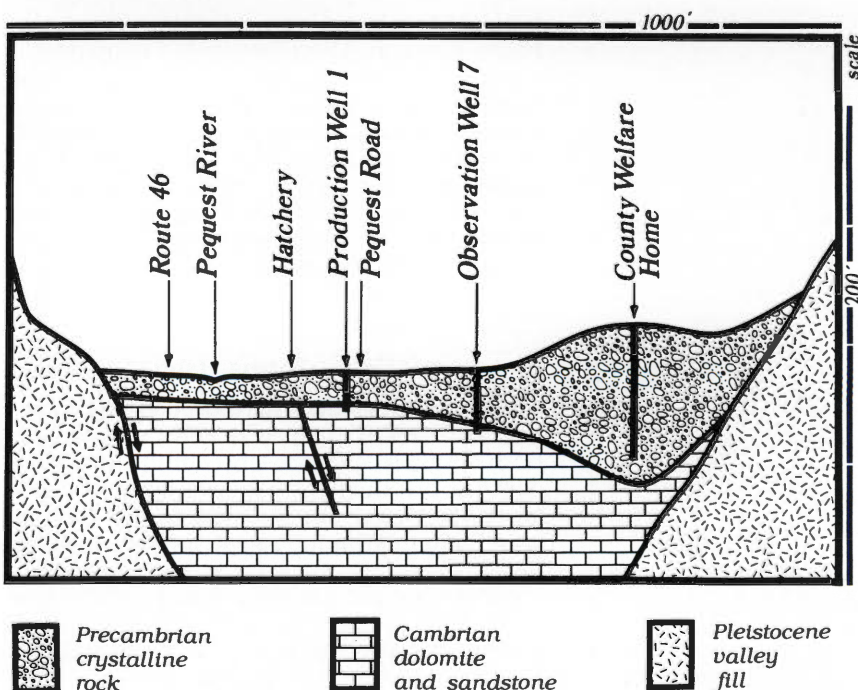
Today, the Pequest Trout Hatchery relies on six wells, which can pump up to 10,000 gallons per minute. More important, the water is not used up; instead it is pumped, processed, used and recycled.

After being pumped into the hatchery, water is channeled into an aerator building, which looks and sounds like a cascading waterfall where dissolved oxygen is added so the fish can breathe easily. It flows from there into the first set of raceways, then into another aerator building where more oxygen is added. Finally, after passing through a second set of raceways, the water is returned to its source.

"What we're really doing," Powers points out, "is taking the water from one portion of this vast underground reservoir, diverting it through our hatchery and releasing it back into the aquifer."

To make sure that the Pequest hatchery is not beset with the same kinds of problems as the one in Hackettstown, the state keeps a close watch on the use of the land it purchased to protect this rich source of water. With careful planning, both people and fish will benefit from one of nature's richest resources for years to come.

Below: North-south geologic profile of the Pequest Valley through the south end of the Pequest Hatchery. The carbonate rock aquifer is overlain by and interacts hydrologically with highly permeable glacial valley fill sediments.
(after Hutchinson, 1981)



White-Tails & Gobblers

BY BOB ERIKSEN

"How was your deer season, Bill? Did you fill the freezer?"

"Oh, it was all right. I took a nice buck with the bow but didn't see a thing during firearm season. Just don't seem to be the deer there used to be."

"You know, Bill, I've heard other hunters say the same thing. What do you think the problem is?"

"It's those wild turkeys. Ever seen where they've gone through the woods? They eat everything in sight—all the deer food. Since Fish and Game put those turkeys out, the deer have been scarce."

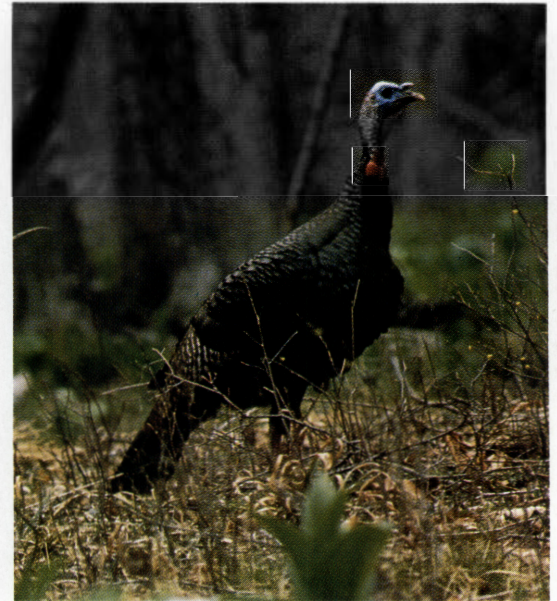
This line of thinking has been expressed by more than one unlucky deer hunter. You'll seldom hear it in areas where wild turkeys are long-established but such reasoning crops up fairly regularly in places where turkeys have recently been reintroduced. In fact, one of the most frequently asked questions at sportsmen's shows or club meetings is, "Do deer and turkeys compete for habitat and food?"

Let's look at some basic facts about white-tails and wild turkeys and think about the possibility of competition between them. First off, white-tailed deer and wild turkeys have thrived for thousands of years on the same range. Neither species declined to the point of danger or disappeared until the European settlers arrived and eliminated much of their shared habitat. At that point, both species declined. This suggests that the two species are compatible and that competition for available range is not a problem. If the two animals competed for habitat, one would have won the prize—survival. The other would be extinct.

While the two species share range, each prefers specific areas of that range. Turkeys tend to use mature hardwoods during most of the year. In summer, they feed in fields on insects and weed seeds. Old fields, where certain fruits and seeds are found, are used in winter. Deer, on the other hand, would rather use an overgrown field with heavy cover than the open woods. White-tails like the edge more than the deep forest.

Different Eating Habits

What about competition for food? Wild turkeys and deer do enjoy some of the same foods. Both animals eat acorns, beechnuts, and wild cherries, but then so do grouse, squirrels, raccoons, and black bears. If one type of food is abundant, many animals will feed on it. When food really counts, such as in the stressful cold of winter, the favored foods of deer and turkeys differ. Both species have high energy requirements in winter but rely on different natural food sources for their calories. You will prob-



ROY DECKER

ably never see deer picking undigested corn out of manure spread on fields by dairy farmers, or wild turkeys eating red maple twigs. When was the last time you watched a January white-tail feeding on insect larvae in a spring seep as turkeys do? Deer browse on woody stems in winter, while turkeys use other food sources. Abundant "unnatural" food such as waste grain in a harvested field will be used by both, but in that setting there's plenty to go around.

While feeding, white-tails tend to remain at the food source for a period of time, moving very little. Wild turkeys usually scratch, feed, and move in a pattern that can cover three to four miles in an hour. An adult deer consumes five to eight pounds of food per day for every hundred pounds of body weight. In many areas of New Jersey there are 40 or more deer per square mile of range. A full-grown wild turkey may eat up to three-quarters of a pound of food a day. Turkey population densities seldom exceed ten birds per square mile. Now ask yourself who eats more food, the deer or the turkeys, on a given square mile of ground?

Deer and turkeys often feed together. They even rely on each other to notice danger. If turkeys feeding with deer display nervous behavior, the deer become more alert. Turkeys react to the signs of alertness in deer such as a raised head and ears pointing forward. A snort will cause feeding turkeys to flush. This type of "cooperation" would not occur if the two animals competed.

White-tails are generally more adaptable than wild turkeys. They are commonly found closer to humans than wild turkeys and can



LEONARD LEE RUE III

thrive in changing environments. For that reason, there is a good deal more suitable white-tail habitat in New Jersey than turkey habitat. Wild turkeys are simply too shy to survive in suburbia.

Questions to Ask

If you believe that white-tail populations in your favorite woods are declining, there are some things you should do. Spend some time determining whether the decline is real or perceived. Is it just because you saw fewer deer or didn't get a buck last season? To find out for sure, check the records of the annual antlered buck kill in your deer management zone. The harvest of antlered bucks is indicative of population trends: If the numbers are stable, so is the herd.

Should you find that the buck harvest is declining, there are still questions to answer. Biologists who specialize in deer management may purposely be engineering a decline in the herd because of farm damage or poor condition of the deer. Find out what the management strategies are for your area.

Changes may have taken place in your favorite white-tail spot. The area may be grown up beyond usefulness for deer. As fields age, their attractiveness to deer increase for a time and then declines as the field turns into forest. Natural systems are constantly changing. Like it or not, your favorite deer stand from 1965 may be less productive in 1985, even though the overall deer population may not have declined.

Most of the changes in vegetation happen

so slowly that we fail to notice them. One of the best ways to appreciate what happens to your favorite hunting spot is to photograph the area from the same position at five-year intervals. Do it on a holiday or perhaps "opening day" every time so it becomes a habit. Look at the pictures after 20 years. The differences will surprise you, and will also affect the quality of your stand.

Now back to the competition issue. Without closely examining the impact of competition between deer and turkeys, would wildlife agencies put competitive species on the same range and take a chance of ruining hunting opportunity? White-tailed deer are the bread and butter of wildlife managers. They are attractive to hunters and can thrive in a variety of situations. They are wary and are a valuable trophy. White-tail hunting is probably the major incentive for hunting license sales in the East. If deer and turkeys were not compatible, wildlife biologists would have some tough decisions. Which species would hunters prefer? What effects would any negative impact have in wildlife populations? What would the general public think?

Fortunately, white-tails and wild turkeys can thrive together. The proof is in the pudding. Top white-tail-producing states such as Pennsylvania, Texas, New York, Missouri, Alabama, Mississippi, and South Carolina are also on top of the turkey harvest list.

As an avid deer and turkey hunter I'm happy to say that we can enjoy the best of all possible worlds. We can enjoy the challenge of white-tail hunting and the excitement of calling spring gobblers in the same woods!

New Developments in Artificial Reefs

DIVISION OF FISH, GAME & WILDLIFE



BY EVELYN AND
DEWITT MYATT,
BILL FIGLEY

Above: The Pauline Marie sinks slowly on the Atlantic City Reef.

Above, right: The high profile of a shipwreck attracts a school of foraging bluefish.

It's hard to imagine anything that could have looked more forlorn than the rusty old freighter whose proud seagoing days were a thing of the past. Floating idly at her berth awaiting her fate, she was a victim of nature's ravages that had left her beautiful only in the eyes of her old captain and crew. The *Pauline Marie*, however, was not destined to be the victim of a cutting torch that would turn her into a tangle of scrap steel. Instead, she was acquired by the New Jersey Artificial Reef Program and went down with dignity as an artificial reef in March 1985. She now provides continuing services from her watery grave in the Atlantic, some twelve miles off Atlantic City, and her appeal to marine life is undeniable. Her interior compartments now shelter fish and crustaceans; her decks now provide substrate for mussels, soft corals, and plant life; and her newfound productivity has put delicious seafood on many tables.

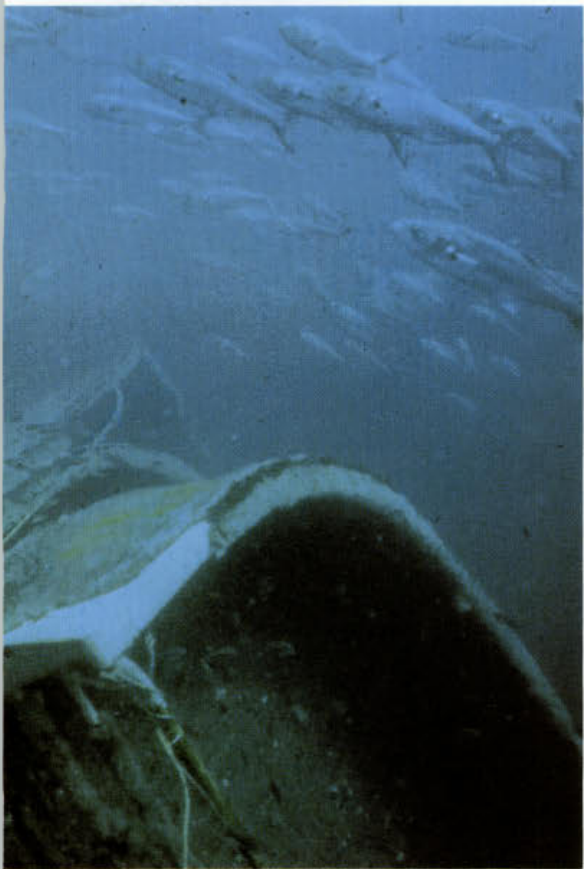
The *Pauline Marie* literally "went down" as part of New Jersey's more recent artificial reef history. Artificial reefs, as most anglers know, are man-made structures placed on the ocean floor to attract fish. This practice has a history going back about two centuries in the United

States. New Jersey's artificial reef history spans about fifty years, beginning in 1935 with the industrious efforts of the Cape May-Wildwood Party Boat Association. Veteran saltwater sportfishing enthusiasts may remember that this group sank vessels and other materials about 10 miles off Cape May Inlet to form the Cape May-Wildwood Fishing Preserve, then enticed trainloads of Philadelphia anglers to the area with the fulfillable promise of excellent fishing on the preserve.

So successful was this venture that the idea of artificial reefs caught on quickly, with Atlantic City Chamber of Commerce being the next group to build a reef nearby. After that, the trend spread northward along the coast, and by 1937 the Brielle Chamber of Commerce had begun construction of a reef off Manasquan Inlet. The same year another reef was built off Sandy Hook, utilizing rocks and rubble excavated during the construction of New York's subway system. Soon artificial reefs, or "fish havens," dotted the New Jersey coastline, imaginatively built from a hodge-podge of materials that included Christmas trees, car bodies, tires, old vessels, and concrete rubble.

Artificial reef construction declined in the

PAT YANANTON



1940's because of World War II, but during that period hundreds of vessels were torpedoed and sunk by German U-boats, becoming de-facto artificial reefs. The 1950's and 1960's brought renewed efforts at artificial reef construction, as recreational salt water fishing became a popular pastime for millions and privately owned pleasure boats became more commonplace. By the mid-60's, the scientific community also became involved in artificial reef construction in New Jersey when Sandy Hook Laboratory began investigating experimental artificial reefs as fishery management tools.

In addition to research of artificial reefs to better understand their effects, Sandy Hook personnel were instrumental in promoting reef construction, advising potential reef builders on how to build reefs for best results and serving as intermediary for obtaining surplus government materials, such as decommissioned Navy vessels, for use on artificial reefs. This promotion led to new artificial reef construction by private groups between the late 1960's and early 1980's, when Sea Girt, Garden State, and Stork reefs were built.

It's obvious from this brief history that artificial reefs aren't novel to our coastline, but just where are these artificial reefs into which historic efforts were placed? With few exceptions, like the Subway Rocks and Sea Girt reefs, most have not withstood the harsh demands of the marine environment and have subsequently disappeared into the ocean floor or have been swept away by storms and currents. Others may still be doing their jobs, but for all practical purposes they're lost to the fisherman because they're unmarked and their locations generally unknown.

To keep history from repeating itself, significant new artificial reef developments are taking place. The Department of Environmental Protection's Marine Fisheries Administration has planned a statewide network of artificial reefs that will involve the placement and management of a reef (or series of reefs) within reasonable traveling distance from each major inlet between Sandy Hook and Cape May. For saltwater anglers, this means many more exciting sportfishing opportunities will be available than have been in recent years, and catches should show notable increases as the new artificial reef network becomes well established.

Since the State has become actively involved in artificial reef construction it has sunk a number of derelict vessels in addition to the *Pauline Marie*, the *Good Times*, the *Shirley Ann*, the *American*, the *Morania Abaco*, and the *First Lady*, as well as experimental tire units, have been placed in specially selected and federally permitted locations along the coast. So far, five reef sites have been permitted by the U.S. Army Corps of Engineers, four of which now have reef material in place; the fifth site, off Ocean City, will be developed soon. The locations of these reefs are shown on the accompanying map.

For fishing tips and illustrations, specific locations, distances, and magnetic bearings from major inlets to the artificial reefs, send a self-addressed stamped envelope to Marine Fisheries Administration, CN 400, Trenton, N.J. 08625. Ask for New Jersey Artificial Reefs, Information Series, 86-1.

Why Artificial Reefs?

By establishing a network of artificial reefs along its coast, New Jersey has put out the welcome mat for marine organisms—a local attraction to catch their interest and satisfy their needs. Just as with human populations, sea creatures need food and shelter to survive and reproduce, so by nature they keep moving until they find a hospitable environment that suits those needs. The often barren, sandy bottom that characterizes the ocean floor off



Reefs

- existing
- ▲ proposed
- 1. Manasquan
- 2. Sea Girt
- 3. Garden State North
- 4. Garden State South
- 5. Atlantic City
- 6. Ocean City
- 7. Cape May

to the artificial reef program, take along an inexpensive homemade anchor. On a calm sea, a small boat will stay in place when anchored with a concrete block. Or, you can make a simple grapple anchor from bent reinforcing rods and pipe, as illustrated in Figure 1. If the grapple snags, a hard tug on the anchor line will straighten the rod hooks, freeing the anchor.

MIND YOUR MANNERS! Good reef etiquette means following these "Golden Rules" so that everyone can enjoy the trip:

- It's first come, first serve, as with any favorite fishing spot. Stay a reasonable distance from anchored boats to prevent tangled lines, dangerous collisions, and lost tempers.
- Don't tamper with reef materials or buoys. Keep in mind that it's a federal offense to tie your boat to a buoy. Tampering can result in lost, damaged, or displaced buoys, making it difficult for others to find the reef on future trips.
- Don't litter; save your trash for proper disposal when you get back to shore.
- Release—alive—all fish or shellfish that you aren't planning to eat. Conservation is the by-word here, because an abused resource is quickly depleted.
- Obey all fishing regulations, staying within applicable size and catch limits.

WATCH OUT FOR DIVERS! Proceed with extreme caution when traveling near a dive boat displaying either a red flag with a diagonal white stripe or a blue and white flag. Federal law prohibits boats from coming within 100 feet of an anchored dive boat with its flag up. Also keep a sharp lookout for bubbles that indicate a scuba diver below.

SAFETY FIRST! Divers should exhibit caution when exploring shipwrecks. Sediments stirred up by divers in internal compartments will severely reduce visibility. There are also many snags that may entangle diving gear.

STEER CLEAR IF YOU'RE TRAWLING OR DREDGING! Fishermen using such mobile fishing gear as otter trawls, purse seines, and dredges should stay out of the reef sites shown on the map on page 11 to avoid damaging gear on the concrete and steel bottom structures. These types of gear may also scatter reef material off the reef site, thereby enlarging the area in which damaging snags may occur.

CONSULT OFFICIAL NAVIGATIONAL CHARTS! When heading for the reefs, please



Another tire unit became host to a large mussel population.

UNIVERSITY OF RHODE ISLAND

use NOAA/NOS charts and be aware of U.S. Coast Guard Notices to Mariners to arrive safely at the reef sites.

Help Build a Home for a Fish

Artificial reef construction efforts can be greatly increased through private donations, and the project would particularly welcome derelict steel vessels for reef material as well as money to boost its construction budget. *The Fisherman Magazine* has established the New Jersey Sport Fishing Fund, a non-profit fund dedicated to the construction of reefs along the entire New Jersey coast. Donations will be accepted from all sources, with contributions of large donations being recognized as lifetime sponsors of specific reefs. Monetary donations should be mailed to:

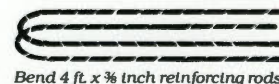
Sport Fishing Fund
c/o The Fisherman
Magazine
339 Herbertsville Road
Bricktown, N.J. 08723

Be a reef booster and reap the rewards of better fishing, better diving, and better management of our natural resources!

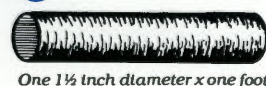
New Jersey State Library

ILLUSTRATIONS BY
BARRY PREIM

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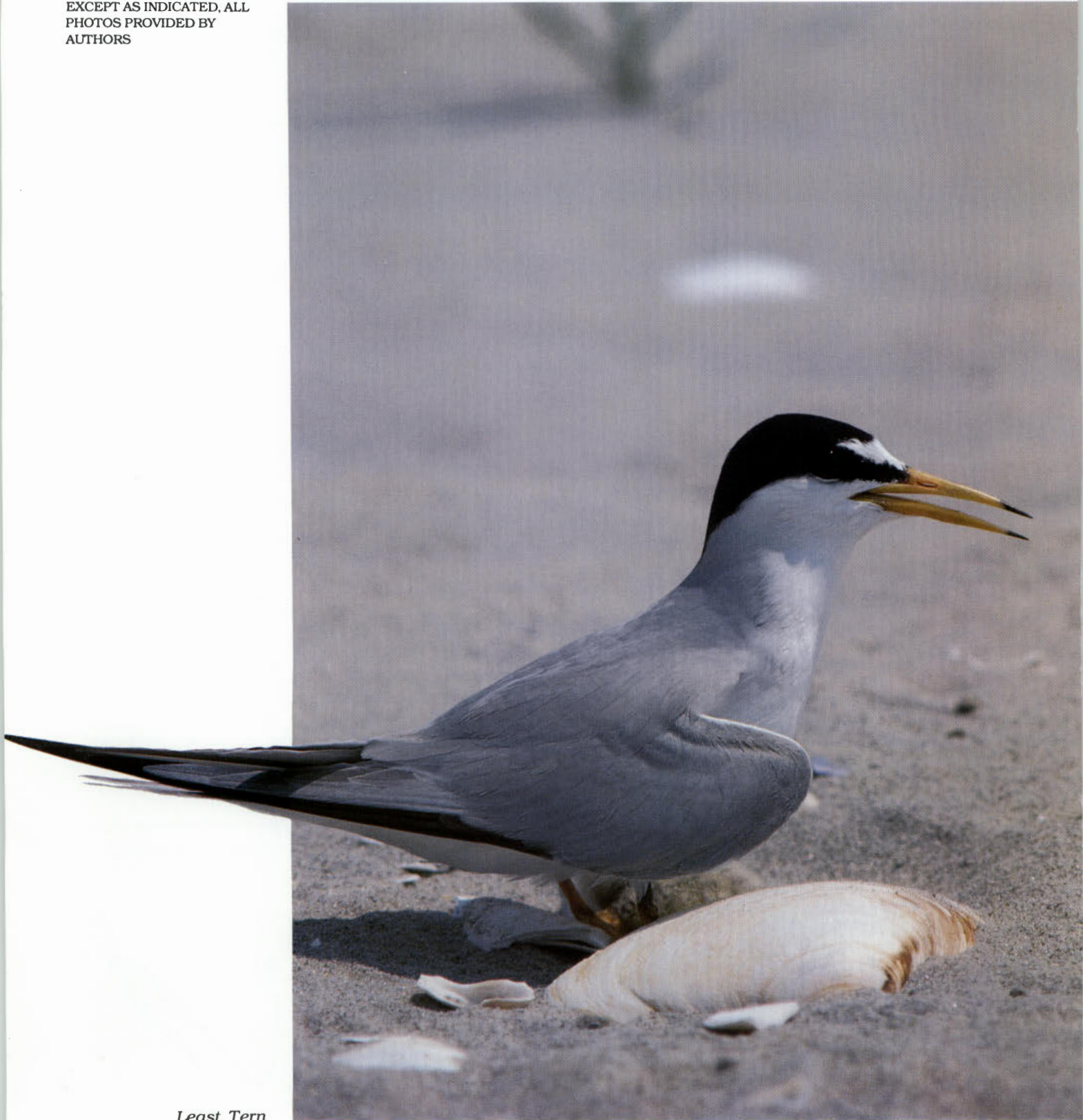


3



Our Endangered Beach Nesting Birds

EXCEPT AS INDICATED, ALL
PHOTOS PROVIDED BY
AUTHORS



Least Tern

DAVID JENKINS &
DR. JOANNA BURGER

Sunbathers are not the only creatures which "flock" to the New Jersey's shore each summer. Every year several species of birds return from points south to raise families on our fine white sand beaches. Three birds which nest right on the sand out of the reach of high tide, the least tern, black skimmer, and piping plover, are classified as endangered in New Jersey.

Piping Plover

The piping plover (*Chardrius melodus*) gets both its common and scientific name from its soft, musical "peep-low" call. It is a small pale bird, (6-7½") the color of dry beach sand with a jet black band across the top of the forehead and another, usually incomplete, around the neck. The entire underparts are white. When approached the piping plover often crouches in the sand, relying on its cryptic coloration to escape notice until it flees by running rather than flying down the beach. During the summer, when it is nesting in New Jersey, the legs are yellow, as is the black-tipped bill. Male and female piping plovers are virtually indistinguishable in the field, although on females, the black bands are somewhat more brown. In the fall, the dark bands fade considerably with the autumn molt and the entire bill darkens. Immature birds lack the black markings entirely.

Least Tern

Least Terns are small (9" long) pale terns with a black cap, white forehead, gray back and forked tail. Adults have black wing tips, a bright yellow bill, and yellow feet. They resemble the much larger Common (13-16" long) and Forster's (14-15" long) Terns that also breed along our coasts. In addition to size, Least Terns can be distinguished from these larger species by their bill color and white forehead. Forster's and Common Terns have deeply forked tails, all black foreheads, and red (Common) or orange (Forster's) bills.

Adult male and female Least Terns are indistinguishable in the field, although there are slight size differences. Immature Least Terns lack the rich black cap and have only a dark, dingy nape with black around the eyes; their bills are black and their wings are also generally darker. In New Jersey young birds can be seen following dispersal from the breeding colony, but immatures (1 year olds) are seldom seen in the breeding colonies.

WADE WANDER



Piping Plover

Black Skimmer

Black Skimmers are black above and white below, and they are larger (16-20") than Least Terns. They have a thin, scissor-like bill with a longer lower mandible. The bill is bright red towards the gape and dark tipped. Skimmers also have a white forehead, and the black extends below the eye, often making it difficult to see their eyes unless the sun glistens from them. Their striking black and white pattern with a bright red bill makes them easily distinguished from all other birds along the shore.

Unlike Piping Plover and Least Tern, male Skimmers are easily distinguished from females by their large size. Male skimmers are a third bigger (and heavier) than females, and have larger, heavier bills. However, they do not differ in color pattern. Young of the year are speckled brownish above and white below, with shorter, reddish bills.

Skimmers get their name from their habit of skimming along the water's surface with their long lower mandible below the surface. When fish hit the bill they close it, catching the fish. In the early morning or late afternoon solitary or small groups of skimmers can be seen skimming along the quiet waters of bays or along salt marsh creeks and channels.

Most of New Jersey's beaches are lined with resort hotels, boardwalks, businesses, or second homes. Precious little undeveloped beach remains. What is left is by no means free from the influence of people. During the summer, when these birds are nesting, one would be hard pressed to find a single stretch of New Jersey sand without someone sunbathing, jogging, fishing, or somehow enjoying our magnificent beaches. Yet, the least tern, black skimmer, and piping plover manage to find room to nest.

But that is only the first of their problems.



Frequently their inconspicuous nests are crushed by unwary beachgoers. Disturbed birds leave the nests and eggs which aren't crushed are exposed to the hot sun, or predators. Unleashed pets wandering through the colony can also cause abandonment, either directly by destroying nests, or by keeping the birds from incubating.

Man Contributes

Man also indirectly contributes to predation by attracting rats and other predators with the garbage he frequently leaves behind.

Probably as a direct result of habitat loss and disturbance, terns, skimmers, and plovers are nesting on nontraditional sites such as saltmarsh wrack, and dredge spoil. Here though, they may encounter greater predation pressure and often more frequent tidal flooding.

When man's depredations are coupled with nature's flooding spring tides and predators, whole colonies can fail, producing no young. With fewer and fewer colonies, the impact to the population could be disastrous, especially if permitted to occur for several consecutive seasons.

For the past several years the Department of Environmental Protection's Endangered and Nongame Species Program has been working to insure that both man and birds can share the beaches. Each year nesting populations are censused and reproduction assessed. Intensive management efforts including fencing, posting, and patrolling have been successful in reducing depredations to nesting birds. In some areas rats and other predators are controlled to reduce the unnaturally high predation. Recently, Dr. Joanna Burger of Rutgers University has been experimenting with the use of decoys to attract terns to safer, more protectable sites.

As a result, populations have stabilized or even increased in most areas. Unfortunately, the pressures which make protective management necessary continue to increase, and although populations may be holding their own, management efforts must be maintained and expanded.

Recognizing this need, several of New Jersey's most active conservation organizations and governmental resource agencies have joined forces to facilitate protection of New Jersey colonial waterbirds. At the inducement of the Endangered and Nongame Species Program, they have formed the New Jersey Colonial Waterbird Conservation Coalition. Member organizations include the New Jersey Audubon Society; the Nature Conservancy;

American Littoral Society; Wetlands Institute; New Jersey Beach Buggy Association; Atlantic, Jersey Shore, and Monmouth chapters of the National Audubon Society; Sea Grant Extension Service; Rutgers University Ecology Programs; U.S. Fish & Wildlife Service (Forsythe National Wildlife Refuge); National Park Service (Gateway National Recreation Area—Sandy Hook); and DEP's Division of Parks and Forestry and Division of Fish, Game & Wildlife.

One of the main goals of the New Jersey Colonial Waterbird Conservation Coalition is to mobilize volunteers to erect protective fences and signs and to patrol active colonies. Many of the member organizations and agencies which form the New Jersey Colonial Waterbird Conservation Coalition frequently hear the question from concerned conservationists, "how can I help?" The association hopes that it can provide an accessible and productive way for people to become involved in protecting some of New Jersey's vanishing wildlife.

Main Goals

The member groups also work to foster cooperation between conservation organizations and municipalities and other land owners along the coast to increase public awareness and seek local cooperation for fencing and posting efforts. Slide programs, informational brochures, and other educational materials are being developed to reach the beach-going public and foster a positive acceptance of management efforts.

If you are interested in becoming involved in any facet of colonial waterbird protection, get in touch with one of the organizations mentioned and let them know you want to help. Any organization desiring to take an active role in protecting New Jersey's colonial waterbirds can join the coalition. Contact any of the organizations associated, or New Jersey Division of Fish, Game & Wildlife, Endangered & Nongame Species Program, CN400, Trenton, N.J. 08625.

Our endangered beach-nesting birds require only a small portion of our vast beaches and restriction of these areas is a small price to pay for insuring their continued survival. Beachgoers can help assure the success of management programs by heeding the warnings on the signs and by going around rather than through fenced-in or posted areas. With continued research and management efforts and protection of the remaining beach properties from excessive development both birds and people can continue to enjoy the New Jersey shore.

Black Skimmer



the view from *Finn's Point*

BY PAUL E. TAYLOR

For years it had stood there—a rusting eyesore. Many people, unfamiliar with the history of the area, didn't know what it was. Some thought it might have served as a lookout tower at one time. Others thought it might have been a water tower. Some even wondered if it was the stack of a long-abandoned manufacturing plant. Several years ago \$2000 was offered to anyone who would tear it down and haul it away.

But some people in the area knew what it was and worked hard to save it. Today the Finn's Point Rear Range Light near the Delaware River in Salem County is one of the few lighthouses in New Jersey open to the public. Every third Sunday, except in winter, several volunteers are on hand between 12:00 noon and 4:00 P.M. to escort visitors up the narrow spiral stairway for a view of the surrounding area at 105 feet in the air.

Save the Lighthouse Committee spear-headed the effort

From this vantage point visitors have an excellent view of the nearby farmland and estuaries of the Delaware River. The river itself is in clear view, making it easy to see the tankers and large ships which regularly travel its waters. To the north may be seen the twin spans of the Delaware Memorial Bridge. Toward the southwest rises the Salem Nuclear Plant on Artificial Island.

Finn's Point Rear Range Light was built in 1876 at a cost of \$1,200. It was put into operation on April 2, 1877. Originally a fixed beacon kerosene-vapor light with 150,000 candle power was installed. The structure was encased with cast iron plates riveted together. This light was operated in connection with a shorter front range light (no longer standing) located closer to the river bank, 1.4 miles south of the rear light. When the two of them were lined up, the ship was on course.

Even though the area was remote at the time and the job was a lonely one, there was never a scarcity of applicants for the position of lighthouse keeper at Finn's Point. The keeper lived in a house beside the light and received an annual salary of \$500. Twice every night he had to climb the 127 steps to refill the lamp.

In 1939 the lighthouse was made automatic. It continued in operation until March 22, 1950. The United States Coast Guard declared it excess property on June 18, 1951 because of changes in the river channel. During the



1950's it became part of the Killcohook National Wildlife Refuge. On August 30, 1978 it was added to the National Register of Historic Places. Now it is part of the recently created Supawna National Wildlife Refuge, and administered by the United States Fish & Wildlife Service.

In 1983 the lighthouse was restored by the federal government at a cost of \$33,199. The iron-plated casing was cleaned and repainted, and necessary reinforcements and other repairs were made. A roofed-over bulletin board presenting information about the lighthouse was constructed, and a cyclone fence erected to protect the site.

Local people initiated the project and formed a Save the Lighthouse Committee. Betty Husarick, chairperson, spear-headed the lengthy effort. Committee members collected thousands of signatures for a petition which went all the way to Washington. Area Congressman William Hughes became interested and supported the project. A public dedication of the restored lighthouse was held in October, 1984.

Finn's Point Rear Range Light is located at the junction of Lighthouse and Fort Mott Roads, between Killcohook and Supawna National Wildlife Refuges southwest of Pennsville, two miles east of Fort Mott State Park.

PHOTOS BY AUTHOR

Groundwater Cycle

← Direction of Groundwater Movement

↓ Human induced impacts on groundwater

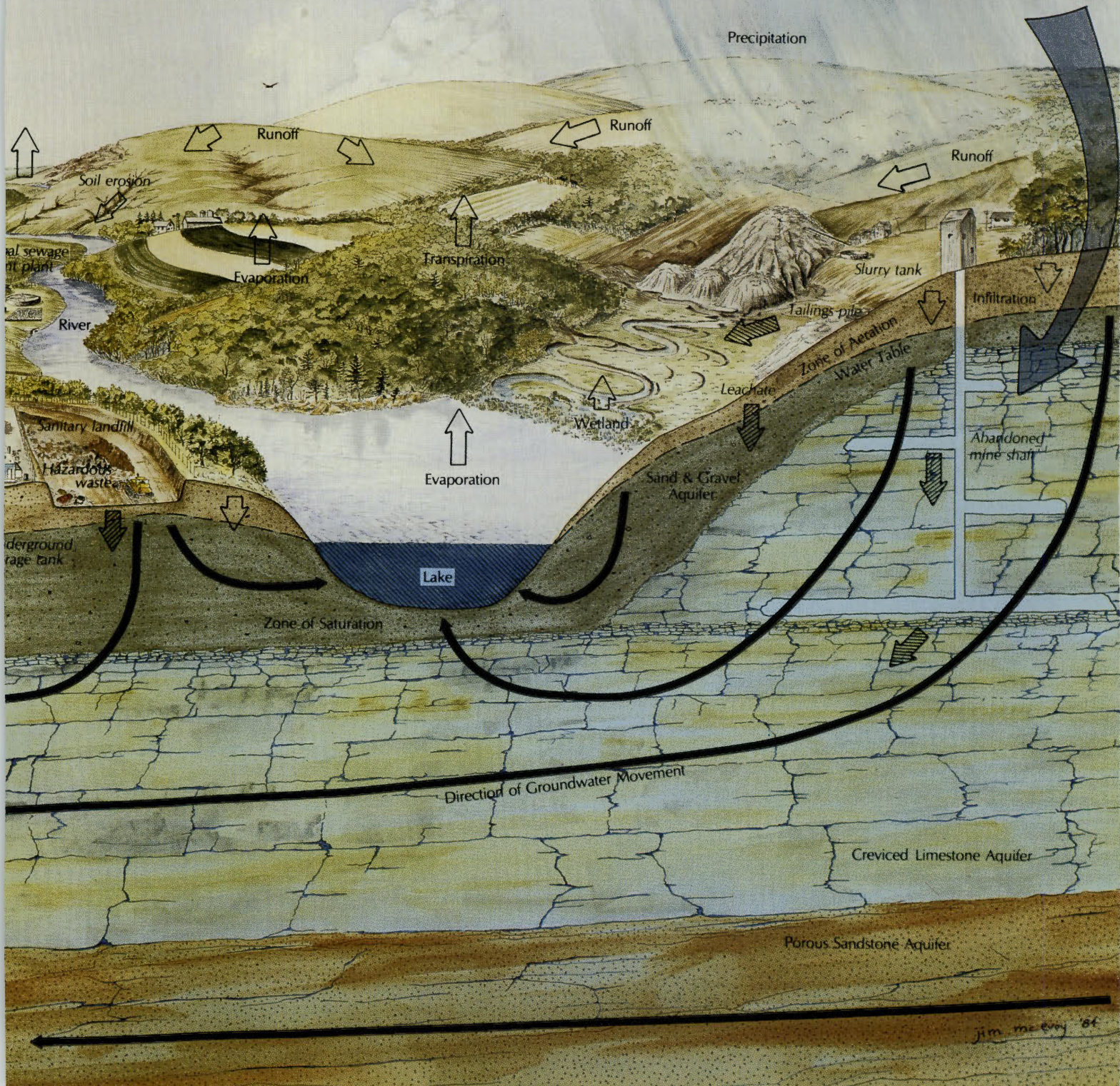
↓ Natural processes



Groundwater—the only source of drinking water for more than four million New Jersey residents and a major source of water for agriculture and industry—is one of our most valuable natural resources. Found primarily in deep underground geologic formations known as aquifers, groundwater is replenished from precipitation and surface water seepage through the earth's surface. Contamination from hazardous waste disposal sites, landfills, underground storage tanks, malfunctioning septic systems and other sources is a serious threat because polluted groundwater is difficult to clean.

This illustration, prepared by the Wis-

consin Department of Natural Resources, shows graphically how the water cycle, groundwater and land use are related. Rainfall, runoff, soil erosion, infiltration, wetlands, lakes and rivers all affect the quality of New Jersey's groundwater and the major source of drinking water for nearly half the state's population.



Cycling at Great Swamp

PHOTO BY AUTHOR





BY ROSALIE STRACHAN

Although the Great Swamp is best known as a haven where nature lovers pursue their interests of birdwatching, hiking and nature photography, many people have discovered that it's a great place for bicycling, too. Casual riders enjoy leisurely cruising on the back roads, while dedicated or aspiring racers, heads down and legs spinning, sprint along New Vernon/Long Hill Road. Other cyclists include the Great Swamp as part of longer rides through the surrounding hills.

Even from the road, you can spot the many forms of life that use swamp as habitat. Through the seasons you can watch the swamp maples change from the pink glow of spring buds to the light green, then dark green of summer, until autumn turns them ruby red. Roadside flowers have their seasons, too: marsh marigolds, flag irises, daylilies, fireweed, goldenrod and asters are easily seen.

As you pedal along, you may spot a turtle strolling across the road, a deer pausing for a better look at you, a woodchuck scuttling into a ditch or perhaps a muskrat slicing through the stream at one of the bridge crossings, while a flutter of goldfinches darts along beside you.

The swamp provides habitat for humans, too, as well as being a recreational area. White Bridge is a popular spot for fishing or for launching a canoe for the trip through Millington Gorge. Others enjoy horseback rides or carriage rides along the roads, or put their horses through their paces in roadside fields. Many runners find the flat terrain suited to speed work as well as easy jogging. And along the way are houses, so the swamp isn't a deserted, dismal place, but one where man and nature constantly merge.

Take a Water Bottle

Many small villages surround the swamp, so when you cycle there's no problem finding cold drinks, snacks and a variety of places to start. Within the swamp, water and restrooms are located at the Environmental Education Center on Lord Stirling Road and at the Wildlife Observation Center on Long Hill Road. There are also water pumps at the Lord Stirling Horse Trailer Parking Lot as well as in front of the Environmental Center. However, since the route is open and sunny, the best bet is to take a water bottle; then you always have something to drink.

Three roads, Lord Stirling/White Bridge, Pleasant Plains and Long Hill/New Vernon

Road, actually cut through the swamp. Two of them, Long Hill and Pleasant Plains, bisect the National Wildlife Refuge. Pleasant Plains is closed from dusk to 8 A.M., so plan accordingly. Traffic on Long Hill can be heavy during corporate commuting hours, generally 7 to 9 A.M. and 4 to 6 P.M. weekdays. Sections of Lord Stirling and most of Pleasant Plains Road are unpaved, so you might prefer to plan a route that uses only hard-surface roads. However, since the purpose of the tour outlined here is to see as much of the Great Swamp as possible, any aversions to dirt roads will be ignored.

Tour Starts at Parking lots

As described here, the cycle tour starts at either one of two parking lots on South Maple Avenue, Basking Ridge, near Lord Stirling Road. To the left, as you pedal down Lord Stirling Road, lie the rolling meadows and open fields of Lord Stirling Stable. To the right, where Somerset Hills Airport was until a few years ago, is a townhouse development. At the slight rise in the road and to the left, where the yellow house stands, is the site of Lord Stirling's manor house, being excavated by an archeological group through the Environmental Center. (The site is only open to the public during the annual open house.) William Alexander, called Lord Stirling because of claims to Stirling Castle in Scotland, served as a major general in the Continental Army during the Revolution. Like many others who fought for freedom, he died bankrupt, and his estate fell into ruins, eventually being destroyed by fire.

The ponds of Somerset County Environmental Education Center come into view next. The building, well worth a visit, is the first solar-heated and-cooled public building in this country.

At White Bridge, the name of the road changes. Continue straight and, right before the next bridge, you'll come to the home of The Raptor Trust where Len Soucy nurses injured hawks and other birds of prey back to health. Continue past Pleasant Plains Road and make a left at the intersection of Long Hill/New Vernon Road. Of interest are an abandoned field-stone springhouse now falling into ruins, the Wildlife Observation Center and the various bridge crossings, where you can get a glimpse of the Great Swamp's "swampiness" as good as any you'll find if you were to hike the trails.

Long Hill Road didn't earn its name for nothing. The hills begin as soon as the road leaves the swamp. Just remember that the law

of gravity is the best part of bicycling: What goes up must come down, although it often feels like it's the other way around. And there's no law against walking a bike up hills, or even turning back.

At the top of Long Hill, make a left on Lindsley to reach Lee's Hill Road, the best part of the tour if you like to go fast. If you want to build up a good head of steam, you can go to the end of Long Hill and climb the steep section of Lee's Hill before starting your descent. Much as I enjoy easy speed, you do miss the scenery, and Lee's Hill is perfect: White farmhouses and red barns set under leafy canopies and rolling meadows where sheep and horses graze. Near the end, before turning back into the swamp on Pleasant Plains Road, you'll see AT&T looming over Osborne Pond on the right and the lush fields of the swamp on the left.

This area doesn't look like swamp to me. The first section of Pleasant Plains Road is paved and runs between sheepfields that turn to gold in the evening sun. Inside the Refuge, you'll pass the scattered houses of Refuge employees, ponds and, set well back from the road, the Refuge headquarters. A right at the intersection and you're back on White Bridge Road for a total of about 13 miles.

Detours and Diversions

Due to the heavy equipment used in constructing the townhouses on Lord Stirling Road, the surface resembles a series of bomb craters. If you want to avoid this, take South Maple towards Millington, making a left on Hilltop near The Barons (more townhouses) and a right on Riverside. You'll come out on Lord Stirling less than half a mile from the Environmental Center.

Young's Road, connecting to Bailey's Mill Road, makes an interesting sidetrip if you don't mind roller-coaster roads. The hills aren't long, but they're steep, although Bailey's Mill is relatively flat. I find the contrast between the old and modern architecture fascinating, as well as the size of some houses.

For additional flat riding, do out-and-backs on the sideroads, Carleton and Pleasant Plains, go to the end of White Bridge where it dead-ends at the Wilderness Access parking lot, or ride to Meyersville.

If you want to do a circuit but prefer to avoid Pleasant Plains Road, continue straight on Lee's Hill Road, which turns into Madisonville. After a steep climb up Pennbrook Hill, make a left at the traffic light onto North Maple Avenue, which takes you back to Basking Ridge. You may want to stop and admire the ancient oak in the Presbyterian Churchyard.

The Great Swamp Cycling Circuit is just as scenic in the opposite direction. It has the added benefit of better views and an easier climb up Lee's Hill, but the ride down Long Hill could be dangerous for inexperienced riders. If you go in this direction, you might make a right at the traffic light in New Vernon and follow Green Village Road to either Millbrook or Pleasantville Road to return to the swamp.

If you'd like to approximately double the length of your ride, consider starting at Loantaka Brook Reservation. The Roads are generally rolling, with a few steepes thrown in for challenge. This is horse country; you might see redcoated riders in a distant field or fording a nearby stream. Spring Valley road once was part of Morristown's "Golden Age," when the wealthy built little summer houses which still stand among their newer, but not always smaller, neighbors. Any of these roads are enjoyable—Sand Spring Lane, Van Beuren, Red Gate—but I especially like Dickson's Mill where the stream winds beside the road, running down from the dam at Silver Lake.

Loantaka has a bike trail (with a water ford) and dirt trails used by the horses from Seaton Hackney Farm. Picnic tables, water and restrooms are available.

So whatever your bicycling style, whether it's short and slow, long and challenging, or just plain fast, make the Great Swamp part of your cycle life.

Addresses:

The Raptor Trust, although not a public area, does permit visitors as long as groups aren't large.

The Raptor Trust
1390 White Bridge Road
Millington, NJ 07946 (201) 647-2353

The Somerset County Park Commission and the National Wildlife Refuge can send you brochures on their facilities and on the wildlife and plants to be found.

Environmental Education Center
190 Lord Stirling Road
Basking Ridge, NJ 07920 (201) 766-2489
Great Swamp National Wildlife Refuge
RD 1, Box 148, Pleasant Plains Road
Basking Ridge, NJ 07920 (201) 647-1222

You can get an excellent map of Morris County as well as a map of Loantaka Brook Reservation from

Morris County Park Commission
53 East Hanover Ave., PO Box 1295R
Morristown, NJ 07960 (201) 829-0474

A Great Swamp Bicycle Tour is one of several available from the state. It will take you on a longer loop around the swamp near Madison and Chatham, and to Far Hills. Free.

William Feldman, Bicycle Advocate
1035 Parkway Ave., CN600
Trenton, NJ 08625



the tale of Tripod Rock



The Garden State can boast of an outstanding glacial erratic known as Tripod Rock that raises historical mysteries in the highlands of New Jersey.

Glacial erratics, most experts agree, are souvenirs of the Wisconsin glacier, the last glacier to visit the state, which slid slowly out of Canada 30,000 to 40,000 years ago. It covered High Point with 1,200 feet of ice.

The glacier uprooted rocks from their geological homes, carried them away on an escalator of ice, and dropped them off when the ice sheet thawed a mere 12,000 to 13,000 years ago. These displaced rocks and boulders are known as erratics and most came to rest on Pre-Cambrian rock outcroppings that pop through the earth's crust at intervals between Vermont and Virginia.

Fossils embedded in erratics indicate that some were moved at least 10 miles by the ice from origins in New York State, where glacial erratics are also found in abundance.

Tripod Rock is a rare erratic that is "perched," meaning that three smaller stones under the massive boulder prop the rock totally off the ground.

Geologists explain this phenomenon, with its bizarre results, simply. The erratic boulder descended through the melting ice to mix with loose soil and broken bedrock plowed up by the glacier known as glacial till. When the loose till eroded as the mucky firmament and gravel washed away over time, Tripod Rock made an almost unbelievable three point landing on smaller boulders.

This natural wonder, located in Kinnelon Borough in Morris County, is one of the most spectacular erratics on the East Coast. But in recent years, observations point to other roles for this erratic that may indicate an interest in the site by New Jersey's ancient inhabitants.

Thomas F. Brannan, a Middletown, N.Y. land surveyor, published an article on Ancient Stone Trail Markers in the New Jersey-New York region in a 1982 publication of the New England Antiquities Research Association (NEARA). Brannan describes a series of leys, or survey and trail routes, that have stone markers every 30 to 40 English statute miles. Interestingly enough, he connects Tripod Rock with a ley that starts in Kinnelon, passes through High Point State Park near another perched erratic and Indian rock shelter, through several Indian campsites, before terminating in Callicoon, N.Y.

In the late 1970's, Brannan's interest in Tripod Rock lead him to invite the counsel general of the Irish Consulate in New York City, Jared O'Cleary, on a visit to the rock. Both men agreed the erratic bore no resemblance to Cromlecks, the ancient three-sided stone slab burial chambers of Ireland.

Although Tripod Rock, and other major erratics in Kinnelon, has been sprayed with graffiti and showered with glass bottles, interest in it perked up again in 1981 when a group gathered to watch the June 21 summer solstice from the site.

BY GARY HAYDEN

PHOTOS BY BRUCE SCOFIELD

*Pat Gleason visits
Tripod Rock with
wonderdog Sheena.*

Summer solstice
viewed through Tripod
Rock "gunsight."



The small assembly included Bruce Scofield, author of *Circular Trail Hikes in Northern New Jersey*, Mead Stapler, past president of the North Jersey Highlands Historical Society and author of a NEARA report on Tripod Rock, Kinnelon Borough Historian Lucy Meyer, and professional archaeologist Edward Lenik.

Aided by the gypsy moth infestation which denuded much of the foliage that year, the group witnessed the sun set behind a ridge but viewed through a "gunsight" formed by two perched boulders at Tripod Rock. Reaction to that event ranged from elation in some to Lenik's scientific scepticism, "I saw the sun set between two rocks. So what?"

To answer that question, Scofield returned to the site in December 1983 with Meyer and Stapler to locate a sighting stone, like the bead at the end of a shotgun barrel, that would virtually certify the site as a simple solar observatory with possible ancient calendar ramifications.

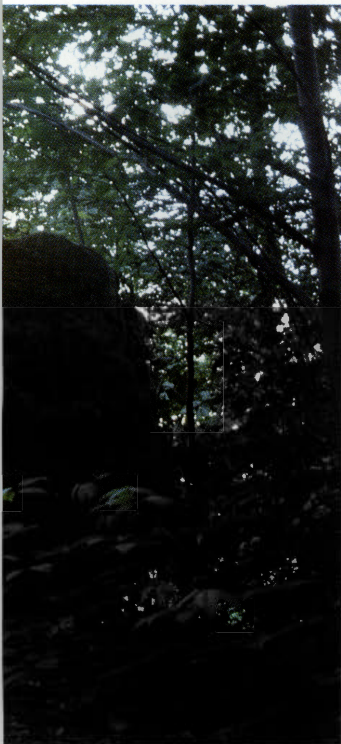
Using a bright flashing strobe light and portable two-way radios, Scofield scoured a ridge about a half mile to the west, in the gathering twilight of the winter solstice, on instructions from Meyer and Stapler stationed at the gunsight. Scofield was directed to a position where the sighting stone should lie. But instead, Scofield found fresh bulldozer tracts and a boulder that had been pushed away from his location. The tantalizing question re-

mains—was this the sighting stone? Had a bulldozer operator doing his job in a suburban development unwittingly destroyed a remarkable calendar site?

While the solstice alignment from Tripod Rock cannot be verified beyond doubt, Scofield has located another, small, erratic near Tripod Rock that points toward the winter solstice in alignment with two other rocks.

Other erratics are found in the general vicinity, perched and otherwise, of Tripod Rock including a massive erratic larger than a boxcar—Bear Rock. This erratic, situated in a marshy valley between Tripod Rock and the ridge Scofield scoured for the sighting stone, was first described as an Indian rock shelter by New Jersey's pioneer archaeologist, Max Schrabish, in a 1913 state survey. Schrabish probed the site, to the cringes of modern archaeologists, and reported that two distinct levels of culture, stone and pottery, were found. These distinctions, and the very cultures themselves whether Paleo-Indian, Archaic, or Woodland, are a great mystery and remain so to this day. Supposedly Schrabish turned his excavated Bear Rock material over to the New Jersey State Museum but the artifacts have never been seen or located by local historical authorities and their whereabouts remain uncertain.

A detailed examination of the site would yield clues about the ancient peoples who lived



close to Tripod Rock besides the Tintles. An old inscription on Bear Rock, possibly from Colonial times, carries the Tintles name. Today that family name is found in the Pompton Lakes area.

What is known about the indigenous inhabitants of the area centers on the area of Pequannock Township, just a few miles east of both Bear and Tripod Rocks.

There, on the plains west of the Pompton River, Schrabish found so many camp sites that he called the area "one of the more frequented aboriginal sections in Northern Jersey." He also found rock shelters in the hills on the present day border of Kinnelon and Pequannock Township.

In addition to a large presence of native Americans, these plains were at the intersection of what amounted to an Indian interstate trail system. One major trail ran along the Pequannock River to Minisink Island in the Delaware River, one trail led north along the Ramapo River to the Suffern, N.Y. area, and yet another trail was worn out of present day Pequannock to the Watchung Mountains and then on to the seashore where the tribes held annual pilgrimages.

One erratic is called both Turkey Rock and Balancing Rock.

Seafood scraps from these pre-European vacations, were tossed into a pile, a shell midden, that disappeared when the Hunt Farm in Pequannock Township became the Sunset Valley Golf Course. The links are located at the base of the hill ranges where the erratics and rock shelters are situated.

The Indian "interstate" trails may also have helped tribal trading and commerce. Two notable finds near the Pompton River include a shale gorget from the Cleveland, Ohio region and an obsidian Folsom Point. The culture which made Folsom Points thrived in Clovis, New Mexico.

One erratic that may have been seen from the plains near the Pompton River is called both Turkey Rock and Balancing Rock. This perched stone was visible in its hollow when the hills were lumbered heavily in the late 1920's. One can't help wondering if there was a migratory role for this peculiar erratic located about halfway between Tripod and Bear Rocks and the Indian trails and encampments.

Most historical authorities admit that the perched erratics intrigued the ancient inhabitants but to what extent they considered them is pure speculation. As Lucy Meyer points out, "They (Indians) were very aware of their surroundings. They had time to observe nature. They didn't have to stand around waiting for a bus."

One Kinnelon erratic could have been used as an observation point.

One Kinnelon erratic that could have been used as an observation point in both modern and ancient times is Ladder Rock, an unperched but balancing erratic that was so named because of a long-gone iron ladder placed against it. It is not far from Schrabish's rock shelters and old mines.

All of the erratics in Kinnelon are near continuing suburban development although poor soil percolation in much of the borough hampers rampant development. Yet progress marches on.

Plans are underway to complete I-287 which currently ends in Suffern, N.Y. and Montville, NJ. The concrete expressway will parallel an old stage coach road that hauled passengers over the plains beneath the highlands of Kinnelon.

With both highway and residential construction comes the possibility that more unsurveyed calendar and erratic sites may be damaged. Throughout north Jersey, as Scofield will attest, many balancing and perched erratics have been intentionally, but probably mischievously, toppled before they could be properly inspected for possible solar or astronomical calendar alignments.

In an attempt to protect Kinnelon's most outstanding erratics, Tripod and Bear Rocks, from development and further mutilation, Lucy Meyer has launched a preservation drive. The object of this effort, which has the blessings of Kinnelon Mayor Glenn Sisco and the borough council, is to have both erratics designated as natural and historic sites in the borough master plan. Yet all the borough can legally do is request that the landowners never alter or develop these magnificent sites.

Whatever awaits the fate of Tripod Rock, and other outstanding erratics in the New Jersey highlands, the fact remains that it is subject to erratic human behavior until its unique geological, and historical characteristics are recognized, studied, and protected.

Turtle Trapper

BY SARI HARRAR



Herb Misner knows six ways to catch the snapping turtles that live in the cedar water ponds of Burlington County Pinelands.

Misner, a 65-year-old retired auto mechanic from Medford, has been trapping snappers for half a century. He sells them live, to fish markets, restaurants and local customers as the basic ingredient for snapper soup.

He can catch a snapper by the tail with his bare hands. On rare occasions he "fishes" with a chicken head on a string. Most often he uses a big, cylindrical wire trap he makes by hand and baits with whole cans of oil-packed sardines.

"The oil is important," he said. "They follow it right up to the net."

On a late summer morning, Misner set out to check three traps sunk in Fisher's Dam, a small lake filled with water lilies and cedar stumps in an undisturbed section of Southampton Township. Working alone, Misner hauled a battered aluminum rowboat out of his pick-up truck.

Ten years ago he bought the boat new. But it leaks now, making it necessary for him to carry a plastic bottle he uses as a bailer among his trapping gear.

He pulled the boat down a sand and gravel bank and into the lake. It was a 10-minute trip to the first trap. Misner rowed with his legs apart, his baseball cap low on his forehead. The oars he handled were narrow-bladed, weather-beaten, older than his boat.

"I beat a lot of oars, so I keep a supply of old ones," he said. The week before, he snapped an oar in the middle of the lake and had to row to shore with one, then walk the boat back to his truck along the bank.

Unlaced Boots for Safety

Fat drops of sweat rolled off his nose. He wore old jeans, a loose shirt and unlaced work boots—as a safety precaution. "In case I fall out of the boat," he explained. "So I could kick them off."

He followed a trail of iridescent sardine oil to the first trap. Balancing in the prow, Misner pulled in his unwieldy catch. Inside the 5-foot-long trap was a 14-pound snapper.

It hissed and fought as Misner lowered it, head first, into a bag. "The trick is to get that head past the hand you're holding the bag with," he said. "His jaws are like a razor—sharp and hard as a razor."

He's been bitten only two or three times and considers himself lucky. "You can lose a finger," he said. "Turtles will bite even if their heads are cut off. The only way to make them

PHOTOS BY DENNIS MC DONALD AND
PROVIDED BY THE LIBRARY OF CONGRESS

let go is to run a broom straw or a wire up their nostril."

At nearby Lake Ockanickon, the turtle hunter wore hip waders into thigh-deep water to check another trap. The mud sucked at his heels as he bent to pull up the wire cage. Inside was a small "butter belly" turtle he preferred to throw back.

Misner is a shy man with strangers, and didn't make much of the fact that he grew up and lives by the old ways. His elders taught him the finer points of trapping—that turtles move to deeper, colder water in summer and can usually be found where their favorite food, water lilies, grow.

He joked that catching turtles is a hobby, a good morning's exercise and "a way to get a little extra spending money for beer." But he also considers himself an endangered species, one of the last old-time turtle trappers.

"None of my sons really keeps it up," said the father of four grown boys and one married daughter. "You're really too busy when you're young."

He was 14 years old when an old man taught him to trap with his bare hands and feet.

"We'd walk around where they were draining lakes and cranberry bogs and poke in the mud with a stick," he said. "When you found a turtle, you'd stand on it. The mud was soft and it came up to your hips sometimes."

"Now turtles always move forward. They move when you stand on them. That way, you'd know where the head and the tail was," he said. "I'd reach in and pull them out with my hands. Sometimes the mud came up to my armpits."

Not all the turtles were sold. "We'd make a couple pots of soup, get a half barrel of beer," Misner said. "Everybody would come and sit under the tree."

His face lit up as he talked about the parties that "used to be a big thing on Sundays in the summer."

Misner, a widower, recalled the way his wife Thelma cooked snapper soup.

"First, I'd cut the head off," he said. "You scald the turtle till the dark skin and the shell come off. Just dip it in and out of the water. Underneath, the meat is white like chicken."

His wife would boil the turtle meat and cut it in chunks. In the cooking water, potatoes and onions were boiled and the turtle meat, some chopped hard-cooked egg and spices were added. The spices were first put in a cloth bag, he said. "so you could take it out and not have leaves floating in the soup."

These days, the old-time trappers who could

catch snappers with chicken heads, string nets and pointed sticks tied in fishing line have all but died out. But the turtles appear to be abundant.

Misner caught 300 turtles in 1983 and about as many in 1984. Some weigh up to 40 pounds. He's driven live loads weighing in at 1,000 pounds to Philadelphia in the back of his truck.

Traps All Over

His trapping grounds include Scout camps, streams and private lakes—anywhere landowners give him permission to trap. Some call him in to get rid of a turtle that may be eating ducklings or fish.

A small, vigorous man, he walks quickly through the Pines, on trails lined with wild blueberry bushes, ferns and the white flowers of the sweet pepper bush.

His highways are the network of sandy backroads that wind from the middle of Burlington County to Little Egg Harbor. "You can drive them all the way to the shore, if you know where you're going," he said.

Turtle season, from May to September, has left his skin sunburned. The years left it leathery and a little loose. His legs are wiry, his hands gnarled and larger than his slim arms would suggest.

Misner doesn't mind having a little fun with the turtles he keeps in a white porcelain bathtub in his backyard.

"Someone will come along to buy them," he said, as he pulled cinderblocks and a heavy metal screen off the tub. Five turtles wallowed in the muddy water, ugly as baby dinosaurs.

He hauled out the biggest one and rapped it on the shell with a two-by-four. "You've got to get their attention," he explained.

The turtle responded by hissing and opening jaws as big as a cat's head. Misner eased a stick into the turtle's mouth and saw it snapped in half with the efficiency of an axe.

"You can't take your eyes off them when you play with them," said Misner, who keeps chickens, dogs and steers in the backyard.

In the house, he displayed a new net he will lash to the center of his turtle trap when the weaving is done. With it, he hopes to catch the elusive grandfather of the Fisher's Dam snappers, a 50-pound turtle he nearly caught once.

"I think that turtle broke into my trap once and stole the bait," he said. On one trip, a friend managed to grab the huge turtle, but had to let go when the boat nearly overturned in the struggle.

"It's the biggest turtle I've ever seen," he said. "And it always gets away."



the Musconetcong Monster, the Flatbrook Fiend and other delights



BY ALLEN G. EASTBY

PHOTOS PROVIDED
BY AUTHOR

It was already hot when the station wagon turned off the highway. Once the dust kicked up by tires spinning across the gravel of the pullout settled, I keyed open the tailgate and began to climb into my chest waders. Before I had the suspenders hooked over my shoulders, my face was washed by sweat and my T-shirt was soaked. I had to pause as I threaded the line through the guides of my flyrod to wipe perspiration from my eyes. No matter how much I wanted, and needed, a day on a trout stream, I told myself while I straightened my leader, this was going to be a quick trip: an hour or two in this heat was all I could take.

I was patting down the pockets of my vest, making sure I had forgotten nothing, when two anglers emerged from the thick tangle of brush masking the Big Flatbrook from the road. They nodded good morning. I asked them how they had done. They both grinned like little boys after a successful raid on the cookie jar and one of them said simply, "Ants."

In the marrow of my bones I knew: no matter how hot it was, this was going to be a long day, and a good day, probably the best day of the season. This was the day I had been waiting for. This was the day I would savor when January's cold sapped the car battery and when flu struck in February. This was the day I would recount to my friends at the rod and gun club meeting. It had happened, as it does every season. Sooner or later there comes a day, usually in June, sometimes late in May, very rarely early in July, when trout—and trout fishers—become aware that terrestrials, the untold millions of land insects dwelling in the fields and woods bordering trout streams, are beginning to find their way into the water. Blown by a warm summer breeze (the "grasshopper wind" they call it in Pennsylvania), swept away by rain showers, or blun-

dering off brush and branches, ants, beetles, leaf hoppers, crickets, and caterpillars drop onto the surfaces of pools and riffles and are trapped and carried along by the current. Waiting for them are trout, hungry trout.

Just in Time

Terrestrials usually begin to appear in significant numbers just in time, for the trout. The period when aquatic insects are readily available—mid-April to mid-June—is over, or nearly so. Food is growing scarce. Aside from small fish, a few nymphs, and an occasional crawdad or scud, the larder is bare. Then, almost as if they were the answer to a hungry trout's prayer, down the stream float ants and fat grasshoppers, beetles and writhing caterpillars. To the uninitiated, they look like creatures from a bad science fiction movie ("The Beetle That Ate Bridgeville" perhaps, or "The Crickets That Kicked Clinton"). To the trout, they represent survival. To flyfishers, the appearance of terrestrials marks the beginning of the best angling of the year.

Using imitations of land insects to take trout began in earnest 40 years ago on the famous limestone spring runs in the Cumberland Valley of south central Pennsylvania. From the intellects and imaginations of a group of keenly observant anglers who fished famous streams like the Letort, Big Spring, and the Yellow Breeches, came a selection of flies that could take trout when all else failed. Over the years, other flyfishers in every part of the country have refined and revised the original terrestrial fly patterns and developed new ones. Nowadays there are literally thousands of terrestrial imitations available to anglers. Just about every fly tying book details tying techniques and it is hard to find a store

*Right:
The Musconetcong
Monster (3rd from top)*

*The Flatbrook Fiend
(4th from top)*

catering to flyrodders that doesn't carry a decent selection of terrestrials.

However, new patterns and effective variations on old standbys appear every year and there are certain flies that are particularly useful on specific streams. For example, on the Big Flatbrook a beetle imitation with a metallic green body and very long "legs" takes trout when other patterns are ignored. Dubbed the "Flatbrook Fiend," this fly can be tied with a body of deer or elk hair, polypropylene yarn, or painted cork or balsa wood. On the Musconetcong, a black and white striped caterpillar—which somehow got the nickname "Musky Monster"—is exceptionally effective, especially on the water downstream from the "fish for fun" area. On small woodland streams beetle patterns in light brown and tan are good, while meadow sections can best be fished with black beetles. The fly tying angler, then, is at a distinct advantage since he (or she) can tie flies suited to favorite streams and match the "terrestrial hatch."

But even if an angler is forced to make do with a limited selection of terrestrial flies, it is still possible to enjoy some splendid fishing since sound tactics are more important than pattern. How an ant or a cricket is shown to the fish is the key to success.

For almost 40 years now it has been accepted that terrestrials should be delivered with a distinct "splat." Trout, the argument runs, are alerted to the presence of terrestrials by their noisy arrival in the stream. After all, a grasshopper, it is said, lacks the ethereal grace of a mayfly. By and large, this is excellent advice. Few land insects (except ants) alight daintily on the surface of a pool or a run. Instead, they crash. Often, a fat beetle imitation plopping onto the surface will bring trout racing from several feet away. Once in while, two or more fish will actually compete for the fly, particularly if the trout are holding in relatively shallow water. When fishing a caterpillar imitation, it is not at all unusual to witness trout ignoring naturals that drop quietly into the flow in favor of a clumsily cast artificial. But there are also times when a more refined approach pays off.

Trout Can be Skittish

Although terrestrial time usually coincides with a decline in fishing pressure, on our streams there always seem to be anglers; even on dusty days in August you find cars parked along the South Branch of the Raritan and the Big Flatbrook and anglers risking heat stroke to catch a trout or two. Trout in such heavily fished streams become very wary very quickly. They are skittish and prone to panic at the

slightest provocation. They may fool you and hover in plain sight, but when a chubby Letort Hopper kerplunks about their heads, they know it's attached to a leader and they let caution overrule hunger. This is when the hard learned skills so useful during mayfly, caddis, and midge hatches are necessary. Long, fine leaders (as long and as fine as you can handle), careful casts, and drag free drifts are vital. So too are small flies, imitations of ants, jassids, and tiny beetles, flies that will waft gently onto the water's surface. Although most rises to terrestrials will be splashy affairs, when fishing a size 20 beetle to selective trout, the take will generally be gentle, often barely perceptible, requiring an equally gentle slip strike in response.

As a guide to tactics there is no substitute for experience. Useful as well are knowledge of the stream and at least a nodding acquaintance with the insects living along the stream bank. But as a general rule, it is wise to use small flies, fine leaders, and a quiet presentation when there is competition from other anglers. Should a flyrodder be lucky enough to have a stretch of stream to him- or herself, larger flies and a more casual, if not downright noisy, presentation is best. Whether you are fishing with an 8X tippet and a size 24 ant or a 3X tippet and a size six grasshopper, it is always best to work *upstream*. Even on a summer shrunken stream, it is possible to approach to within easy casting range of wary trout if you come up behind them. Indeed, it is often best not to wade at all, but to come slowly up along the bank, keeping low, casting only when the quarry is in sight, in essence, *stalking* the trout. All too often, flyfishers, spoiled by the easy conditions of April and May, wade boldly down the middle of the stream, frightening the spots off the trout. Then they complain of those wretchedly ineffectual flies they read about and were foolish enough to try. If they had just used a little common sense, and applied some of the trout lore usually reserved for trips to fabled waters far from home, they would have added to the store of memories that sustains an angler through the winter.

As for me, it has been one of those winters—the battery didn't go dead, but the flu struck twice and friends have begun complaining about the latest "terrestrial tale." I'm waiting for the day, that special day, when I feel in the marrow of my bones that terrestrial time has again arrived. I've waited patiently, but now the palm of my casting hand is itching, my fly box is filled with beetles and ants, and a couple of caterpillars. I'm ready. So, too, are the trout.



Dear Editor

New Jersey Outdoors welcomes letters from readers. Letters for publication should include the writer's name and address and should be mailed to: Editor, New Jersey Outdoors, CN 402, Trenton, N.J. 08625. Letters may be edited for reasons of length or clarity. Please keep the letters coming. We'd like to hear what you think about the magazine. We'll also try to answer questions and if we cannot, we'll ask our readers for help.

"I caught an eel."

Stephen and George think your magazine is great. They both like hunting and fishing—and, I hope, save the copies as one is supposed to do with the "National Geographic."

I do not hunt, and the only time I tried fishing I caught an eel. That did it!

However, the covers on "New Jersey Outdoors"; front back—outside and inside—are a delight to look at six times a year.

Henrietta O'Neil
(Mrs. Paul T. O'Neil)

Watch Out for Ticks

I am concerned about the growing menace of ticks in the New Jersey fields and woodlands.

Ticks can cause serious illnesses such as Rocky Mountain Spotted Fever, Tularemia and the relatively new Lyme disease. Most "bites" fortunately do not, but to discover a tick digging in certainly doesn't do much for one's peace of mind.

New Jersey Outdoors and the New Jersey Health Department may be useful in alerting the outdoors public to the threat of ticks; what they look like; and protective measures that can be taken. As for myself I have yet to find a procedure that works in the removal of an embedded tick.

Cornelius Hogenbirk
Waretown

We agree. It is amazing how something so small can be so disturbing. The N.J. Department of Health does publish information on ticks. You can receive a copy by writing directly to N.J. Department of Health, Epidemiology and Disease Control, CN 360 Trenton, N.J. 08625.

1800's Boatbuilders

I am currently attempting to locate historical information about the South Jersey towns of Alloway and Quinton and their importance to the early 1800's livelihood of boatbuilding along the Alloway Creek.

Specifically, I am after copies of articles, written accounts and diaries which describe locations and the use of various gates along the creek involved in the damming and releasing process to "flush" the merchant boats along their course down the shallow creek from Alloways to the Delaware.

I would like to find copies of original hand sketches, engravings and early prints made which capture the various phases of the boatbuilding "industry" along the Alloway Creek and might show the gates particularly at the site of the present Alloway Lake.

Should any readers be able to steer me toward any additional sources, I would greatly appreciate any help offered.

C.D. Gilbert
Alloway

Responses to C.D. Gilbert's request for information may be sent to NJO, CN 402, Trenton, NJ 08625. We will forward them on.

Oops!

The March/April Issue was interesting and well illustrated as ever. Hope you don't give anyone more than thirty lashes for screwing up the names and pictures of Wildflowers on page 19.

The picture of the fishermen on Spruce Run (p. 22) made me wince. Two big guys in an 8 foot pram. What a way to go.

Thomas L. Jeramaz
Hopatcong

Many NJO sharp-eyed readers spotted the mixup of the wildflower names. For the record, the photos on page 19, from top to bottom are of Bull Thistle, Fringed Gentian, Wild Columbine,

and Daisy Fleabane. And several readers also pointed out the serious safety hazard posed by the big fishermen in the small boat.

A complaint

We could do without the free publicity on Dan's Sport Shop in William Kane's *Evolution of Spruce Run* (March/April). I believe the readers would enjoy more knowledge about the actual fish that lurk in the depths of Spruce Run than on the walls of some tackle shop. The reservoir hosts an assortment of fish, Mr. Kane would have had a more constructive view of this in those five paragraphs under a title of prime fishing area. We all know where Mr. Kane gets his bait from! Don't we.

John James
Florham Park

ROCK SET FOR STUDENTS AND ADULTS

The Rock Set contains samples of nine rocks and six sediments collected by the New Jersey Geological Survey from throughout the state. Included are specimens of limonite, the bog iron ore mined in Colonial Burlington County, marble, quarried today in Sussex County, greensand, dug in Gloucester County for use as a soil conditioner and water softener, and diabase, the rock of the New Jersey Palisades. Also included are a geologic map and 19-page booklet which defines the major rock types, describes the samples and discusses the collection and display of rocks.

New Jersey Rock Sets (\$3.50 each postage paid) are available from:

Department of Environmental Protection
Bureau of Collections, Licensing Mgt.

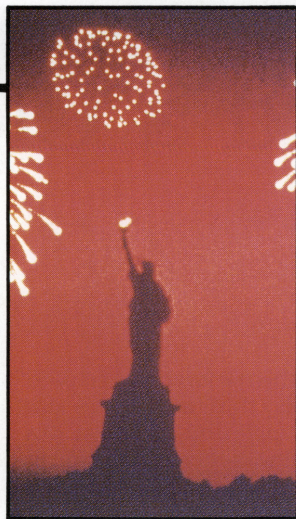
Services
Map and Publication Sales Office
CN-402
Trenton, NJ 08625

Prepayment is required. Make check payable to "Treasurer, State of New Jersey."

CALENDAR OF EVENTS

MAY

- 2, 3, & 4 NJ AUDUBON'S SPRING BIRDING WEEKEND at Cape May Point State Park. (609) 884-2736—Cape May Bird Observatory.
- 3 ANTIQUES AND COLLECTIBLES SHOW AND SALE at Allaire State Park, Farmingdale. (201) 938-2371.
- 4 GOVERNOR'S WATERFRONT MARATHON at Liberty State Park, Jersey City. (201) 435-0736.
- 10 MAY FESTIVAL AND FLOWER SHOW AND SALE at Allaire State Park, Farmingdale. (201) 938-2371.
- 11 PUBLIK TIMES IN RARITAN. Colonial Fair with puppet shows and 18th century crafts demonstrations at Wallace House Historic Site, Somerville. (201) 725-1015.
- 17 WORLD SERIES BIRDING—24 HOUR BIRDATHON at Cape May Point State Park. (609) 884-2736—Cape May Bird Observatory.
- 17 NEW JERSEY FORESTRY ASSOCIATION 10th Anniversary meeting. A program of Urban Forestry and Farmland Tax Assessments. Old Heidelberg Restaurant, Trenton, N.J. (609) 292-2531.
- 17 PROPOSED PAULINSKILL VALLEY TRAIL HIKE (Easy to Moderate). Meet Blairstown Footbridge Park, Rt. 94 at 10 a.m. (201) 356-3289.
- 17 HOUSE TOUR AND FLOWER SHOW OF HISTORIC HOMES IN SOUTH PLAINFIELD. 1 to 5 p.m., 60th Anniversary of South Plainfield.
- 24 BIRD WATCHING at Forsythe National Refuge, Brigantine. (609) 652-1665.
- 24 FREE STATEWIDE FISHING DAY (No license required but all other rules apply.) CLINICS at Pequest Hatchery and Natural Resources Education Center, Oxford and Union Lake, Millville. (201) 637-4125.
- 31 BIKE RIDE: BIRMINGHAM-ONG'S HAT. Thirty miles of easy rural pedaling. Meet 10 a.m., corner of parking lot, Acme Super Saver, Hight St. (Rt. 541) & Ridgely St., Mt. Holly. (609) 267-7052.
- 31 6TH ANNUAL CANOE JAMBOREE at Monmouth County Turkey Swamp Park. (201) 842-4000.



JUNE

- 1 DELAWARE/RARITAN CANAL FISHERMAN'S ASSOCIATION South Bound Brook Fishing Derby. (From Lock 10 to Lock 11 on canal.) Dawn to 7:30 p.m. Juniors—no license required (under 14 yrs.). PRIZES. (201) 356-5384 or (201) 469-2710.
- SATURDAY SAILBOAT RACES at Spruce Run Recreation Area, Clinton. (201) 638-8572.
- 4, 7 FLOWER TOURS OF NATIVE RHODODENDRONS AND ANNUALS at Skylands, the State Botanical Gardens, Ringwood. (201) 962-7031.
- 8 ART SHOW to benefit the Natural Lands Trust; works by Stefan Martin on display at Ark II Gallery, 33 Mine Street, Flemington, NJ 08822. (201) 782-8235.
- 8 DECOY SHOW—Special commemorative postmark and cacheted covers available at Batsto Post Office, Wharton. (609) 561-0024.
- 8 DOG SHOW AND ETHNIC FESTIVAL at Liberty State Park, Jersey City. (201) 435-0736.
- 14 INNERTUBE FLOAT—HARRISON-BODINE. Meet 10:30 a.m. just below Harrisville Dam, Rt. 679 (563 spur on old maps), about 11 miles south of Chatsworth. Bring innertube and old sneakers. Children and weak swimmers must wear life jackets. (609) 267-7052.
- 21 SUNSET LAKE AMPHITHEATRE/HISTORIC BRIDGETON. Third Annual Folk & Bluegrass Festival, 3 to

8 p.m. Parking charge, \$2.00. (609) 451-4802.

- 21 FIVE MILE RUN at Cape May Point State Park. (609) 884-2159.
- 25-28 OPEN AIR THEATER Presentation of "Measure for Measure" at Washington Crossing State Park, Titusville. (609) 737-0609.
- 28 STROH'S RACE at Liberty State Park, Jersey City. (201) 435-0736.
- 28 MORRISTOWN CIRCULAR BIKE RIDE. Meet at Jockey Hollow Visitors Center off Tempe Wick Rd. at 10 a.m. Moderate—21 miles. (201) 362-5253.
- 28, 29 COLONIAL ENCAMPMENT with reenactment (6/29) of the Battle of Monmouth at Monmouth Battlefield State Park, Freehold. (201) 938-2731.
- 29 LIBERTY DAY CONCERT by Sweet Adelines at Allaire State Park, Farmingdale. (201) 938-2731.
- 29 WINDSURF & SWIM, SPRUCE RUN RESERVOIR. Meet 9 a.m. at Boat Launch of Rt. 31 near Clinton. (201) 637-6676.
- 29 WHITESBOGS BLUEBERRY FESTIVAL AND CROSS COUNTRY RUN with craft show and tours of village and bogs. Lebanon State Forest, New Lisbon. (609) 726-1191.
- 28-JULY 6 LIBERTY WEEK at Liberty State Park, Jersey City. A variety of special events are scheduled—an American music spectacular with the Boston Pops, a New Jersey Pops concert, a performance by International Ballet Stars II, Opsall '86, an international naval review, the world's largest fireworks spectacular and more. Some will require admission fees, some advance ticketing. Watch your local paper for admission and ticket information.

JULY

- 3-12 OPEN AIR THEATRE PRESENTATION of "The Music Man" at Washington Crossing State Park, Titusville. (609) 737-0609.
- 4 INDEPENDENCE DAY CELEBRATION at Allaire State Park, Farmingdale. (201) 938-2371.

To avoid disappointment, it's best to call the numbers listed for more detailed information about each particular event.

Toward a Cleaner River

BY JAMES GAFFNEY

In the early 1970's the nation became painfully aware of the fact that our rivers and streams were severely polluted and that dramatic cleanup action was needed. That increasing recognition prompted Congress in 1972 to pass stronger legislation—the Clean Water Act—to cope with the problem. The Act gave the states the responsibility for making their waters “fishable” and “swimmable” by 1985.

The task was not a simple one. Cleaning and protecting waters was made complex by a variety of sources of pollution—municipal, industrial, non-point and dredge and fill activities. Since municipal and industrial wastewater was a major problem and could be controlled by construction and operation of sewage treatment plants, the Clean Water Act mandated a program of federal grants to share the costs (up to 75 percent) with the state and local governments.

The work began, but cleanup of rivers and streams proved much more time consuming than first was realized and various amendments have been passed which have extended the deadline for cleaner water to 1988; the basic requirements, however, remain unchanged.

Good Progress Made

New Jersey has made good progress in the program, and today there are some 430 municipal sewage plants that treat combined domestic and/or industrial waste. The result is a gradual improvement in water quality in many rivers and streams throughout the state. While most of these plants are secondary treatment plants, a few areas in the state have constructed advanced treatment facilities.

One of these operates on a major tributary of the Raritan, the state's longest river. This is the River Road Plant, just below Carnegie Lake dam on the Lower Millstone River in Mercer County. It has been operated since 1979 by the Stony Brook Regional Sewerage Authority. River Road is designed to clean up sewage from Kingston, South Brunswick and West Windsor and Princeton and sludge from plants in Hopewell and Pennington.

The purpose of wastewater treatment plants is to concentrate the physical, chemical and biological actions of a river or stream to reduce household and industrial pollution levels and raise dissolved oxygen levels. The process is as follows: wastes flowing into the River Road plant first enter aerated grit chambers designed to stimulate oxygen-loving bacteria to convert the carbohydrates in the sewage into carbon dioxide and water. The grit is removed, then the waste is combined with activated sludge and enters aeration tanks. Here large mechanical aerators produce a spray. This action is reminiscent of the way in which sprays of water, bouncing off boulders in fast flowing streams, increase the water's oxygen levels and stimulate oxygen-loving bacteria to decompose carbohydrates.

Next, the bacteria-laden wastewater enters tanks and is settled out as sludge. Part of the sludge is recycled and the rest is sent on to sludge-thickening tanks. After this, the sewage enters the nitrification process where ammonia is converted into nitrates and nitrites with oxygen-loving bacteria. Part of the nitrate/nitrite sewage is reused and the rest enters the nitrification settling tank—again simulating the action of a river.

The nitrified sewage next goes through special filters to remove suspended solids and colloidal materials. Then chlorination removes the high buildup of pathogenic and beneficial bacteria, and sulfur dioxide reduces the chlorine level to safe limits. Next the suspended solids are sent to tanks where mechanical aerators increase the dissolved oxygen. What's left is discharged into the Lower Millstone River.

What has the River Road plant done for the Lower Millstone? The water going out the plant is considerably cleaner than the water that spills over the Carnegie Lake dam. Non-point pollution from erosion and stormwater runoff brings phosphorus and nitrogen—setting up conditions that favor algae growth in late summer. It also brings pesticides, chromium, lead, oil and grease into Carnegie Lake and the Millstone River. Point sources



METCALF AND EDDY ENGINEERING CONSULTANTS

The River Road plant on the Millstone River is one of the state's advanced sewage treatment facilities.

like Princeton's aged sewer lines result in water with high fecal coliform counts entering Carnegie Lake and Stony Brook. The East Windsor plant is operating above capacity and discharges some untreated waste into the Upper Millstone.

State water quality standards, designed to measure whether a river is clean enough to support fish, to supply drinking water and be used for recreation have classified the Lower Millstone below the River Road plant FW2—non trout waters. This means there should be warmwater fish species like sunnies, largemouth bass and pickerel in the Lower Millstone and that it can be used for water supply, boating and swimming. (Since trout require high oxygen levels, cool temperatures and low suspended solid and ammonia levels to survive, the cleanest waters in the state are classified, trout production waters.

Suitable for Fishing

Is the river suitable for fishing? The Lower Millstone is self-supporting for largemouth and pickerel. In other words, the Bureau of Freshwater Fisheries in Department of Environmental Protection's Division of Fish, Game and Wildlife, does not stock the river with these species; they live and grow there on their own. The Bureau *has* stocked the Raritan River with blueback herring, an important food source for anadromous and

warmwater fish and the blueback herring have moved up into the Lower Millstone. Many fishermen, canoers and kayakers use the Lower Millstone from spring through fall, gaining access from the Delaware and Raritan Canal State Park.

Has the River Road plant met the requirements for swimming in the Lower Millstone? The "swimmable" criteria sets levels at which pathogenic bacteria could be unhealthy for humans. This is important on the Lower Millstone since the Elizabethtown Water Company withdraws Lower Millstone water for its drinking water customers if it cannot obtain enough from the Raritan Canal (adjacent to the Lower Millstone). During last year's Canal dredging, the water company relied on the Lower Millstone for drinking water supply a great deal.

Due to its meandering nature and shallow topography the Lower Millstone is not deep enough under normal circumstances for swimming, diving or water skiing. In fact, the discharges from the River Road treatment plant currently meet state criteria for a "fishable" and "swimmable" Lower Millstone. Now the Authority is wrestling with improving the Stony Brook and the Upper Millstone water quality to be "fishable," more suitable to other forms of recreation and at the same time dealing with the effects of the explosive Route One Corridor growth on the Lower Millstone's water quality.

STONY BROOK WATERSHED ASSOC.



The Millstone is a major tributary of the Raritan River.

The Other Gap

BY FRANK T. DALE



Did you ever wish, while admiring our beautiful Delaware Water Gap, that the highways, bridges, and people would vanish, that only the fabulous geography would remain, pristine and secluded? Well, there is such a gap on our Delaware River and it is not far away.

Walpack Bend is located near Flatbrookville, New Jersey, just downriver from Bushkill, Pennsylvania. It is part of the National Wild and Scenic Rivers Area. There are no nearby highways and this Gap can be reached only by canoe. The course of the river is deflected by high, rocky ridges so that it completely reverses direction twice in the space of a mile or so. Nowhere else in its entire length does the Delaware make such a spectacular reversal.

The river here is squeezed by ridges and mountains on both the New Jersey and Pennsylvania sides, creating a faster water flow and some very respectable rapids. Here, too, both the Flatbrook and Bushkill discharge their cold mountain waters and bountiful trout, making this an outstanding fishing area.

The Bushkill Access area on Route 209 in Pennsylvania is the best spot to enter the river for a trip through Walpack Bend.

As you push off, the river seems straight and wide but even from here, looking downstream, you can see a mountain apparently blocking the way. The left bank of the river is a ridge of rock. As you proceed you're sure the river must disappear down a giant drain—it seems to go straight as an arrow to the mountain front.

Look out! "V's" on the water surface pointing upriver indicate boulders.

Suddenly, the rock wall which was on the left bank disappears and the river rushes through this breach, turning eastward and then northeastward, completely reversing directions. It is just opposite this breach that the Bushkill River enters on the right. This outstanding Pennsylvania trout stream feeds fish into the river here and the deep eddies at this confluence hold that behemoth of the Delaware, the muskellunge, lurking in the cold water, waiting for a feast of trout.

The rock ledge that was originally the left bank now appears on the right, only now it is much higher. Near water level it is a sheer wall but as it rises, it slopes gently and is covered with hemlocks and a few hardwoods. If your

eyes first opened at this point, you'd guess that you were in the Maine wilderness.

The main channel of the river hugs the right bank in the shade of this imposing cliff wall and the river is deep and dark. Occasionally huge, sharp-angled boulders broken off ages ago from the cliffside appear suddenly in the dark depths of the water, some reaching up to within inches of the surface.

A river map published by the Delaware River Basin Commission indicates a river depth here of 25 feet. In a footnote, it tells us that this is a nesting area for bald eagles in the spring. I've never seen any eagles but redtailed hawks are a common sight, soaring in pairs above the river, calling to each other. Shad are here in the spring and early summer and after spawning can be seen swimming in schools, fins above water.

As you proceed around the bend, the river widens somewhat and becomes less deep. The huge boulders are exposed all across the river, creating rapids whose ominous roar gives fair warning.

Again, the river is racing toward a drain, it would seem, for blocking its passage is the Kittatinny Range, highest in New Jersey. And again, at the last moment the river turns, this time to the south, seaward. At this bend another mountain stream enters, the Flat-

brook, from the New Jersey side.

Now the river resumes its rightful direction, with the high, forested Kittatinny Mountains on the left bank. The Walpack Bend experience is almost complete—but wait! Again you're greeted with an angry growl, the roar that portends white water. Indeed, in the distance you can see white, frothy water leaping up.

As you near the rapids, really a series of three, look for the "V's" on the water surface pointing downriver, for these indicate your route. The "V's" pointing upriver indicate boulders and there are many of these. The canoeist in the bow will earn his keep!

It's impossible to describe the location of these huge, barely submerged blocks of stone, for at different water levels different boulders appear near the surface. And I believe even their location changes from year to year. So be alert. Kneel in the canoe to give you more stability, and by all means wear your life jacket. And good luck. When you've passed through these rapids you've completed the most exciting stretch of white water in the New Jersey section north of Foul Rift at Belvidere.

Best of all, you've experienced a canoe trip of exhilarating beauty and solitude.

You've passed through a true river wilderness—Walpack Bend.

Left: Bird's Eye view of the gap.

PHOTOS BY DIANA DALE



The Catfish Secret

BY BOB McDOWELL

ILLUSTRATIONS BY CAROL DECKER

One of the best kept fishing secrets in New Jersey is the fabulous variety of catfish and the fishing opportunity that these whiskered fighters offer the Garden State angler.

There are three major species of catfish in our waters that command the attention of "catfish insiders" who know the angling pleasure these freshwater fish provide.

The most common catfish in our state is the brown bullhead. It is found in streams, ponds, large lakes and rivers throughout the state. The other two species, widely distributed and popular with fishermen, are the white catfish and the channel catfish. There are several smaller species of catfish such as stone catfish and madtoms which are less frequently encountered.

The white catfish and brown bullhead are natives in our state waters. The channel catfish was imported from the mid-west and stocked in many of our streams and lakes by the Division of Fish, Game and Wildlife. In addition, all the species have been introduced by helpful fishermen giving them a ride in live bait buckets and releasing them in waters where historically they were not found.

The largest of the three species is the channel catfish which may get as large as 50 pounds. Our current state record is 33 lbs. 3 oz. which was caught in Morris County's Lake Hopatcong in 1978. The white cat reaches a length of 24 inches, and the current New Jersey record for the species is 10 lbs. 5 oz. which was caught in the Raritan River in 1976. The smallest of the three is the brown bullhead. The current state record for the species is 2 lbs. 1 oz. which was caught in 1983 in the Passaic River.

To an experienced eye these catfish are easy to distinguish. The channel cat is the more streamlined of the three. The upper portions of the body are light gray and the sides and belly are a silvery white in color. The two most obvious characteristics are small dark spots on the sides and the deeply forked tail.

The white catfish is chunkier, and has a wide head and mouth. The upper portions of the body are a dark gray-blue and give way to a light bluish side and a snowwhite belly. The whiskers are black on the upper jaw and white on the lower jaw. The most outstanding characteristic is the blue eyes. This catfish's tail is not sharply forked as the channel cat's and the ends of the tail are rounded.

The brown bullhead is the least colorful of the three and as the name implies, the upper portions of the body are dark brown. The sides of the fish are a mottled brown and the belly is tan to yellowish. The tail is rounded with only a slight indentation in the center as opposed to the more forked tail of the other two species.

All three catfish have similar life histories. They lay their eggs in nests during the spring and the adults guard the eggs and the young. In fact, as a boy growing up on a north Jersey lake, in the late spring I frequently saw softball sized, swirling masses of baby catfish in the shallows. It was great fun to catch the young cats for observation, and on several occasions the adult catfish tried to chase my intruding hand away. The "catfish attack" was amusing and added to the experience.

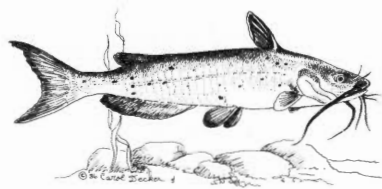
Catfish usually inhabit the slower, deeper areas of the body of water they live in. However, the channel catfish is often found in the swifter portions of larger rivers and streams. They eat just about anything including minnows, crustaceans, worms and insects.

Just like their whiskers (biologists like to call them barbels) all these catfish also have a spine or barb on the leading edge of their pectoral and dorsal fins. When frightened they erect these sharp instruments. When handling catfish one must be careful to avoid these, especially with a just caught, wiggling fish. However, catfish are no more dangerous to handle (contrary to some old wives tales) than other species such as yellow perch or largemouth bass.

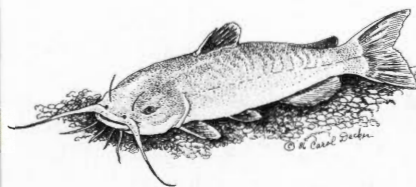
Catfish are eager to bite almost any time of the year, even during ice fishing season. But the best time is the spring and fall. The most important consideration is the time of day. The best fishing occurs during the evening and after dark. Catfish may be caught during daylight hours but they will be found in the recesses of the deeper holes and will be less willing to accept the bait.

Perhaps the best reward for the catfish enthusiast is the fine eating these fish provide. There are truly "the chicken of the sea" of freshwater fish. Deep fried and served with "hush puppies," they are hard to beat.

For information on waters stocked with channel catfish by the Division of Fish, Game and Wildlife, send a self-addressed, stamped envelope to: Catfish Stocking List, Division of Fish, Game and Wildlife, CN 400, Trenton, New Jersey 08625.



CHANNEL CATFISH



WHITE CATFISH

FRONT COVER

Island at end of Ken Lockwood Gorge. Photograph by Cornelius Hogenbirk

INSIDE BACK COVER

Brown Bullhead. Illustration by Carol Decker

BACK COVER

Great Falls at Paterson. Photograph by William D. Griffin



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