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Cover: Crater Lake research boat is launched from new boathouse to sample lake water, algae, and zooplankton on a still icy March lake.

In the world of communication, James Gorman may have come up with a winner. Gorman is the author of a column entitled "Light Elements," and in the November 1986 issue of *Discover* he tackles the problem of how to communicate ecological principles. His essay is "The Granola Factor, or the Track as a Model Ecosystem," and in it he expounds, both humorously and with scientific integrity, on the validity of ecological principles as they work in human society.

Gorman makes the obligatory bow to such timeworn analogs as "the pond" and "the tragedy of the commons," and then goes on to couch his human ecology lesson in terms of a true story at Saratoga Raceway in New York State. The column demonstrates in entertaining fashion how even the least likely pockets of human society can furnish updated ecological metaphors. Park interpreters, in concert with park scientists, could probably add enormously to the effectiveness of their park programs by borrowing a page from Gorman's saucy little "book."

In a nutshell, the Gorman tale describes how an entrepreneur in manure turned the waste products from 1,100 trotters and pacers from a \$100,000 a year loss to the track (the cost of carting the stuff away), into a \$300,000 income item. Robert W. Morris set up a system based on the U.S. Department of Agriculture's sludge composting operation in Beltsville, Md., that transforms the daily 150 cubic yards of manure, straw, and sawdust from the horses' stalls into rich, crumbly compost that a garden guru has called "brown gold."

Gorman paints the operation as "efficient, elegant, ecologically sound" and couches his message in terms that can be readily grasped and appreciated by today's audiences: namely, as an operation "developed not out of a sense of oneness with all life, but for the sake of **money**."

In replacing the pond as an ecological model, Gorman points out that "a racetrack operation is built on the \$2 bettor, whom we might compare to photosynthetic phytoplankton, or algae. In the pond, the plankton and algae capture the energy of the sun and form the base of the food chain. At the track, the \$2 bettors do something similar. They provide the money. The parimutuel betting system, through which this money flows, guarantees that all life forms at the track are interdependent, as in natural ecosystems."

Gorman goes on to describe how betting on the various horses affects the odds and demonstrates their closely tied relationships. He draws further analogies between the pond, where sunlight, vegetation, and bigger and bigger animals feed on one another, and the track, where money is transformed into fancy cars, stocks and bonds, and so forth, as a result of action at the betting windows.

Gorman's final paragraph sounds the clarion call to park interpreters. It completes the ecosystems analogy and puts the challenge directly to those of us who are trying to make national parks as meaningful as they can be only if they are interpreted at their splendid, self-maintaining best. Concludes Gorman:

"I put \$2 to win on Love Champ in the first. She surged ahead at the wire and paid 10-1. I also bought some Saratoga Organic that day, and later I worked it into my garden. The way I see it, Love Champ not only won me \$20 but next spring she's going to make my tomatoes grow. Now **that's** ecology."

One final word. In no way should this editorial be interpreted as a moral defense of gambling. The fact that many people find racetrack action one of the less glorious ways of spending time and money is part of the point I wish to make — which is simply that ALL systems, whether viewed subjectively as "good," "bad," or "indifferent," are **objectively systems**, and the general principles that drive them are identical. This is the message America's national park owners (the "visitors") deserve to hear during their sojourns in the magnificent National Park System.

APPROXIMATE DEADLINES FOR RECEIPT OF MANUSCRIPTS

Winter issue: November 1
Spring issue: February 1

Summer issue: May 1
Fall issue: August 1

WILLIAM PENN MOTT, JR., Director
National Park Service
U.S. Department of the Interior

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Jean Matthews, Editor: Oregon State University NPS/CPSU, Room 110 Forestry Sciences Lab,
3200 Jefferson Way, Corvallis, OR 97331 (503) 757-4579; 8-420-4579

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Crater Lake Accomplishes First Winter Water Quality Sampling

By Jonathan B. Jarvis

Since the initiation of the Crater Lake NP (CRLA) Limnology program in 1982, the need has existed to monitor the lake water quality in winter. All sampling in the past has been restricted to the approximately 90 days of summer. Data collected only in summer restricts the interpretation of the understanding of overall water quality. Winter logistics are extremely difficult, since the park receives over 500 inches of snowfall each year and the lake lies at the bottom of cliffs ranging in height from 600 to 2000 feet. Once on the lake, the boat used must be capable of extracting samples from the entire 2000 feet of lake depth. Still, winter monitoring was determined to be essential to understanding of the Crater Lake ecosystem, so preparations began in early 1985 for a trip in the winter of 1986.

Boathouse is Constructed and Stocked: In the summer of 1985, CRLA staff, a Student Conservation Association High School Work group, the Tokete Hot-shot fire crew, and the Medford Reserve Seabees constructed a boathouse on Wizard Island. The boathouse consists of a marine rail system with generator powered winch and cable, attached to doli-ies that allow the removal and deployment of the park's two primary research vessels. The rear of the boathouse is designed as a separate work/storage/sleeping area of approximately 360 square feet. At the end of the summer, two metal cabinets on the raised floor were stocked with non-perishable food items. Food for four persons for 30 days was estimated and stored. Three 55-gallon drums of gasoline, hand pump, outboard oil and spare parts were stored in the main area of the boathouse. Tools, lumber, nails, insulation, and a variety of other necessary items were left in the boathouse when it was closed in the fall.

Preplanning and Practice: A "Position Statement and Operational Plan for Winter and Spring Research on Crater Lake, Crater Lake National Park 1986" was prepared, reviewed and approved. Several methods for access were studied, and it was determined that helicopter transport was the safest. The use of a tree-lined corridor and/or avalanche prone snowchute were considered only as an exit route in an emergency. A practice session was carried out with team members plus CRLA ranger staff. They practiced self arresting, ice axe techniques, and teamwork on snow, and spent the night in snow caves within the caldera. Contacts were made with helicopter contractors and with the 304th Air Force Unit. Press interest developed and was accommodated by the park PIO and the Team Leader. The team expected to set-up a field laboratory in the boathouse, so necessary lab instruments and chemicals were boxed for transport to the island. All equipment was weighed, labeled and numbered for slingload transport. An important item in this equipment was a Zodiac inflatable boat with a 25hp engine, to serve as back-up to the researchers and access to the shore if use of the tree corridor was necessary as an emergency exit from the caldera.

In January and February, 1986, two attempts were made to reach the lake. Both were canceled when inclement weather restricted use of the helicopter.

Chronology of Successful Sampling Trip:

March 4: Based on the U.S. Weather Bureau's predictions of a strong high pressure through Friday, a

helicopter was contracted for transport of the team to the Island.

Team Members:

Jon Jarvis, CRLA Resource Management Specialist, Team Leader

Roger Andrascik, CRLA Park Ranger, Alternate Team Leader

Jerry McCrea, CRLA Biotechnician

Mark Buktenica, CPSU Biotechnician

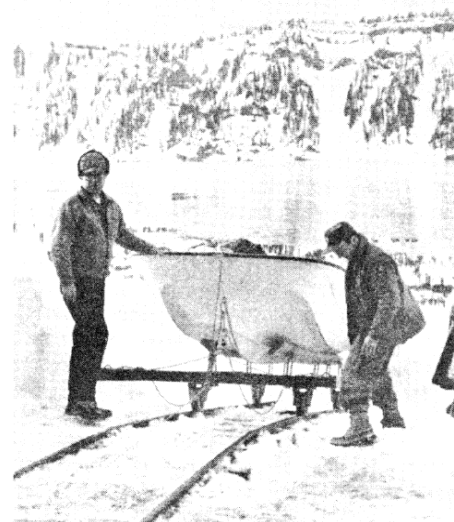
Gary Larson, NPS Aquatic Ecologist and CRLA PI.

The helicopter transported the team and four slingloads of equipment to the island without problem. The remainder of the day was spent shoveling 15 feet of snow away from the front of the boathouse and preparing the boats for deployment.

March 5: The Boston Whaler was deployed in excellent weather and the following tests were completed at Station 13: Physical/Chemical: temperature, chemistry, photometer, secchi, trace metals, color; Biological: phytoplankton, zooplankton. The Zodiac was inflated as a back-up boat and two team members remained in the boathouse to serve as rescue.

March 6: On this day the rain began, with 1.45 inches of precipitation recorded for the 24 hrs. The following samples were taken at Station 13: Biological: chlorophyll and nutrients. Springs also were sampled for nutrients. Numerous avalanches, some of very large size, were observed within the caldera.

March 7: The rain began to switch to snow with 2.02 inches of precipitation in the 24 hour period. A small field laboratory was set up and the chemical (SC, DO, TA, and pH) analysis of samples collected over the previous days was completed. A generator operated the instrumentation. Though the field and laboratory work was complete and the team was ready to leave, the weather did not permit the use of a helicopter. Forecast from the U.S. Weather Bureau and the Northwest Avalanche Center did not predict a window for helicopter flight in the next 24 hours.



Out to launch the research boat, after digging out the ramp from boathouse to water's edge, are Gary Larson (left) and Jerry McCrea.

March 8: Overnight, the temperature fell to 24F and .79 inches of precipitation fell. The team members continued routine tasks in the boathouse and waited for the window to return. A plan of escape was developed in anticipation of having to climb out to save the samples before they were spoiled by time. The water samples were divided evenly to equal 28 lbs. per person. Each person emptied his pack to keep weight under 50 lbs. The team would use the tree corridor to climb out, thereby avoiding the use of the avalanche prone chute. The Zodiac would be used to access the shore and it would be cached at the tree corridor for future use. The team went to bed anticipating the climb out.

March 9: Overnight, the temperature fell below 19F and .31 inches of precipitation fell. A window in the weather finally opened in late morning and the helicopter lifted the team and samples from the island. Samples were then analyzed in the park laboratory and the Forestry Sciences Laboratory at Oregon



The first ever winter lake sampling team at Crater Lake NP poses at the water's edge. Left to right, Mark Buktenica, Roger Andrascik, Jerry McCrea, Gary Larson (principal investigator), and Jon Jarvis (resource management specialist and author).

Crater Lake

Continued from page 3

State University.

Conclusions and Findings: The data collected during the winter trip were not by themselves significant. However, they provided the background for understanding the data collected in the following summer. The nutrient recharging that occurs during the winter sets the stage for the summer's biological activity. Only through comparison to the winter data can we understand the significance of the summer data. It also was noted that avalanches carry large volumes of soil into the lake during the winter and this contributes significantly to the water clarity measurement values. Actual data collected on the trip will be published in the 1986 Crater Lake Limnology Annual Report, available in late winter, 1986. We have shown that Crater Lake can be successfully sampled in winter with proper planning and preparation. Future trips are planned for FY87.

Jarvis was Resource Management Specialist at Crater Lake NP until October 1986, when he became chief of Resource Management at North Cascades NP.



Nice place to visit, but you wouldn't want to live here is the verdict from Jon Jarvis (left) and Roger Andrasik as they look over the team quarters behind the boathouse.

Crater Lake NP Supt. Bob Benton has announced a new action plan for the park, based on the Director's 12 point plan. Among recent accomplishments, in addition to development of a complete inventory of historic, current, and future Crater Lake water quality data:

- Completion of the Natural and Cultural Resources Management Plan for the park.
- Removal of hazardous and toxic wastes from the park.
- Inclusion of the Bicentennial of the Constitution into Crater Lake interpretive programs.
- Assignment of interpretive personnel to the Lake research vessel. (Interpretive rangers were able to give visitors the latest findings from Lake studies during the 1986 summer season.)

Scientists, Superintendents Differ On Researchers' Role in RM Region

By Katherine P. Kitchell and Rosemary Nichols

In a recent study of the effectiveness of the National Park Service science program conducted in the Rocky Mountain Region, both scientists and park managers with scientists in their parks commented extensively on who should supervise a park's research program and the critical role of the park scientist. Three questions dominated expressed concerns:

To what extent should park scientists contribute to resource management and other non-research activities?

Rocky Mountain scientists and superintendents agreed about the researchers' responsibility to conduct and publish their own research, but disagreed about the appropriate degree of involvement of research personnel in resource management. As Table 1 indicates, some scientists were more willing to assume non-research duties than others.

Some superintendents thought that reviewing resource-related reports and extramural research proposals were appropriate activities for park scientists. Others needed assistance with writing and reviewing resource management plans and thought that scientists should provide it. Both superintendents and scientists recognized that assignment of research personnel to non-research tasks often led to conflict between them and reduced job satisfaction for scientists. Superintendents, however, did not share the scientists' view that their use as consultants jeopardized their professional development.

Should park research programs and scientists be controlled by superintendents?

Due to the potential for their being detailed to resource management, Rocky Mountain Region field

scientists, who have reported to superintendents or assistant superintendents since the 1984 decentralization of the science program, contended that park scientists should be independent of park managers. Scientists felt that placing research personnel under the authority of superintendents resulted in a research program characterized by crisis management and research priorities that reflected the superintendents' personal preferences.

According to some scientists, transfer of park superintendents resulted in changes of research direction and emphasis and the termination of projects underway.

From the scientists' perspective, among the disadvantages of greater control of field research by superintendents was that superintendents regarded attending professional meetings and seeking recognition by other scientists as unimportant. Park scientists thought that, without superintendents' support for seeking professional recognition and attending professional meetings, they could not meet the performance standards for scientists specified in the National Park Service's research grade evaluation process.

Superintendents supported their supervisory authority, citing responsiveness to management needs, avoiding controversy, and the ability to program research like construction or maintenance as advantages. In contrast to scientists, superintendents thought that supervision of scientists by the regional or Washington offices allowed scientists to work on projects of interest to them rather than park priorities. From the superintendents' perspective, regional office control of research personnel jeopardized field-level managers' commitment to research.

How can superintendents and scientists

Table 1. Park scientists' responsibilities: areas of agreement and disagreement between superintendents and the scientists themselves.

Both scientists and managers **strongly agreed** that scientists should:

- Conduct management-oriented research
- Provide professional consultation on resource decisions
- Review documents related to resource management issues
- Convey constraints on research in parks to non-Park Service scientists
- Place *their own* research results in the management context
- Compile and synthesize technical information
- Publish their research results

Some managers and scientists **agreed** that scientists should:

- Supervise contract research
- Write resource management plans
- Review resource management plans
- Evaluate proposed resource management actions
- Review *others'* research proposals and research results
- Strive to establish a respected professional reputation
- Place *others'* research results in the management context

More managers than scientists thought that scientists should:

- Review documents related to resource management issues
- Evaluate *others'* proposals and research results

More scientists than managers thought that scientists should:

- Identify and define research problems
- Seek peer recognition

Some scientists and **no** managers believed that scientists should:

- Make presentations at professional meetings
- Compete for scientific honors and awards

be made more responsive to each other's needs?

Basing research conducted on the priorities set in a park's resource management plan was suggested as a solution to managerial concerns about park research meeting management needs. Scientists believed that the consistent use of the research grade evaluation process would encourage higher productivity and research quality, but felt that the process may need to be modified to enhance responsiveness of researchers to management priorities.

The current research personnel evaluation process requires that scientists be rated according to their research assignments, qualifications, supervision received, originality, and research contributions. Evidence of attainment may include technical publications, reports to management, awards and peer recognition, or an evaluation of a scientist's work by a recognized authority in his field.

Several interviewees suggested resolving the question of control over scientists assigned to parks by adding to a scientist's research grade evaluation a performance standard evaluating his responsiveness to his park's research needs. Such a standard could be identified by a superintendent in cooperation with the scientist and regional science staff through the resource management planning process. The existing elements of the research grade evaluation process would encourage and support the professional development of scientists, while the addition of standards for responsiveness to management needs would result in more accurately targeted research programs.

Both scientists and superintendents suggested that holding park superintendents accountable for the support of research and of scientists in their parks could resolve the problem of superintendents' assigning scientists to non-research tasks. Accomplishing this, it was suggested, might require rewriting the position descriptions for superintendents as well as adding an emphasis on successful communication with scientists to the selection and promotion of superintendents.

Kitchell, a research assistant in the Department of Forest Resources at Utah State University at the time of this study, is now Park Ranger-Resource Management at Canyonlands National Park. Nichols is a consultant on public lands policy with particular interest in the national parks.

Table 2. Attitudinal and professional differences between park managers and scientists.

Dimension	Managers	Scientists
Values	Agency and societally based Include political feasibility	Professionally based Exclude non-rational considerations such as politics
Knowledge	Generalized	Specialized
Objectives	Practical and political Serving the public Implementing policy	Theoretical and factual Searching for "truth" Answering research questions
Reward Systems	Based upon actions Output-oriented	Based upon thought and ideas Process-oriented
Orientation to:		
Time	Highly constrained at times Short-term view Focused on the day-to-day	Rarely constrained Long-term view Focused on futures (e.g., ecosystem changes)
People	Emphasis on interaction with others	Emphasis on working independently
Research	Applied research preferred Often needed immediately	Basic research often preferred Many projects require multi-year study

Briggle Challenges PNR Scientists To 'Bridge the Management Gap'

By Jean Matthews

A three-part agenda for scientists who "want to make your voices heard" in the parks where they do research was offered by Pacific Northwest Regional Director Bill Briggle at a November meeting of the regional scientists in Seattle.

"You can't achieve your own goals without the cooperation of park management," Briggle suggested, "and in order to gain this cooperation you need to (1) develop management's confidence, (2) cooperate with management in meeting *their* needs, and (3) deliver a quality product."

Briggle challenged the scientists to think through the process involved in starting and carrying out a research program. How do the scientists and the manager come to know each other's expectations, he asked. Management often doesn't know what it wants. Some managers wait for a scientist or a planner to define the problem. This is the part of the equation, Briggle said, where management must do its own homework . . . "sit down and think through what the actual management needs are in terms of research."

"But then," he continued, "it's up to the scientists to be up-front with management and spell out the long-term goals of the proposed research." He conceded that this is probably the most formidable stumbling block in the present process. "Scientists tend not to lay out the long-term commitments needed, for fear the superintendent will throw up his hands and reject everything. I know this is true for I've done it myself," Briggle said.

His suggestions for bridging this "understanding gap" encompassed the idea of presenting research proposals that include some short term pay-offs – some "immediate gratification" to park management along the way to the longer range goals.

But above all, Briggle urged more openness on the part of scientists in describing and justifying the longer range aspects of their research. "Firming up a partner-

ship between science and management means finding ways of reaching real understanding of what each of your agendas is," he said. "I think we have done very well at this, up to the point where the scientist is hesitant to go the last mile in describing the commitment he needs from park management and where the park is substantially in the dark about that long-term commitment."

Briggle painted a theoretical scene, drawing from his own experience as a superintendent. "You come in with a project for reestablishing native grasses. The superintendent sees tall prairies with shoulder high grasses rustling in the wind and Indians dancing carefully on the green. *You* know this is a long-term dream. *He* may want, and probably deserves, a product he can expect to see in his own lifetime!"

Briggle described the needs of a regional director, from his point of view, as "an active dialogue on the cutting edge issues." He told the scientists: "I'm very keen on trends. I want to know what's happening out in the parks of this region and what problems are developing that we might tackle and solve right now – with the knowledge we already have – instead of studying them while they worsen. How do we get around to the front end of these developing problems and handle them *before* they become crises?"

He described NPS Director Mott's interest in park science as a commitment to "the calculated risk." The Director is telling you to be forthright in your assessment of the scientific aspects of park problems, Briggle said. "He's saying you should put *all* the management options into your reports – not just the ones that are likely to meet with public approval. If shooting alien species to rid the park of their deleterious effects is likely to be the only viable action option, then say so. We need to plug in our public relations effort at this point, so as to educate the press and the public and deflect as much as possible the offended, outraged reactions that are sure to emerge. If you give us a report that does not forcefully address this option, you have delivered a 'study' that is going nowhere."

Admittedly, said Briggle, this is a tall order. "It means stepping off a cliff we've been reluctant to step off," he said. "But the alternative is to sit on our science and then dump it all on the public in an Environmental Assessment statement, with no preliminary attempt to educate."

The Director, Briggle said, has indicated that he expects science to do its job for management up to the point where further study (and public silence) is counter-productive, and the time comes for "the calculated risk." He recognizes that this is likely to produce flak we haven't generated before, but in actuality we are only generating flak that would come anyway – and we would be introducing the flak at a more manageable point in the overall process."

Briggle emphasized the team nature of this way of doing things. "It means we have to be completely candid within our own ranks," he pointed out. "We all have to understand one another's goals and objectives and the risks involved. We need to communicate not only outside the Service but with one another. Interpretation and our public information offices must be plugged in throughout the process. The entire operation could use this vehicle for becoming more internally aware. So let's get on with it!"

Interpretation, Management, Science Ties Promoted Through Interregional Workshops

By Jean Matthews

More than 75 research scientists, resource managers, and interpreters, mostly from the National Park Service but also representing the Forest Service and the California Department of Fish and Game, gathered in mid-September at a lodge just outside Sequoia and Kings Canyon National Parks for the third in a series of interregional workshops designed to bridge the gaps between scientific research, resource management, and interpretation in National Parks. NPS Director Mott has strongly endorsed the workshops.

Pacific Mountain Parks was the title of this latest interregional gathering; it followed a May 1986 workshop on Southwest desert parks and a February 1985 workshop on coastal parks. Dick Cunningham, Chief of Interpretation in the NPS Western Region, conceived and has led all three workshops, and a 1987 session on island parks is tentatively slated for Hawaii.

Three superintendents – John Davis of Sequoia and Kings Canyon, Gil Blinn of Lassen Volcanic, and John Reynolds of North Cascades – opened the 5-day sessions with descriptions of their parks' problems and opportunities and the interpretive steps being taken to bring the public into an understanding of, and support for, park management.

Blinn, for instance, spoke of a "walk on water" interpretive program, dramatizing the role of water in an ecosystem. He described field seminars held in conjunction with the Loomis Museum Association, bringing in outstanding speakers to help the park staff and seasonalists better understand their own park, and spoke of computer tie-ins with other National Parks for comparison of wildlife, eruption area recovery rates, and other matters of an interpark nature. Overnight facilities for visiting researchers, provided by the park, have made possible exchanges with scientists from Mount St. Helens and have enriched the Lassen Park staff's store of knowledge about their own park, Blinn said.

Science and Politics

Reynolds stressed the relationship between science and politics in National Parks and dwelt at some length on the need to conduct and interpret research within the context of an overall "sense of fitness and pride in the resource we manage." He urged the workshop participants to "think this week in terms of the future and holism. What is in one's mind can become a reality. We don't have the luxury," he said, "of simply taking hold of the past and shoving it into the future."

A fourth superintendent, not actually present, also was heard from when Reynolds quoted Bob Barbee of Yellowstone NP: "Harnessing an elk, a moose, and a bison and trying to get them all to pull one cart is pretty much like trying to get science, resource management, and interpretation to work together to run a park."

Davis spoke of the enormous responsibility on NPS personnel to "preserve, protect, and perpetuate your trusts." He suggested that those present make a real effort to "mix up and listen to one another, and share your thoughts for better understanding. We must communicate," he told the gathering, "not just with one another but in the political and public sense."

Throughout the week, the problems peculiar to

mountain parks were explored. Theme management, human ecology of parks, fire management, air quality and acid rain, biological diversity, wildlife/human interactions, endangered, relict, and alien species, and impacts on mountain ecosystems – these were the chief topics, each introduced from the scientific viewpoint, then studied from the management standpoint, and finally explored for its interpretive possibilities.

Interpreters were credited generally by both science and management, for instance, with having generated "great understanding and almost 100 percent acceptance" on the part of the public for the evolving fire management policies within the National Park System. This was a deliberate educational effort on the part of park science, park management, and park interpreters. Superintendent Davis emphasized the need to extend these interpretive efforts beyond the park boundaries – especially into the immediate park environs. "The people who live around the parks have tremendous proprietary interests and they must be included and dealt with," he said.

The Public Press

With regard to the public press, Davis pointed out that when newpeople were invited into the park to watch a prescribed burn their attitude was that it was dull. "That was good," he said. "It defused what might have been a touchy issue."

What emerged at the workshop was a sense of the need for a team approach. Ranger and maintenance staff involvement in communication were stressed by Blinn, and Reynolds added that "personalities are so important – more so than job descriptions. Symbiosis depends on people chemistry." If interpretation is to continue to function with less staff and fewer dollars, Blinn suggested the use of VIPs (Volunteers in

Parks), outside organizations and agencies, universities, and the press. Reynolds added his belief that better interpretive uses could be made of the Ranger cadre in parks.

Gary Machlis of the University of Idaho's NPS Cooperative Park Studies Unit, who led a session on the human ecology of parks, maintained that better understanding of visitors and their roles in the park system will make for better and more effective interpretation.

Al Denniston of Lassen Volcanic NP, moderator of

Among the immediate results of the September 1986 workshop, Cunningham reports that several parks have indicated closer coordination of the three areas (science, management, and interpretation). At Hawaii Volcanoes NP, for instance, bi-weekly meetings now are held by the Superintendent and his three chiefs – of science, resource management, and interpretation. In the Western Region, miniworkshops modeled on the larger workshops are planned for next year to explore specific problem areas.

the Fire Management session, told the workshop that Jan van Wagtenonk (Yosemite NP research scientist) would tell them why we should burn, Tom Nichols (Sequoia/Kings Canyon NP air quality resource manager) would tell them why you shouldn't burn, and then Bill Tweed and Cindy Nielsen (interpreters from Sequoia/Kings Canyon and Channel Islands, respectively) "will tell you what they said."

This was the format for all subject areas: an

Continued on page 7



Touching the resource while they explore ways of coordinating science, resource management, and interpretation, these workshop participants enjoy the sunshine and balmy September temperature on the deck of Montecito-Sequoia Lodge just outside Sequoia-Kings Canyon National Parks. Photo by Larry L. Norris.

Migratory Birds Provide Northerners with 'Tropical Connection'

By Richard L. Cunningham

About 150 species of birds that breed in the United States and Canada migrate southward to spend the winter in the tropics. Of these, about 50 species, primarily water and shore birds, fly as far south as Chile and Argentina. The majority winter in Mexico, Central America, northern South America, the Bahamas, and the Greater Antilles. Thus, many of "our" birds spend only a brief eight to ten weeks on their North American breeding grounds.

Breeding bird surveys in the United States have shown that most of the migrant species to the tropics are decreasing. These migrants should be of international concern, not only because they cross international boundaries, but because they are a representative part of the natural heritage of every country in which they occur. "Our" North American migrants become an integral part of the tropical ecosystems. They are just as much a part of the ecosystems of Central and South America as they are of North America. Their conservation depends upon the preservation of tropical ecosystems.

Worldwide, tropical forests are being cleared at an astounding rate. Estimates vary that somewhere between 25 and 100 acres of tropical forest are being destroyed each minute. Equivalent in size to Texas and Arkansas, Colombia contains almost 2,000 species of birds – about one-fourth of the world's total.

Primary Forests Disappearing

Colombia may also contain about 50,000 species of flowering plants. Yet Colombia is losing about two million acres per year of its primary forest. Throughout Latin America farmland, cattle pastures, and building developments are replacing the native tropical forests. Currently, less than one percent of low-land tropical forests are protected in Latin America.

The wintering range for migrant birds in the West Indies, Mexico, and Central America is greatly compressed when compared with the broad expanse of their breeding range in North America. This tends to concentrate migrants on their wintering grounds. For example, on Jamaica, the two species of resident wood warblers are joined by 18 other species during migration and winter. Perhaps more than one-half of

the natural vegetation of the Greater Antilles and Central America already has been converted to pasture and farmland. Since wintering migrants are concentrated in this small region, the effects of habitat loss is greater than in North America. Thus the survival of neotropical migrant birds depends upon preservation of both their breeding and their wintering grounds.

Continued tropical deforestation will result in the decrease of virtually all species of land birds, both migratory and resident. About half of the migratory species are territorial on their wintering grounds. Several migrant species join flocks of the mixed resident species as part of the territory in which they forage. Wintering migrants have evolved a variety of ecological adaptations for using food sources that are quite different from those of their North American breeding grounds. Some species change from insect eating to fruit, nectar, or more omnivorous habits. Fruit and nectar dependent birds require large areas that contain a high plant species diversity.

Tubular Tongue Evolves

The Cape May Warbler is a good example of adaptively changing its diet from its breeding grounds to its wintering area. The Cape May nests in spruce forests from Canada's southern Northwest Territories eastward to New Brunswick and southward to northern New Hampshire and southern Manitoba. From this breeding range of several thousand square miles, it winters almost exclusively in the Bahamas and Greater Antilles. Unique in the warblers, the Cape May has evolved a tubular tongue that enables it to feed on a fruit diet. Thus, on its concentrated wintering grounds, the Cape May Warbler changes from an insect diet to that of nectar and fruit juices. This then reduces competition with 19 other species of warblers that winter in the West Indies.

Representative of the migrant thrushes, the Swainson's Thrush breeds in the boreal forests of Canada and in the mountainous areas of the northeastern and western U.S. It has a widespread wintering range, occurring from central Mexico southward through Central America to Brazil, Bolivia, and north-west Argentina. In Costa Rica and Guatemala it occurs in heavy, humid forest between 2,000 to 4,000 feet. Swainson's Thrushes sometimes join mixed flocks of resident birds that follow army ants (they don't feed on the army ants but on other insects driven by the ants).

Continued tropical deforestation may well cause major population reductions in several forest-dwelling North American migrants. When these reductions occur, it is possible that North American permanent resident species and temperate migrants may expand their populations as the tropical migrants decline.

For the foreseeable future the likelihood of outright extinction of North American migrants due to habitat loss in the tropics seems remote. Two species, Bachman's Warbler and Kirtland's Warbler, would be the most threatened with extinction. However, several other migrant species will no doubt become rarer.

All is Not Well

There is growing evidence that all is not well on the "home front" either. The clearing of forests in the eastern United States and the resultant woodlots are fragmenting populations on their breeding grounds and contributing to the overall decline of several

forest species. It may well be that in the future the last major refuges for our migratory song birds will be the larger national parks, forests, and wildlife refuges.

The "Tropical Connection," the relationship between North America breeding grounds and neotropical wintering grounds, offers exceptional possibilities for NPS interpretive programs. It is a global conservation message that truly connects the Americas together by biological threads hundreds to thousands of miles in length.

The conservation message we need to communicate to our park public is that the preservation of ecosystems, and their component plants and animals, here in North America in our national parks, forests, and wildlife refuges is not by itself enough. Certainly the preservation of "our" migrant birds and their role in North American ecosystems is dependent upon their future existence as an integral part of Neotropical ecosystems far to the south of us – ecosystems whose future is in dire jeopardy.

Cunningham is Regional Chief of Interpretation, Western Region.

Chernobyl Effect on Birds

The Chernobyl fire plume, which blew over the Ukraine wetlands following the nuclear accident in the U.S.S.R., has U.S. agencies worried about the effects on migratory birds, some of whom are used for human food. According to the Up Front section of November's *Discover* magazine, the EPA, State Department, U.S. Fish and Wildlife Service, and the National Wildlife Federation are urging the formation of a research program on radioactivity in migratory birds, which are covered by a 1976 U.S.S.R.-U.S. convention.

First inquiries, it was agreed, should be made by those countries whose bird populations use the Ukraine flyway, and the NWF decided to ask the European Economic Community to consider providing extra funds to scientists studying wildlife so they could extend their work to the taking of radioactivity readings.

At *Discover's* press time (late October), the EEC had not responded.

Monarchs' Migration Is Concern

Public awareness of the monarch butterfly's "unique and spectacular" migrations is the keystone for hope of saving this beautiful species according to The Monarch Project, a Mexican conservation group, and the World Wildlife Fund. As crucial roosting sites disappear under continuing development and construction, the Mexican government has issued a proclamation declaring the monarch's overwintering sites as "ecological preserves."

Colin Norman, in an article in the Sept. 19, 1986 issue of *Science*, describes the monarch's astonishing life cycle, the key to its existence (the milkweed plant that grows prolifically in North America), and its need to reach Mexico each winter to escape North America's killing cold.

Heavy tourist visitation to the Mexican wintering sites is helping tip the scale toward conservation there, Norman reports. But "the situation in California is more complex." The insect's western winter roosting areas (en route to and from Mexico) have been disappearing at an alarming rate as developers turn prime ocean real estate into houses and condominiums.

Interpretation

Continued from page 6

objective scientific look at all sides of a subject, followed by the practical applications and interpretation that flow out of research findings.

Knowledge vs. Certainty

The final day's session, on natural resource communication, was titled "Knowledge versus Certainty." This intriguing idea was explored by a panel that represented research, management, and interpretation at several levels, including *Park Science*, followed by lively group discussion. The consensus was that science should provide valid, reproducible research results that would undergird the formulation of agency policy and management action. All of the above, should be fodder for creative, tuned-in interpreters.

Cunningham, in a wrap-up to the workshop, restated the overall objective of all the workshops: "To minimize the bureaucratic and geographical barriers that separate us as Regions, and to concentrate on the mutual concerns and opportunities that can bring us together as National Park System stewards."

WASO Directions In Interpretation

By Martha Aikens

Our direction for the past and for the next fiscal years is one that stems directly from the Director's 12-point plan and the six basic objectives for interpretation. These objectives are:

- Information and orientation
- Understanding and appreciation
- Participation and skill development
- Protection of the visitor and park resources
- Dialogue between public and park management
- Education

An analysis of the 12-point plan and the basic objectives for interpretation resulted in a revised Role and Responsibility Statement for interpretation, distributed to the Regional Directors in February 1986. Because the scope and scale of interpretation objectives were expanded, the official guidelines and standards for interpretation (NPS-6) were revised and put out for formal review. The guidelines and standards for Cooperating Associations also were revised and have been distributed.

To prepare interpreters to assume their newly defined duties, we revised the Interpretive Skills courses, adding Interpretive Skills III (Special Programs and Services), Interpretive Skills IV (Interpretive Writing), Interpretation for Managers, Interpretation for Populations at Risk, Interpretation: Private Sector Coordination, Interpretive Planning and Critical Issues: Workshop in Interpretation. We also requested seed money to support the Skills teams and funds to revise a self study course, entitled "A Personal Training Program for Interpreters."

The Park Heritage Gateway Program was developed specifically to help us better utilize urban recreation areas as education centers. Its focus is greater public awareness, involvement, and support of the National Park System. Six pilot areas include four recreation areas, one lakeshore, and a national park.

Other program areas reviewed for more effective utilization were the Volunteer in Parks and the Student Conservation Association programs.

One element of the 12-point plan is "to share our understanding of critical resource issues." The Director has suggested we do that by integrating research, resource management, interpretation, and public information, which is what the interregional resource management/interpretation workshops are designed to do.

In the past, when discussions have been held about "education" as an objective, the discussions have been in terms of advising visitors of the condition and status of park resources. This is done through regular interpretive programming and in-depth seminars and workshops. Now, when we speak of education, we also add the advising of visitors about global conservation concerns – concerns that the National Park System shares with the rest of the world. Our first Servicewide attempt at carrying out this objective could come in 1988, the year in which the Director has expressed a desire to have acid rain and air quality as our Servicewide interpretive theme.

meetings of interest

1987

March 2-6, THIRD CALIFORNIA ISLANDS SYMPOSIUM, HOSTED BY Santa Barbara Museum of Natural History, Santa Barbara Botanic Garden, and Southern California Academy of Sciences, at the SB Museum, to provide a forum for contributed papers on all aspects of research and resource management on the California Islands, including islands off the coast of Baja California, Mexico. Contact Dr. F.G. Hochberg, SB Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, CA 93105. (805) 682-4711.

March 17-18, BEYOND THE PRESIDENT'S COMMISSION: PREPARING FOR THE FUTURE OF PARKS AND CONSERVATION, sponsored by the National Parks and Conservation Association (NPCA) billed as "the first major response within the conservation community to the final recommendations of the President's Commission on Americans Outdoors (PCAO), due to be published in January 1987. Contact: NPCA, 1015 31st St., NW, Washington, DC 20007; (202) 944-8530.

March 22-24, 40th ANNUAL NORTHWEST ANTHROPOLOGY CONFERENCE, at Salishan Lodge, Gleneden Beach, Oregon. Contact Richard Ross, Dept. of Anthropology, Oregon State University, Corvallis, OR 97331.

March 25-27, EIGHTH ANNUAL PARK AND RECREATION ENFORCEMENT AND VISITOR PROTECTION WORKSHOP, at Albright Training Center, Grand Canyon NP; Contact Bruce Wicks, Dept. of Recreation and Parks, Texas A & M University, College Station, TX 77843-2261. (409) 845-5418.

Park Rangers Heard From On Interpretation Status

A resolution, proposed by Jim Tuck, Rocky Mountain Regional Interpretive Specialist, and passed at the October Ranger Rendezvous at Grand Tetons NP, objects to "the placement of interpretation on a different level from other ranger activities." The full resolution text follows:

We applaud the Director's recent announcement of the creation of the position of Associate Director, Interpretation, for the indication of the importance the Director feels for this aspect of National Park Rangers' duties. For too long, interpretation has received rhetoric but no funds to back up what has been professed by upper level management as high importance.

We cannot, however, agree with the placement of interpretation on a different level from other ranger activities, specifically the area of visitor protection. We therefore propose that, because a National Park Ranger's duties are composed of three equally important activities – Interpretation, Resources Management and Visitor Protection, that a more appropriate reorganization would result in the following:

Associate Director, Park Operations
Interpretation Division
Visitor Protection Division
Resources Management Division
Concessions Division
Engineering & Safety Services Division

This would more appropriately reflect the relative importance of the activities that comprise park operations.

It is of prime importance that ALL those divisions listed above be recognized as parts of the total "Park Operations" organization.

U.S., Canada Park Directors To Co-chair Conference Panel

Approximately 80 park rangers, interpreters, and resource managers will attend the 8th Annual Park and Recreation Enforcement and Visitor Protection Workshop at Albright Training Center in Grand Canyon NP March 25-27, according to Bruce Wicks, conference coordinator.

National Park Service Director William Penn Mott, Jr., and his Canadian counterpart, James Collinson, Deputy Minister, Environment Canada, Parks Canada, will co-chair one of the workshop panels. The workshops are cosponsored by Texas A & M University and the National Park Service. (See Meetings of Interest for Contact.)

Highland Archeology Focus

Jim Thomson and Bob Mierendorf of the NPS Pacific Northwest Regional office, are coorganizers of a symposium on Highland Archeology/Ethnography in the Pacific West, to be part of the 40th Annual Northwest Anthropology Conference March 22-24, 1987, at Salishan Lodge, Gleneden Beach, Oregon.

The study of archaeology has traditionally been confined to the lowlands, restricted to river valleys, "upland" divides between major rivers, and mountain foothills, Thomson said. As a result, little is known about the prehistory of highland landscapes, the areas more specifically described as upper-montane, subalpine, and alpine. Yet throughout widespread areas of the mountains west, highland landscapes comprise a large portion of the home ranges of ethnohistorically described Indian peoples and prehistoric populations as inferred from archeological remains. This symposium will explore all aspects of highlands adaptations for both ethnohistoric and prehistoric time periods. It is concerned equally with description of primary research results and with the methodology and theory of highlands research.

Eight Regions Participate in Wildlife Management Workshop

By Thomas W. Lucke

Twenty-eight NPS employees from eight Regions gathered on the Colorado State University (CSU) campus in Ft. Collins from Sept. 15 to Oct. 3 for a Basic Wildlife Management Workshop, sponsored by the Albright Training Center. The workshop was designed by Eugene Decker, a professor in the Department of Fishery and Wildlife Biology at CSU, and coordinated by Doug Morris of the Training Center. Instructors included William Ehorn (Superintendent of Channel Islands NP), Cliff Martinka (Research Biologist, Glacier), Regional Chief Scientists Dan Huff and Milford Fletcher, Maurice Hornacker (Director of Wildlife Research Institute in Moscow, Ida.), Al Le Count (Research Biologist, Arizona Game and Fish Department), Henry McCutcheon (Research Biologist, Rocky Mountain NP) and various professors from CSU. Management perspectives and concerns about wildlife issues facing the NPS in the 1980s were addressed by Jack Neckels (Deputy Regional Director, Rocky Mountain Region) and James Thompson (Superintendent, Rocky Mountain NP).

Classroom presentations examined issues such as wildlife ecology, characteristics of wildlife populations, wildlife habitat concepts, conservation of endangered species, remote sensing of wildlife habitats, the role of fire in habitat management, grizzly bear management, management of marine resources and ungulate ecology. Comparative approaches to wildlife management were reviewed during discussions on National Parks in Zimbabwe by Eugene Decker, on wildlife management in Central Europe by Professor Julius Nagy of CSU and on wildlife management in Bavarian National Parks by Prof. Wolfgang Schroder of the University of Munich.

In addition, workshop participants spent a day at Rocky Mountain NP, where park staff introduced the group to the complexities and realities surrounding an elk management program. A second field trip took the trainees to Wind Cave NP, where Supt. Ernesto Ortega and his staff detailed the delicate blend of law, politics, pressures and science required to manage the park's bison herd.

A final aspect of the workshop required attendees to break into small groups and discuss the 1963 Leopold Report, which has guided wildlife management in NPS areas over the past two decades. In a lively evening session, each mini "blue ribbon panel" presented its recommendations as to how the Leopold Report should be expanded or modified to meet the new challenges and conditions the NPS will face in the 1980s and beyond.

Evans Wins Tilden Award

Phil Evans, NPS interpreter from the Southeast NPS Region, has been named 1986 recipient of the Freeman Tilden award for excellence in interpretation. Disclosure of the honor was made at the September meeting of the Association of Interpretive Naturalists conference in September at the Delaware Water Gap National Recreation Area. Evans exercises his outstanding brand of interpretation at Fort Raleigh National Historic Site, which is managed as part of the Cape Hatteras National Seashore.

Gene Pools Task Force Proposes Five-Year Plan

A NPS Task Force on Conserving Gene Pools met in Washington, D.C. Sept. 16-18, at the call of NPS Director William Penn Pott, Jr., and under the leadership of Christine Schonewald-Cox, NPS Research Scientist with the NPS/CPSU at University of California, Davis.

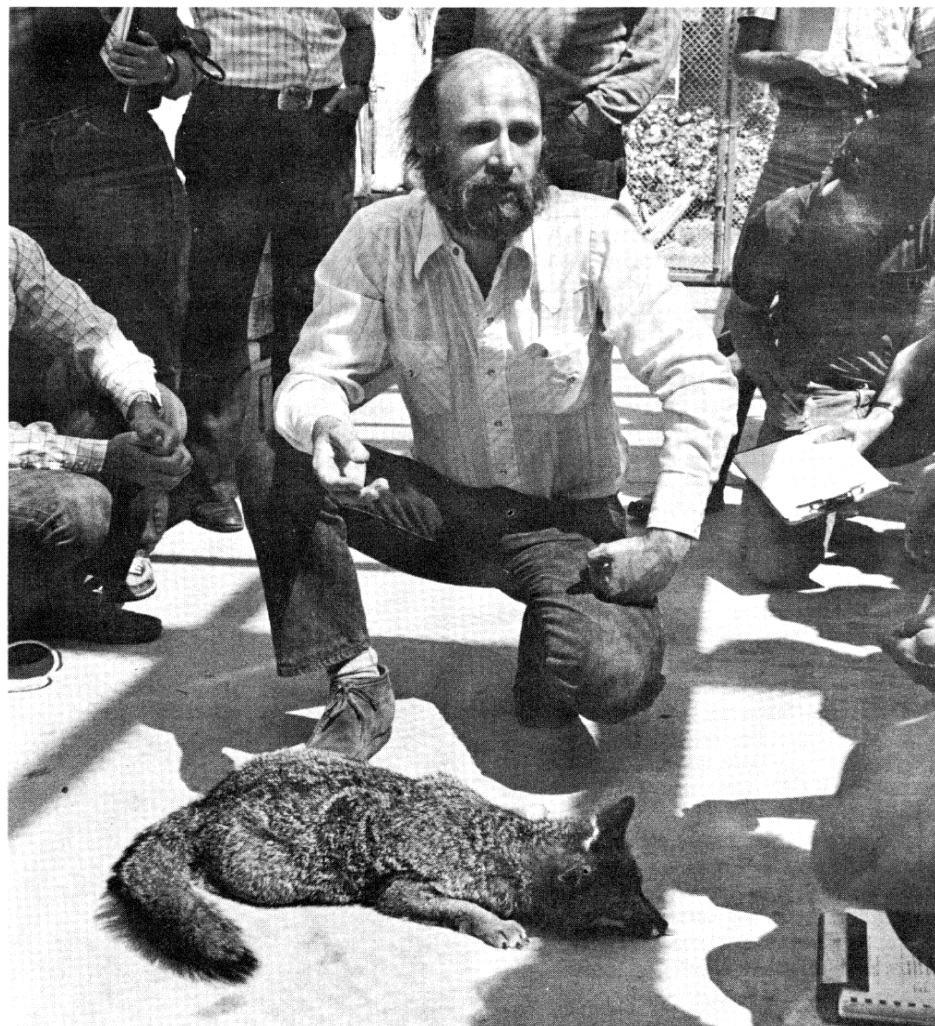
The 20-person group included a selection of outstanding non-NPS scientists in genetics, demography, community ecology, and related fields: Dr. Peter Brussard of Montana State University, Dr. Steven M. Chambers of the U.S. Fish and Wildlife Service, Dr. John Eisenberg of the Florida State Museum, Dr. James L. Hamrick of the University of Georgia, Dr. Larry D. Harris of the University of Florida, Dr. David Kafon of the National Council on Gene Resources, Dr. Lawrence Riggs, president of GENREC in Berkeley, Dr. Michael H. Smith of the Savannah River Ecology Laboratory, and Dr. Bruce Wilcox of Stanford University.

Several members of the Task Force met with NPS Assoc. Dir. Dick Briceland following the meeting and generated a five-year action program which later was

proposed to Director Mott. This program focuses on inventory and monitoring of biological diversity in the parks, training of NPS staffs, public education and outreach, interagency cooperation, and establishment of a Director's Steering Committee for Biological Diversity. The proposed five-year action prototype program would open the door for intensive biological diversity work in the National Park System, according to Dr. Schonewald-Cox, who is currently reviewing and synthesizing the mountain of material produced by the three-day Task Force meeting.

"We plan," she said, "to have the report ready for public presentation by the winter of 1987. Meanwhile, the Director has responded favorably to our proposal, and it is now being presented to the Regional Directors."

"Based on the outcome of the RDs' response," Schonewald-Cox said, "a program eventually will be established that will increase our knowledge of biological diversity and sharpen our ability to make decisions and to apply our knowledge in the management of the National Park System."



An immobilized Kit Fox is examined by John Sacklin, Environmental Specialist at Redwood NP, during a training course on wildlife immobilization held during the summer at Humboldt State University and cosponsored by the University and Redwood NP. The course was attended by personnel from NPS, BLM, USFWS, and several state agencies and organizations, according to Redwood NP Supt. Douglas G. Warnock.

Biology and Public Policy of Lyme Disease at Fire Island

By James G. Northrup

In 1975, two women from Lyme, Conn., called their State Health Department to report a strange phenomenon. The first said her daughter had been diagnosed as having juvenile rheumatoid arthritis and that 11 other children in the same community had been similarly diagnosed. The second woman said four members of her immediate family had arthritis, from children to adults. Investigating these and other reports, medical researchers discovered a new, rapidly spreading zoonosis, now known as Lyme Disease.

Transmitted by the bite of an infected tick, Lyme Disease (LD) now affects several NPS areas, and others are certain to be affected as the disease spreads and awareness increases. The disease has been reported primarily from three recognized endemic areas; the coastal areas of the northeast (Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island); the midwest (Minnesota, Wisconsin); and the west (California, Nevada, Oregon, Utah). Isolated cases have been reported in Arkansas, Florida, Georgia, Indiana, Kentucky, Montana, North Carolina, Tennessee, Texas and Virginia.

In addition to causing serious medical problems, LD poses a whole series of questions for managers of public lands, particularly NPS areas. What can be done to control the disease? What scientific research is needed before sound management decisions can be made? In a National Park, what environmental manipulations, if any, are reasonable to manage this public health problem? What obligation do park managers have to warn visitors and employees about this "natural" hazard? To what degree is the government liable for visitors and employees who contract LD while working or recreating in the park?

Cause

The causative agent of LD is a microscopic spiral shaped bacteria, the spirochete *Borrelia burgdorferi*. In the east and midwest the tick vector is *Ixodes daminii* (Northern Deer Tick), in the west *Ixodes pacificus* (California Black-Legged Tick). These species are much smaller than common wood or dog ticks. There is strong evidence that Lone Star ticks (*Amblyomma americanum*) can also transmit the disease and that deer flies, horse flies, mosquitoes and other blood-feeding arthropods serve as secondary vectors. Needing tissue fluids and blood for development, ticks spend their entire lives as parasites. Immature *Ixodes* ticks attach to a variety of hosts, although the white-footed mouse (*Peromyscus leucopus*) is the most frequently parasitized. The vast majority of adult *Ixodes* ticks however, are found on white-tailed deer (*Odocoileus virginianus*), and thus the common name. While both the nymph and adult can transmit the disease to man, it appears the nymph is the more common vector, as it is actively feeding during the warm months, when people are also active outdoors, and because of its small size, which makes detection difficult.

Distribution

The presence of *Ixodes* ticks seems to depend upon white-tailed deer, although there is some evidence of transport of the ticks to new areas by birds. In the east and midwest for example, wherever *Ixodes daminii* is abundant, deer are abundant as

well. Some researchers now hypothesize that *I. daminii* was once widely distributed across the north-eastern quadrant of the U.S., but virtually disappeared with the demise of the deer herds caused by deforestation and overhunting, surviving only in certain isolated areas where deer remained abundant. Consequent to the relatively recent explosion in deer populations in the country, the tick population appears to be regaining its original broad distribution. It is ironic that what has been a widely heralded success of state wildlife agencies – the proliferation of deer herds to greater than pre-Columbus levels – may turn out to be a disaster for public health. While there is strong evidence that the abundance of *I. daminii* is limited largely by the abundance of deer, ecologists warn against the apparent quick fix of reducing or eliminating deer herds. By eliminating the preferred host, ticks may seek out another large mammalian host, increasing the incidence of Lyme Disease in man even further. Other environmental factors that may limit tick distribution, such as temperature, humidity, vegetational and physiographic features, must be evaluated as well.

Symptoms

The most characteristic sign of Lyme Disease is a skin lesion (known as an erythema chronicum migrans, or ECM), appearing 3 to 25 days after the victim has been bitten by an infected tick. Although highly variable, the lesion usually begins as a red spot, approximately two inches in diameter, often with a clear center, giving it a bullseye appearance. Within a few days, the rash can expand up to 10 to 15 inches, and in some patients will expand to where it is no longer recognized as a ring. Several lesions may appear simultaneously; some patients never develop the lesion. The ECM may be accompanied by fever, chills, headache, malaise, and enlarged lymph nodes, but will generally subside, even without treatment, within a few weeks.

If left untreated, serious complications may appear weeks, even months after the initial lesion, including arthritic, neurologic and cardiac complications. The

arthritic complications, which afflict two thirds of the patients, generally involve one or more of the large joints, and are often migratory. Attacks typically last about a week and can recur for several years. The neurological symptoms mimic other diseases and can occur from two days to three months after the appearance of the skin lesion. Typical symptoms include headache, stiff neck, intolerance to light, nausea, vomiting, sleepiness and a feeling of laziness, partial facial paralysis (Bell's palsy), spasmodic movements and incoordination and laziness of the eyes. Patients with LD who develop cardiac problems may have no prior history of heart disease. Cardiac complications almost always include some form of heart block and may include shortness of breath, rapid and strong heart beats and temporary heart and respiratory stoppage.

Diagnosis

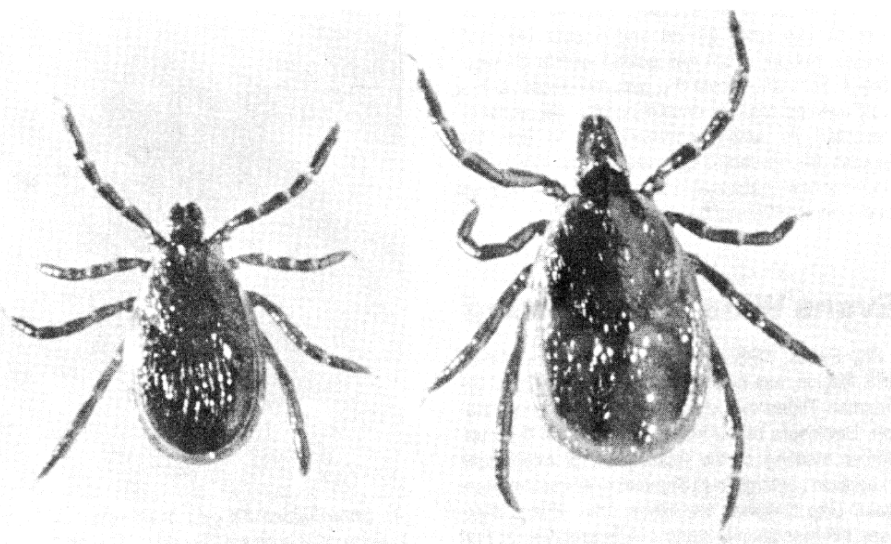
Diagnosis is generally based on the presence of the ECM lesion and the associated symptoms. Cases outside the endemic area, atypical cases or cases presenting only late manifestations are difficult to diagnose, since many physicians are not familiar with the disease. Misdiagnosis is common. Several laboratories have developed a serologic test that measures the presence and level of antibodies against the spirochete. When the ECM is present, only about 50 percent of patients will have a positive test, as the body has not yet produced the antibodies to a level that can be detected. Patients with advanced symptoms, almost always react positively to the test.

Treatment

The optimal treatment for Lyme Disease has not yet been fully defined, and there is some disagreement among medical practitioners. Treatment with high dosages of broad spectrum antibiotics such as penicillin, tetracycline or erythromycin have proven effective in reducing the duration of the skin lesion and in reducing the onset of later complications. Intravenous administration of antibiotics has been required for a number of patients who either did not respond to the initial treatment or who display advanced symptoms.

Public Policy Questions

The public policy questions are complex and involve divergent public interests. NPS management policies concerning health and safety, natural re-



The vector for Lyme Disease in the east and midwest is the Northern Deer Tick, here shown with the female on the right, the smaller male on the left.

source and wildlife management, integrated pest management, use of pesticides, vegetation management, wilderness management and a variety of legal liability questions all come into play.

To address these issues, Fire Island NS, in cooperation with the Centers for Disease Control, The New York State Department of Health, and local authorities, has implemented a management comprehensive program. Scientific research is underway. A public education program has been initiated; a regular program for testing and treating employees has been established; research is being conducted on prevention methods, and a policy for treating affected employees and family members is in place.

Dr. Howard Ginsberg, a research entomologist with the NPS Barrier Island Research Unit at Rutgers University is currently studying the ecology of *I. dammini* on Fire Island. By examining the tick's relationships to various areas and vegetation types, trapping small mammals, collecting ticks and examining individual specimens for the presence of the LD spirochete, park management will gain useful information for decision making and planning visitor activities and future development, with an aim towards reducing exposure. As part of an on-going deer ecology study, tick and blood samples are being collected from white-tailed deer on the island and similarly examined. Dr. Ginsberg plans to study a number of eastern parks next season.

Prevention is viewed as a critical factor in the management of the LD threat, and the Centers for Disease Control is conducting a study of Seashore employees, their personal habits and actions that may increase or decrease the likelihood of attracting ticks or contracting LD.

A public education program has been initiated and a joint NPS/U.S. Public Health Service brochure on Lyme Disease has been written and will soon be available for nationwide distribution.

Legal questions surround the Service's obligation to test and treat employees, and their family members. Employees in required occupancy situations and their family members are at particular risk, and even employees who live "off-island" have accidentally brought ticks into their homes. Complicating the liability question is the difficulty of proving the disease was contracted on the job. Although the Office of Workman's Compensation has not yet denied a treatment claim by a Seashore employee, this issue may one day be challenged in the courts. Some legal experts have argued that the Service has no obligation to test an employee's family members, but park management has countered that we have at least a moral obligation, and the current policy is to do so. In cooperation with the State Department of Health and researchers at the Stony Brook University Hospital, NPS employees and family members, concessioners and cooperating researchers are tested twice each year for LD.

One unanswered question is that of legal liability for park visitors who contract LD. It is probably just a matter of time before a court is looking at the Park Service's efforts to manage this spreading public health problem.

The Seashore would be pleased to share the results of our research, public information program elements or any additional information with interested parks.

Northrup is a Natural Resource Specialist at Fire Island N.S.

Olympic's Coastal Preservation: A Dream Comes True

By Hank Warren

This is a success story involving many characters, but in which the interpreters played a key role in bringing about the protection of a prime national resource: the intertidal zone along some 57 miles of coastline adjacent to Olympic National Park.

The coastal strip of Olympic NP was established as a wild, unspoiled shoreline much as it was hundreds of years before the arrival of European man . . . a place for solitude, discovery and nature's fury. Above all, the coast is a living museum showing the diversity of life at the edge of two great realms: land and sea.

When the coastal strip was added to Olympic NP in 1953 and when it was expanded in 1976 the boundaries stopped at mean high water, which meant that the intertidal zone remained in state ownership. Under the State of Washington four agencies with different missions, Natural Resources, Parks, Game, and Fisheries had jurisdiction over components of the coastal resources. Trying to coordinate the policies of any four powerful semi independent entities, no matter how well meaning, is a gigantic task and the protection of tidepool life along the coast was getting lost in the shuffle. The biggest threats were from fishermen collecting bait, visitors collecting specimens, and the possibility that foreign enterprises would begin collecting food on a commercial scale.

From the beginning, the Naturalist Division of Olympic NP has interpreted tidepool life as if it was an inherent park value, even though the tidepools lay outside the park. However no NPS research funds were earmarked for the study of tidepool life because we did not own the resource and we had to be careful not to alienate the State agencies whose cooperation we needed.

In 1979 when I transferred into the park as Chief Naturalist, I found the park was blessed with a superior staff of researchers. I am a firm believer that naturalists need to be knowledgeable about park resources and preferably expert or near expert in some aspect of park resources. So I took up scuba diving and began to study the intertidal zone intensively. Emphasis was placed upon intertidal studies during seasonal training.

In 1980, under then Supt. Roger Contor, Professor Robert Paine, one of the Pacific Coast's leading authorities on intertidal ecology, presented a seminar to a cadre of the park's staff. As a result of this seminar, Dr. Paine suggested a low key scheme that could be carried out informally by park naturalists to monitor the "health" of the intertidal zone.

At this stage any suggestion that the intertidal zone be added to the park was regarded as impossible and even resisted by some members of the park staff on the grounds that there would be too much political opposition and that the park would inherit a complicated law enforcement situation.

In 1984 a new West District Naturalist, Doug Wilson, was hired with the mandate from the Chief Naturalist that he was to become "expert" on intertidal life. **Then in February 1985 Doug and Park Supt. Bob Chandler attended an interregional workshop on coastal resources management and interpretation, which was the brainchild of Western Region's Chief of Interpretation, Dick Cunningham. The workshop inspired both men.**

During the early summer of 1985, because feed-

back from the diving community had aroused increasing concern about impacts on coast, I determined to raise this issue again. But first I wanted to be sure that "our own skirts were clean" and I audited coastal interpretive activities to be certain they were carried out in a manner that minimized impacts on the resource. Doug and the coastal seasonal staff, using a simple baseline sightings notebook developed as a method to record any sightings of Dr. Paine's indicator species, had already started to monitor the intertidal areas.

Exploring the tidepools and being present on a daily basis, the coastal interpreters realized that impacts and abuses were taking place in the tidepools. For example, some fishermen were decimating the garnet colored tubeworm clusters, also known as feather duster worms. Removed with knife or shovel, the worms were carted off in five gallon buckets to be used as bait for summer surf fishing. Many people collected far more than they could use on a single visit and froze the rest for future trips. Mussel beds were scraped clean with shovel or machete, not to harvest mussels which were out of season, but to make it easier to collect the ribbon worms that live between the mussels. It became evident that an increasing number of people were relying upon the tidepools for subsistence. When one such individual was questioned about the intertidal creatures he had collected, his response was, "It's cheaper than the supermarket."

I presented these preliminary findings to Superintendent Chandler and it was decided that more detailed documentation was needed. Doug and the coastal naturalists began describing the condition of intertidal areas in field notes, maps, inventories and photographs.

The park was fortunate in that the husband of the seasonal interpretive supervisor at one of our coastal areas was a competent seashore algae researcher. He was not an American citizen, so could not be hired by the park. However the park used \$2,000 in natural history association funds to provide an embarrassingly small stipend for him.

Meantime, events had been moving on other fronts. The park and the neighboring national forest had mutually agreed that it would be best to seek legislation modifying their joint boundaries to hydrographic divides. As a part of the legislative briefing package, the Superintendent and our lands officer decided to include a document describing the threats to the coast. Olympic Park Associates, an environmental watch dog group, also was briefed. Everybody felt that the likelihood of legislative action affecting the coast was a long shot, but miracles happen. Olympic NP is fortunate in that Sen. Dan Evans holds a deep appreciation for the park and the entire Washington State Congressional delegation is very supportive. As a result the boundaries of the park have been modified in a number of ways advantageous to the park, including the addition of the intertidal zone adjacent to the park.

This episode demonstrates that the interpretive division is functioning as an integral part of the park's management team and that individuals can make a difference. Without the collective effort described here, the park addition would have remained just a dream.

Warren is Chief Naturalist at Olympic NP.

Indiana Dunes Celebrates Near-Century of Research

By Sam Vaughn

It was 1896 when University of Chicago ecologist Dr. Henry Cowles began his pioneering research in the Indiana Dunes. It was 90 years later when 162 scientists, park rangers, students and dunes devotees assembled for the first Indiana Dunes Research Conference.

Like Frederic Clements in Nebraska, Cowles studied the dynamics of plant succession – the gradual evolution of plant communities over time. He found the Dunes to be a natural laboratory. Bare sand dunes were colonized by succeeding populations of grasses, forbs, shrubs, cottonwoods, pines, and finally an oak forest. This Conference, appropriately entitled: *Indiana Dunes: A Century of Scientific Inquiry*, proved that science in the Dunes has evolved as well.

Researchers gave some 50 papers describing Dunes research. Four symposia constituted the main body of the Conference, supplemented by contributed papers and innumerable hallway and coffee pot conferences.

In the Plant Succession symposium, systems ecologist Jerry Olson presented an updated version of terrestrial plant succession, confirming and clarifying the earlier work of Cowles. His mathematical model compared rates of income and loss for successional stages, and analyzed the "functions describing transient adjustment toward steady states." James MacMahon described how a knowledge of successional variables can enhance our ability to reclaim strip-mined land, and decrease the need for supplementary fertilization and irrigation. In addition, he presented evidence that the "general form and architecture of the plant components of the community are more influential in determining the presence or absence of native animals than is the specific species array of plants" – which might suggest modifications in current law mandating reclamation standards.

Researchers from the National Lakeshore Science Division reported on the effects of cultural disturbances on successional dynamics. Ken Cole documented the impact on terrestrial vegetation of lumbering, drainage, pollution and introduction of exotic species since 1850, while Doug Wilcox related differences in aquatic vegetation to post-settlement disturbances that modified classical successional patterns. Norm Henderson and Noel Pavlovic detailed the importance of fire as a factor in maintaining the climax species composition of black oak savannahs. Ron Hiebert and Noel Pavlovic described the relationship between past land use and plant succession in abandoned residential sites. They reported that site disturbance can affect species composition and successional patterns for at least 100 years. Studies such as these will help managers to restore and preserve park resources amidst urban development and burgeoning visitation.

The Visitor Aspects of Resource Management symposium featured several sociological studies of park visitors. Gary Machlis used human ecology techniques to explore the dynamics of human behavior in urban parks; he compared examples from Cuyahoga Valley, Indiana Dunes and Xuan Wu Hu in the People's Republic of China. Joe Roggenbuck evaluated environmental education programs at the National Lakeshore. He also reported on techniques

that the interpretive staff can use to monitor program effectiveness. Other researchers looked at factors affecting participation in recreational programs, and our ability to predict such participation.

The Shoreline Processes symposium was especially timely, given the current high lake levels and severe shoreline erosion. Stratigraphic studies provided a detailed depositional history that charts Lake levels going back at least 2000 years. Models of wave dynamics and off-shore bottom profiles were applied to predictions of storm damage and coastal stability. A plan for regional shoreline management was introduced. This information could play a vital role in public policy decisions that will affect millions.

The fourth symposium was the Indiana Natural Areas Conference, sponsored by the Indiana Department of Natural Resources. This Conference is held annually in various areas of the state, and was this year incorporated into the Indiana Dunes Research Conference. Sessions had a natural history focus, and covered prairies, plants, bugs and botanists of the Dunes, as well as natural area management in urban settings. Field trips then gave participants a chance to explore the area.

Contributed papers were presented on aquatic resources, cultural sciences, animal and plant sciences, and air quality. Researchers reported on such topics as threats to groundwater chemistry, alternative paradigms for environmental education, nesting success for the great blue heron, prehistoric patterns of plant succession, and the use of lichens as air pollution indicators. University of Chicago ecologist James Teeri summarized the proceedings in his banquet speech on Henry Cowles and the history of ecology.

Lakeshore Chief Scientist and Conference Coordinator Ron Hiebert noted that the conference "provided state-of-the-art education on our most critical resource management issues. The exchange of ideas, the synergy, was really impressive. The public will benefit directly through interpretive programs and publications, and indirectly through more informed public policies."



Conference Coordinator Ron Hiebert welcomed participants and described the current state of science at the Indiana Dunes.

Lakeshore Supt. Dale Engquist added: "It brought together people from broadly diverse fields. In and out of the sessions I heard researchers talking to managers, and sociologists talking to plant ecologists. This conference makes a strong statement about National Park Service support for research and resource management."

The conference was sponsored by Indiana Dunes National Lakeshore, the Friends of Indiana Dunes, Indiana Department of Natural Resources, the Save the Dunes Council and Indiana University Northwest, where the sessions were held. Conference Proceedings will be available after the first of the year from the National Lakeshore. The second Research Conference has been tentatively scheduled for the fall of 1988, and will emphasize the application of research to the management of dune areas.

Vaughn is Visitor Services Specialist at Indiana Dunes NL.



Dunes researchers shared their interests at a barbeque at Indiana Dunes State Park.

information crossfile

A two-page summary of the September national forum on the "imminent collapse" of biological diversity, sponsored by the National Academy of Sciences and the Smithsonian Institution in Washington, D.C., appears in the Oct. 10, 1986 issue of *Science*. Roger Lewin, in his *Research Notes* section, quotes Harvard's Edward O. Wilson: "The tropical world is clearly headed towards an extreme reduction and fragmentation of tropical forest, which will be accompanied by a massive extinction of species."

Appalled at the prospect of this collapse in biodiversity, Michael Robinson of the National Zoological Park in D.C., told the assembled biologists: "We are facing the 'enlightenment fallacy.' The fallacy is that if you educate the people in the Third World, the problem will disappear. It won't. The problems are not due to ignorance and stupidity. The problems . . . derive from the poverty of the poor and the greed of the rich."

Lewin concludes that "the problems are those of economics and politics. Inescapably, therefore, the solutions are to be found in those same arenas."

David N. Cole, Research Ecologist with the USFS, Forestry Sciences Lab, P.O. Box 8089, Missoula, MT 59807, sends word of four recent publications, all available from him as reprints:

Cole, David N. Management of ecological impacts in wilderness areas in the United States. In: Bayfield, N.G.; Barrow, G.C., eds. The ecological impacts of outdoor recreation on mountain areas in Europe and North America. Recreation Ecology Research Group Report No. 9. Wye, England. 1985: 138-154.

Cole, David N. Recreational trampling effects on six habitat types in western Montana. Research Paper INT-350. USDA For. Serv. Intermountain Research Station, Ogden, UT. 1985. 43 p.

Cole, David N. Ecological changes on campsites in the Eagle Cap Wilderness, 1979 to 1984. Research Paper INT-368. USDA For. Serv. Intermountain Research Station, Ogden, UT. 1986. 15 p.

Cole, David N. Recreational impacts on backcountry campsites in Grand Canyon National Park, Arizona, USA. *Environmental Management* 10: 651-659. Reprints are available by writing to David N. Cole, Forestry Sciences Laboratory, P.O. Box 8089, Missoula, MT 59807.

Tests to measure the impact of sulfur dioxide from such sources as coal-fired plants are being conducted by the Health, Safety, and Environment Division of Los Alamos National Laboratory, using one of the commonest trees in national parks – the pinon – as the research focus.

Under an interagency agreement between the Lab and the National Park Service, the study is being conducted in two parts. Phase one, now completed, involved collecting and analyzing foliage and soil from parks near the Four Corners area, where several power plants are located. The second phase consists of fumigating pinon seedlings with sulfur dioxide in the laboratory. Parks from which pinon needles and soil samples were collected are Mesa Verde NP in Colorado, Petrified Forest NP in Arizona, Canyonlands NP in Utah, Bandelier National Monument and Chaco Culture NHP, both in New Mexico.

News of an experiment in Soberania National Park aimed at making iguana raising a financially attractive occupation for Central and South American *campesinos*, is carried on page 7 of the November 1986 issue of *Discover*. Dagmar Werner, an East German scientist working out of the Smithsonian Tropical Research Institute in Balboa, Panama, has devised a method for improving egg-hatching percentages from less than 3 (in the wild) to around 95 percent. On a 2½ acre plot in the National Park, Werner built concrete block nesting chambers, filled them with damp sand, and then transferred the iguana eggs to Styrofoam hatching boxes, letting the sun serve as a natural incubator. Werner is doing follow-up studies on the 1200 custom-hatched lizards to see how well they do when released into the countryside.

Her hope is to make iguana raising so attractive to the native population as to relieve the stressed iguana populations now being over-hunted, and to provide incentive for preserving the rainforest habitat the iguanas need – a habitat that has been rapidly disappearing in the past 15 years.

From Thomas W. Lucke, Chief, Water Resources Division, Fort Collins, comes the note that the latest issue of *The Harvard Environmental Law Review* has an article which presents a new aspect of the external threats issue. Most articles on this subject to date have focused on traditional parks and monuments. Prof. John S. Davis' article, "The National Trails System Act and The Use of Protective Federal Zoning" (Vol. 10, No. 1, 1986, pp. 189-255) applies the concept of external threats or park protection and how to deal with that issue to National Scenic, Recreational and Historic Trails. The author feels that trails are threatened by incompatible development on adjacent property; that state governments have failed to deal with this threat, and that a sound program of federal zoning and trail regulations is badly needed to insure that "the still-nascent trail system fulfills its enormous promise."

The President's Commission on American Outdoors, at a September meeting in Washington, DC, seems to have agreed on the need for an endowed Trust Fund to provide \$1 billion a year for outdoor recreation programs. Various options for funding considered include a "marketbasket" approach that might include offshore oil revenues, user fees, an excise tax on recreation equipment, a summer gas tax, and a land transfer tax.

Commission Chairman Lamar Alexander, in a draft outline for the final report, focused on the need for local initiatives and community action, but added the need for the President to "personally lead – as Teddy Roosevelt did in his time – the crusade to encourage community investment in America's Outdoors so they will still be great for the next generation of Americans."

The Commission reached consensus on the need to complete acquisition of the "federal estate," including the backlog of unacquired national park lands.

A University of Pennsylvania biologist, Daniel Janzen, is engaged in what *Science* (Nov. 14, 1986 issue) editor Constance Holden describes as "an unprecedented attempt to regrow a tropical forest in what he hopes will become a 'case study in self-supporting perpetual ecological and biocultural restoration'." Janzen has been doing research on plant-animal relation-

revegetation notes

Tom Lucke, Chief, Water Resources Division, would like to remind those interested in the general topic of revegetation that an excellent periodical on the topic is available. It is *Restoration and Management Notes*, published by the University of Wisconsin Press for the University of Wisconsin Arboretum. The journal contains well written articles, has a long history of professionalism, and contains advertisements associated with restoration such as Prairie Restorations, Inc. and Prairie Nursery. The latest issue (Vol. 4, No. 1, Summer 1986) contains the following articles: "Restoration and the Reentry of Nature" by William R. Jordan, "Tropical Seagrass Restoration" by Signe Holtz, and "Woodland Restoration: An Overview" by Evelyn Howell. Correspondence regarding the journal should be sent to Journals Division, 114 N. Murray St., Madison, Wisconsin 53715.

ships in Costa Rica for two decades, and aided by foreign money and local talent he is intent upon incorporating the existing Santa Rosa National Park into a much larger 700-square-kilometer Guanacaste National Park. The project involves purchase of adjacent and connecting land.

The article describes the size of the task (enormous), the time frame within which it must be accomplished (almost immediately), and the estimated cost (\$11.8 million), but Janzen thinks he has found the means to restore the entire area within 100 years to where it was when the Spaniards arrived.

Part of the plan, Janzen calls "biocultural restoration," to put biology back into the native people's cultural repertoire – "back on the same status with music, art, and religion." The regenerated forest Janzen sees serving as a "user friendly" library or museum.

In an Aug. 8, 1986 *Science* review of "Wild Horses of the Great Basin," (p. 672), Peter Jarman observes that "over no feral species does public opinion take more extreme positions than over the feral horse in North America." He calls the book, by Joel Berger (Univ. of Chicago Press, 1986. 326 pp, illus. \$24.95) "an excellent, full, and very readable account of the ecology and behavior of a population of feral horses in part of the Great Basin Desert." Berger puts forth an argument for "a national park kept free of all exotic animals, cattle-raising land from which most horses would be removed, and at least three small preserves (free of cattle) for feral horses."

For several years the Washington Dept. of game has had a program of hacking Peregrine falcons in the Columbia River gorge. In 1986, for the first time in 30 years, a successful nest was established in the gorge when one of the introduced birds set up house-keeping with a wild mate and produced chicks.

All the chicks, hackboxes, and attendants are provided through contracts with a non-profit organization called the Peregrine Fund, based in Boise, Idaho. Similar programs are being conducted in many of the western states. If all goes well, this "bird of the kings" may once again be a regular sight along the rimrocks and cliffs of the West.

regional highlights

Western Region

From Christine Schonewald-Cox at the NPS/CPSU, University of California, Davis, comes word that hers and Jonathan Bayless's introductory paper on boundary analysis is appearing in the December 1986 issue of *Biological Conservation* (Vol. 36, No. 4). A truncated version of the article, "The Boundary Model: A Geographic Analysis of Design and Conservation of Nature Reserves," will appear in the Spring 1987 issue of *Park Science*.

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From Aivars Zakis, Redwoods NP Resource Management Specialist, comes news of *Resource Notes*, a xeroxed newsletter planned as a quarterly means of keeping Western Region resource management personnel in informal touch with regard to on-going projects, work recently completed, and planned future work. The stated purpose in Vol. 1 No. 1 (September 1986) was to "complement" *Park Science* (which tries to do the same thing) by going into greater detail about Western Region management projects and by serving as "a confidence builder for some individuals who will make considerable contributions later to *Park Science* and other journals." Zakis asks that contributions to "Resource Notes" be sent him at Redwood NP, P.O. Box 7, Orick, CA 95555, or by computer mail on FIDO to Aivars Zakis at NODE 8480.

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"Epizootiology and Ecological Significance of Malaria in Hawaiian Land Birds" in *Ecological Monographs* is now available from Dr. Charles van Riper, III, at the NPS/CPSU University of California, Davis. Avian malaria, although recently introduced into Hawaii, has been found to be one of the major population regulating mechanisms in native Hawaiian birds. The manuscript is authored by C. van Riper III, S.G. van Riper, M.L. Goff, and M. Laird.

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Research Scientist Gary Davis reports that a Natural Science Report Series for Channel Islands NP and Marine Sanctuary is being established. The Report Series will provide an official outlet and repository for data on population dynamics and resource conditions acquired through monitoring or research in the park and sanctuary. While this series will not take the place of publishing the results of thorough analysis and synthesis in refereed scientific journals or appropriate management reports, it will allow accurate, succinct archiving of basic data on population dynamics and monitoring methodologies. The first manuscript to be published will summarize the first four years of intertidal monitoring data and make recommendations regarding visitor use at Anacapa Island.

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A new Technical Report, entitled *Anatomical and Morphological Adaptations of Plants to Aridity in Death Valley National Monument* (M. Culp), was published by the CPSU, University of Nevada, Las Vegas in May 1986. The report presents the results of a study in which xeromorphic features of stems and

leaves from *Larrea tridentata* Cav. and *Atriplex hymenelytra* (Torr.) Wats. were analysed for anatomical variations within species.

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A panel of specialists was convened in July 1986 to review Sequoia, Kings Canyon and Yosemite NPs' fire management program, with emphasis on giant sequoias. The panel was composed of experts in forest and giant sequoia-mixed conifer forest ecology, fire ecology, landscape architecture and related fields. It took an analytical look at present policies and procedures related to restoring fire to its natural role. The panel's final report, now completed, will be the basis for a new look at fire management in these parks.

Midwest Region

From Gary Willson, Ecologist, Operations, for the Region, comes word of an article from the *Journal of College Science Teaching*, written by Dr. James Jackson who has conducted contract research for the Regional Office at George Washington Carver National Monument and Fort Scott NHS. The article (in the November 1985 issue) describes the unique opportunities for funded research and employment for undergraduates in national park sites — specifically junior and senior level students at Missouri Southern State College working at George Washington Carver. Major research objectives were to collect baseline data on the prairie vegetation, water quality, and small mammal populations, helping park officials develop management plans and "to restore the historic scene . . . wherever practicable."

A memorandum from Gentry Davis, Monument superintendent, in reply to a congratulatory note from Director Mott, described the research program "which answers specific needs identified by management," which provides opportunities for 30 undergraduate students annually to conduct hands on research, and which requires an annual outlay of only \$1,000 on the part of the park.

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Dr. Douglas A. Wilcox, Research Aquatic Ecologist at Indiana Dunes National Lakeshore, was recently named by the Board of Directors of the Society of Wetland Scientists to be the new Editor-in-Chief of its professional journal, *Wetlands*. The Society of Wetland Scientists is an international organization of research and resource management personnel with major professional interests in the biology and management of wetlands. Dr. Wilcox has been an associate editor of the journal for three years and will succeed the current editor, Dr. Gene Silberhorn, in early 1987. His role will be to form a new board of associate editors, each with technical expertise on a specific subject matter, distribute submitted manuscripts to them for review, make final decisions on suitability of papers for publication, make decisions on journal format, and coordinate activities with the publisher and abstracting services.

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Indiana Dunes National Lakeshore reports the completion of an action plan for endangered and threatened plant species. The plan was developed by George Oviatt as part of the project requirements for the Resources Management Trainee Program.

The action plan, while specifically addressing lakeshore species, provides guidelines for dealing with both state and federally listed plant species. Policy for collection, survey and restoration is discussed as well as the format for a ten-year program to monitor these species.

Copies of the plan entitled "Action Plan for Endangered and Threatened Plant Species within Indiana Dunes National Lakeshore" are available from the Resources Management Branch, Indiana Dunes National Lakeshore, 1100 N. Mineral Springs Road, Porter, IN 46304.

North Atlantic Region

A Resource Management Skills Team has been established in the Region, its main goals, to identify critical areas where skills are needed and to develop and conduct training courses to satisfy these needs. Team members have attended a workshop, by the end of which they had identified major topics that will be covered in an introductory course. This course will be offered several times in FY 1987. The Team also will sponsor other courses, including a training course on IPM for Historic Orchards and a session on utilizing the COMMON data base.

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Two major field investigations of nearshore sediment transport problems were undertaken this past year by Dr. James R. Allen, one each at Fire Island NS (FIIS) and Gateway NRA (Riis Park unit). A detailed article, with pictures and graphs, will be carried in the Spring issue of *Park Science*. The Fire Island study focused on the dynamics of eroding beach with a hole in the offshore bar and gave some new insights into infragravity waves (so-called "long waves" known for decades by surfers as "surf beat") and how they couple with other waves to drive much of the erosion of beaches during storms. At Riis Park, the study is of sediment transport around a large groin, which appears to have captured and diverted much of the longshore drift around the old Bathhouse and may explain much of the recent erosion in some places and nourishment in others along the beaches. Scientists from Rutgers Cooperative Research Unit have been involved in both studies.

Pacific Northwest

A Regional evaluation of the science program is being conducted in this Region by a team composed of Ivan Miller, Neal Guse, and Cliff Martinka. Miller is a Management Analyst in the Regional Office, Guse is superintendent at Mount Rainier NP, and Martinka is a Research Scientist at Glacier NP. Visits to the Region's Cooperative Park Studies Units (at the University of Washington, Oregon State University, and University of Idaho) are also a part of the evaluation procedure.

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A proposal for an NPS Bibliographic Database has been written and sent to the Washington Office of



NPS for possible funding. This paper proposes a minimum format for bibliographic citations, a methodology for accumulating citations and distribution of the database as a module for the COMMON database system. Anyone wishing a copy of the proposal or further information may contact PNR Librarian Ellen Traxel, FTS 399-5203 or (206) 442-5203.

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Resource Management Trainee Cat Hawkins is developing a Water Resources Management plan for Mount Rainier NP and has initiated baseline water quality monitoring there. The plan, its implementation, and work done thus far were discussed in October with Gary Larson, Regional Chief Scientist, and Shirley Clark, research scientist with the Region in Seattle. A software program has been developed to store the park's water quality data. The package will be appropriate for use in other parks and will be made available soon.

Southwest Region

The water quality in Buffalo National River is threatened by pollution from a solid waste landfill proposed nearby. This landfill also may contaminate other springs and water wells in the vicinity, which are used for local water supplies. These threats from the leachates which the landfill will generate have been substantiated by research.

The landfill site is located in a limestone karst area typical of the Ozark uplift. The Buffalo River has incised itself deeply into these limestone strata which are shot full of sinkholes and extensive cavern systems. Though the proponents of the landfill claim that a "fat" clay layer exists which can be compacted sufficiently to prevent any leakage, detailed dye-tracing studies performed over a 2-month period early this year showed that leachates will reach numerous nearby wells and springs. Two of the springs are water sources for tributaries to the Buffalo River. One of these, Mitch Hill Spring, is a major contributor of flow to the river during low flow periods. The dye showed up in this spring about 8 weeks after being injected into a sinkhole on land immediately adjacent to the proposed landfill site. The endangered grey bat forages over the river along the reach which can be contaminated.

Park management and staff along with Dr. Jim Quinlan of Mammoth Cave in Kentucky and staff of the Southwest Region's Division of Natural Resources Management have been working with the Field Solicitor to prepare for hearings to stop the landfill. This is in addition to a very aggressive effort which local citizens have mounted to resist the landfill. The entire issue has become politically charged, with gratifying support for the National Park Service's stand from the Arkansas Congressional delegation and Governor's office. Stay tuned for further updates as this fight continues to protect the beautiful Buffalo from this external threat.

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The recent "bloom" of toxic red tide organisms along the Texas coast has disappeared and is gone as quickly and unexpectedly as it appeared, leaving in its wake millions of pounds of dead fish and other marine organisms. The red tide is caused by a single celled plankton organism, and is best known for its effect in contaminating shell fish. The plankton, known as dinoflagellates, "bloom" in water more than 60 degrees fahrenheit. The demise of the recent red tide

"bloom," according to Padre Island Management Specialist Jennifer Bjork, is probably due to a decrease in temperature. A modest research effort was begun shortly after the red tide first appeared. The results of this research will be reported in *Park Science* in the future.

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Guadalupe Mountains NP reports that reintroduction efforts of the Montezuma Quail appear to be successful. Twenty chicks were observed at one time by a visitor to the park, and smaller numbers of young accompanied by their parents have been seen on other occasions.

The bird, also known as a fool or harlequin quail, disappeared from the Guadalupe Mountains decades ago, apparently because grazing livestock usurped their food supply. These little birds will be a welcome addition to the avifauna at Guadalupe Mountains National Park.

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There were 2011 Kemp's Ridley turtle eggs transported from Mexico to Padre Island National Seashore in June of 1986. Of these, 1776 hatched, for an overall hatching percentage of 88 percent. Although no NPS marked turtles have returned to nest at Padre Island, the prospects are so bright that the NPS and several other government agencies have decided to continue the process for another five years. Chief Scientist M. Fletcher promises to write a complete update for an impending issue of *Park Science*.

Southeast Region

After eight years with NPS, Peter White, formerly Research biologist, Great Smoky Mountains NP, has left the Service to become Director of the North Carolina Botanical Garden and a member of the Biology Department faculty at the University of North Carolina at Chapel Hill. The Garden includes 500 acres (mostly natural area) and manages several nature reserves around the state. Garden programs emphasize conservation, rare plant studies, natural habitats, and promotion of native plants for horticulture. Peter will stay active in National Park Service concerns and will maintain an active research program in conservation biology.

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Dominic "Dom" Dottavio, formerly Unit Director of the Cooperative Park Studies Unit at Clemson University, has been appointed Regional Chief Scientist of the Southeast Region. Dottavio succeeds G. Jay Gogue, who has left the Park Service to accept a position as Associate Director of Research at Clemson University.

Prior to his four years at the Clemson Cooperative Unit, Dottavio served as Director of East Coast Operations of the Center for Natural Areas, formerly an ecology program under the Smithsonian Institution. From 1975-1979, Dottavio was employed as an instructor at Purdue University, where he taught classes in forest ecology and served as Associate Director of the Integrated Natural Resources Summer Program for the Department of Forestry and Natural Resources.

A native of Massillon, Ohio, Dottavio holds a B.S. degree in natural resource management from Ohio State University, an M.S. degree in environmental studies from Yale University, and a Ph.D. in forestry and natural resources from Purdue University.

North Cascades Institute Scores Success

By Saul Weisberg

The North Cascades Institute, an independent non-profit field school, held its first summer field season in 1986. The Institute offers in-depth educational programs about the natural and human history of the North Cascades ecosystem in cooperation with North Cascades NP and the U.S. Forest Service. Twenty courses, ranging from field seminars (for which academic credit was available in 1986 through Western Washington University), photography and art workshops, family nature programs, and discovery dayhikes, provided a chance for more than 250 persons to discover the wild beauty of the North Cascades.

North Cascades Institute was born in January 1986 with the support of North Cascades National Park Service Complex (NOCA). Classes, which ranged in length from one to four days, began on the Memorial Day weekend and ran through the end of September. Among the classes offered were nature photography, mountain wildflowers, geology of the North Cascades and Mount Baker, alpine ecology, birds, butterflies, mushrooms, people of the mountain world, watercolor painting, and pen and ink illustration. Instructors for the classes were all recognized authorities in their fields, in many cases the authority on their subject in the Pacific Northwest.

The Institute was created and the first programs designed by, Saul Weisberg (M.S. Biology) and Tom Fleischner (M.S. Biology), seasonal backcountry rangers, and Margie Lundquist (MFA. Art Education), secretary to NOCA Superintendent John Reynolds.

Plans now are underway for an expanded program for the 1987 academic season, including a six-week academic program studying the Skagit River watershed (cosponsored with Huxley College of Environmental Studies). The Institute also will sponsor a three-day symposium on wilderness management in the Pacific Northwest in the winter of 1987. Future plans include an expanded series of year-round field seminars and workshops, as well as research into North Cascades prehistory.

The goals of North Cascades Institute are to 1) promote an awareness of the unique nature of the North Cascades ecosystem, 2) increase public understanding and appreciation of natural processes in the region, 3) enhance public understanding of how human activities affect this ecosystem, and 4) promote an appreciation of the value of wild lands, both for human use and enjoyment, and for their own sake.

The Institute programs encourage participants to examine their roles in natural systems, and become more responsible members of the natural community. The programs also spotlight the historical and cultural legacy of the North Cascades.

Requests for information may be sent to: North Cascades Institute, North Cascades National Park Service Complex, 2105 Highway 20, Sedro Woolley, WA 98284.

Weisberg is Program Director for the North Cascades Institute.

Dissolved Oxygen Levels Restored In the Pools of Carlsbad Caverns

By Cliff Chetwin

You are walking along the paved cavern trail, marveling at the speleothems, which range from massive columns to delicate helictites. On your left is a small pool of water which appears to be several feet deep and which has a dark hole in the center. However, as you edge closer, you notice a mild odor of rotten eggs and it becomes apparent that the deep "hole" is in fact a black sludge of decaying organic matter . . .

Well over 26 million people have visited Carlsbad Caverns National Park since 1923 and in recent years this was an increasingly common experience at several locations throughout the Cavern. In 1982, the park RM&VP staff began to investigate the causes of the sludge, with a goal of correcting the situation.

It was quickly observed that the only pools which appeared to be suffering this fate were those in close proximity to the established visitor trail. Those pools which were smallest and closest to the trail seemed to suffer the most, and in some cases, had "black zones" which reached the surface, releasing hydrogen sulfide gas.

Analysis of the sludge in the "black zone" revealed that a variety of organic and inorganic compounds were being washed/thrown into the pools. These compounds settled to the bottom of the pools where sulfates were reduced to hydrogen sulfide, which in turn was reacting with iron molecules found in the native calcite deposits, to form a black semi-decomposed mass. The limiting factor in this process was the reduced amounts of dissolved oxygen found in most cave pools. Over the years, the decomposition has reduced the oxygen levels to where the bottom level of most of these pools was anaerobic and some of the worst pools had become entirely anaerobic.

We decided to first identify the specific sources of contaminants and devise methods to prevent further contamination of the pools. Once this was accomplished we would then clean the existing sludge from the pools and artificially increase the dissolved oxygen to natural levels.

In order of increasing importance, we found the following sources: 1) organic/inorganic substances that were transported from the surface via natural infiltration; 2) body wastes from small mammals who followed man into the Cavern; 3) organic/inorganic substances contained in the effluent from trail cleaning; 4) organic food stuffs thrown into the pools by park visitors.

There was little that could be done practically to alter the natural infiltration routes so we chose to ignore this source for the time being. The body wastes from mammals, primarily raccoons and ringtails, proved to be the most difficult. They would enter the cave nightly and follow the same route as park visitors, raiding trash cans and the concessioner's underground lunchroom facility. Live trapping and removal to remote areas of the park had little effect, with some individuals traversing 7+ miles to return to be captured in the cave the next night. They also proved to be ingenious in defeating our efforts to secure the trash cans and the concessioner's food storage areas. Finally, in the spring of 1986, we came up with a combination of locks, trash can lids, and a maintenance schedule which they have not been able to defeat, and we feel that this source is now

negligible. The trail cleaning problem has been temporarily resolved by a method that allows R&T to catch the effluent at the trail edge and remove it from the cave. However, this is fairly labor intensive and risks spills. We are looking into some kind of an electric sweeper machine which could scrub the trail and collect the effluent at the same time.

We were able to determine that although many visitors brought food into the cave with them, the main source of organics in the pools was from food sold in the underground lunchroom. By 1983 we were able to identify particular food items that were most likely to end up in the pools and, with the concessioner's cooperation, these items were replaced with other products which have proved far less likely to go the pool route. Also, in 1985, the superintendent established a special regulation which prohibits food in the cave, except in the lunchroom.

By early 1985 we felt the pollution sources were sufficiently controlled that we could begin to restore the pools. Since the Cavern is a relatively dry cave we could not rely on aeration from natural drip rates. We also determined that convective overturn was a significant factor only in deeper pools located near the natural entrance where annual air temperature fluctuations are greatest. When visitation is not heavy, moderate drip rates and convective overturn were found to be adequate to maintain oxygen levels throughout the pools, and visitation was low enough in mid-winter for this to be effective. However, the rest of the year, higher visitation resulted in significantly higher loads of organics, which the pools were unable to overcome.



Coins, plastic gunk, bread wrapper, all contribute to the debris that must be fished out of Carlsbad Cavern pools before they can be restored by mixing procedures. The screen covers, one of which is shown at left, have been tried in pools far off the trail that appear as pits and are targets for thrown items, but eventually they tear and drop their loads into the pools.



Park Ranger Donna Giannantonio uses dipstick to fish coins out of a Carlsbad Cavern pool, prior to mechanical mixing of the water.

Control pools were selected from areas of the cave not open to the public and it was determined that a dissolved oxygen level of 9.0 mg/l was the approximate natural level for shallow pools. The deeper pools were stratified, with readings of 9.0 mg/l at the surface and 7.5 mg/l at the bottom.

Fifteen of the "worst-condition" pools in the Main Corridor and Big Room were selected for treatment. First, RM&VP rangers Ran Kerbo and John Roth established surface and bottom levels of dissolved oxygen for each pool (Table 1). They then scraped

as much of the sludge from each pool as was practical without damaging the pool. Initially, they had planned to use a 12v DC aquarium pump to aerate the pools but it quickly became apparent that

Table 1.

Pool Name	Dissolved Oxygen (mg/L)	
	surface (before/after)	bottom (before/after)
Billing Dove Tunnel	7.8/9.2	6.8/9.2
Black Gunk Pool	7.1/8.8	4.6/8.6
Top of the Cross	7.8/9.4	7.8/9.4
Leptothrix Pool	3.2/8.8	1.8/7.9
Gypsum Block Pool	5.5/8.6	1.8/8.4
Crystal Spring	7.8/9.1	6.2/9.0
Celery Stalk #1	5.9/9.1	0.4/9.0
Celery Stalk #2	6.8/9.2	0.1/9.0
Devil's Spring	7.1/10.2	7.1/10.0
Signature Pool	7.9/9.8	6.6/9.6
Green Lake	8.0/9.3	7.3/9.2
National Geographic Pool	6.0/8.4	0.4/4.2
Sword of Damocles	7.6/9.2	7.6/9.2
Longfellow's Bath-tub (longside)	7.5/8.8	1.9/6.3
Longfellow's Bath-tub (shortside)	7.4/8.8	1.4/7.4

the pools were too large for this to be effective. They then developed a process of mechanically mixing the water using a large paddle, which immediately proved effective. Throughout 1985 and early 1986 they continued the mixing with each pool being treated for approximately 10 minutes per month. Each pool was brought into the target range of dissolved oxygen within the first few months and all 15 have now been held at their new levels for over a year (Table 1). These new levels have been successful in preventing sludge return in all but three of the pools, and the buildup has been only minor in these three.

For the immediate future, we intend to expand the program to other pools in the visitor use areas as well as increasing the number of pools sampled in other areas of the cave to increase our control base. When the park returns to guided tours this winter, we also intend to study the relationship between the amount of organics thrown into pools and guided versus self-guided tours. We will also continue to analyze the three pools still exhibiting problems to discover why they did not respond in the same manner as the other 12 pools.

Chetwin is Chief, Resource Management and Visitor Protection at Carlsbad Caverns National Park.

mab notes

Global biosphere activity these days puts greatest emphasis on improving the functions of existing reserves, but new units continue to be added. At the meeting of the MAB International Coordinating Council (ICC) held in October, nine new biosphere reserves were approved, bringing the total to 261 in 70 countries. Four new countries joined those having biosphere reserves: Algeria, Burkina Faso (née Upper Volta), Sweden, and the Netherlands. The U.S. added no new ones this year, but with the current and recent flurry of study panel activity we should see some next year. A Californian Biogeographical Province selection panel, chaired by Harold Mooney of Stanford University, met in November; and an Acadian-Boreal Coastal Region panel, chaired by James Broadus of the Woods Hole Oceanographic Institute, was to meet in December.

The guiding document for international biosphere reserve activity is the *Action Plan for Biosphere Reserves*, adopted by the MAB ICC in December 1984. At its meeting in La Paz, Bolivia last August, the Scientific Advisory Panel for Biosphere Reserves recommended that each national committee be requested to develop a national strategy to implement the Action Plan, and the ICC has endorsed the recommendation. U.S. MAB will be considering ways to act on this recommendation. At the same meeting, results of a questionnaire on management of biosphere reserves were reported. They showed that U.S. biosphere reserves are strongest in research, monitoring, and conservation, weakest in local participation and involvement in regional planning. BRs in developing countries appear (from the small number of responses) to be strongest in local participation and regional planning.

Bill Gregg, NPS MAB Coordinator, attended an impressive, encouraging meeting on biosphere reserves in India in September. He reports that this meeting was unprecedented in that it was the first national conference to discuss at a high level a national strategy for implementing the Action Plan. India is planning to establish a network of biosphere reserves that will integrate conservation with development. They will seek to conserve wild relatives of economic species and traditional land uses of local people, to improve the health, education, and economic life of these people, and will conduct applied research as well as protect wild species and their environments. Bill feels that India, which has many problems common to the Third World but also enjoys advanced technology, has a good chance to achieve these goals in its biosphere reserves.

At the same meeting, U.S.-Indian cooperation in developing a model biosphere reserve in India was discussed. Special interest was shown in a number of topics recently proposed by the NPS as areas of potential cooperation – notably a biological survey, a conservation data center, a geographic information system, long-term ecological monitoring and research, applications of landscape ecology, and conservation education. Coordination at the U.S. end would be handled by the National Park Service.

U.S.-West German cooperation moves forward with a statement of intent signed in October by the chairmen of the respective national MAB committees. Initial effort will be on environmental monitoring, with emphasis on biological indicators of chemical pollutants; applications of landscape ecology; and environmental education, with emphasis on atmospheric pollutants and their effects. The goal is to begin projects in 1987.

Bill Gregg, a contract designer, and I are producing an international brochure on biosphere reserves to be published by the MAB Paris office in 1987. This brochure explains what a biosphere reserve is and what it is intended to do. We will proceed next to a brochure on U.S. biosphere reserves tailored to the situation and audiences in this country.

Napier Shelton
NPS Washington Office

book review

Red Fox: the catlike canine by J. David Henry. 1986. Smithsonian Institution Press. Washington, D.C. 174 pp. (ISBN No. 87474-520-9).

David Henry's 14-year study of the behavior and ecology of the red fox (*Vulpes vulpes*) in Saskatchewan's Prince Albert National Park is summarized in this delightful book. Henry's work is field ethology and natural history at its best. The book is masterfully written overall; only once does the author lapse into anatomical terms that may bring back bad memories of comparative anatomy classes (when you failed to identify the entepicondylar foramen of the humerus). Chapters 1-2 describe fox habitat and life history. Chapters 4-7 examine the evolution and survival value of various hunting behaviors. The final chapter is a thought-provoking discussion of the level of animal awareness: including the suggestion that examining rare behaviors – in addition to routine easily categorized patterns – may provide insight into what occurs inside an animal's head. I particularly enjoyed discussions of the evolution of foxes as catlike canids, the physics of fox hunting (The Fox as Guided Missile), and the attempts to understand food cache and urine marking behaviors. Following Niko Tinbergen, Henry conducted a series of elegantly simple field experiments to test hypotheses on the development of hunting behaviors (at a level that seemed quite appropriate, I might add, within a National Park). There are lessons to be learned both from David Henry's research approach and his philosophy: "... I am struck by the similarity between testing hypotheses and raising children. Both are initiated as a result of creative moments. Both children and hypotheses need a good deal of nurturing in order to develop, and ultimately both must be let go of because in a very real sense they have lives of their own to live. I suppose one more similarity must be acknowledged – in both cases the progenitor follows the development of his offspring with considerable interest."

Douglas B. Houston
Olympic National Park

AID Bulletin Describes Natural Resource Pubs

Natural Resource Technical Bulletin No. 9, the last in the series originally contracted between the NPS and Earthcare Network, Inc., contains brief descriptions of 63 current publications for natural resource development planners. The information is listed under six headings: natural resources, ecosystem studies, environmental protection, natural system planning and management, general, and marginal lands.

Bulletin No. 9 contains several articles on marginal, fragile lands, a discussion of wetlands and direct development practices therein, and the present situation with regard to Panama mangrove resources.

Previous issues have been devoted to training, biological diversity, coastal zone planning, and environmental planning.

Purpose of the bulletins has been to inform AID personnel and host government counterparts about the help available in carrying out their responsibilities in ways that will assure sustainable development. Ways to continue the bulletins are being explored, and suggestions or information can be directed to Molly Kux, Office of Forestry, Environment and Natural Resources, Bureau for Science and Technology, USAID, Washington, D.C. 20523.

Coastal Fisheries Project at Jamaica Bay Completed

By Bruce Lane and John T. Tanacredi

Of Gateway National Recreation Area's 26,000 acres more than half comprise the open waters and marshlands of Jamaica Bay. The bay has long been known for its extensive bird populations, rookeries and its importance in the Atlantic flyway. More recently however, Resource Managers at the park have been looking at the health, diversity, and distributions of the bay's fish populations.

Geographically located within the boundaries of New York City, Jamaica Bay is part of the larger Hudson/Raritan estuarine system. It is roughly circular in shape and covers an area of approximately 52 kilometers (km). An estimated 40 percent of the fresh water that enters the bay is through surface runoff over the bay's drainage area of 270 km. The remaining 60 percent of fresh water enters from treated wastewater effluent, for a total freshwater input of 420 billion liters/year. The bay contains a number of access channels whose depths range from 6-17m. The average depth is 4m at mean low water. Tidal flushing is limited to the relatively narrow Rockaway Inlet making the residence time of the bay's water about 30 days. The urban development, wastewater effluent, ocean dumping and pollution associated with the New York Metropolitan area has greatly impacted the local waters. Although it is not always apparent to the casual observer, the shores of Jamaica Bay support electrical power plants, petroleum storage facilities, four wastewater treatment plants, three sanitary landfills, an international airport,

and docking space for thousands of boats, all of which can have direct impacts on the water quality of the bay. The waters, marshes, and islands have been manipulated for generations, beginning when the Canarsie Indians collected shellfish on its shores.

Despite the seemingly bad odds, most of the bay appears virtually unspoiled and remains highly productive. Marshes continue to expand, providing spawning grounds and a home for many species of finfish and other marine organisms. A macrobenthic study of Jamaica Bay completed in 1983 by Dr. William Harris and Dr. David Franz, both researchers from Brooklyn College, CUNY, revealed 121 benthic taxa, demonstrating the species richness as comparable to other estuaries in the region.

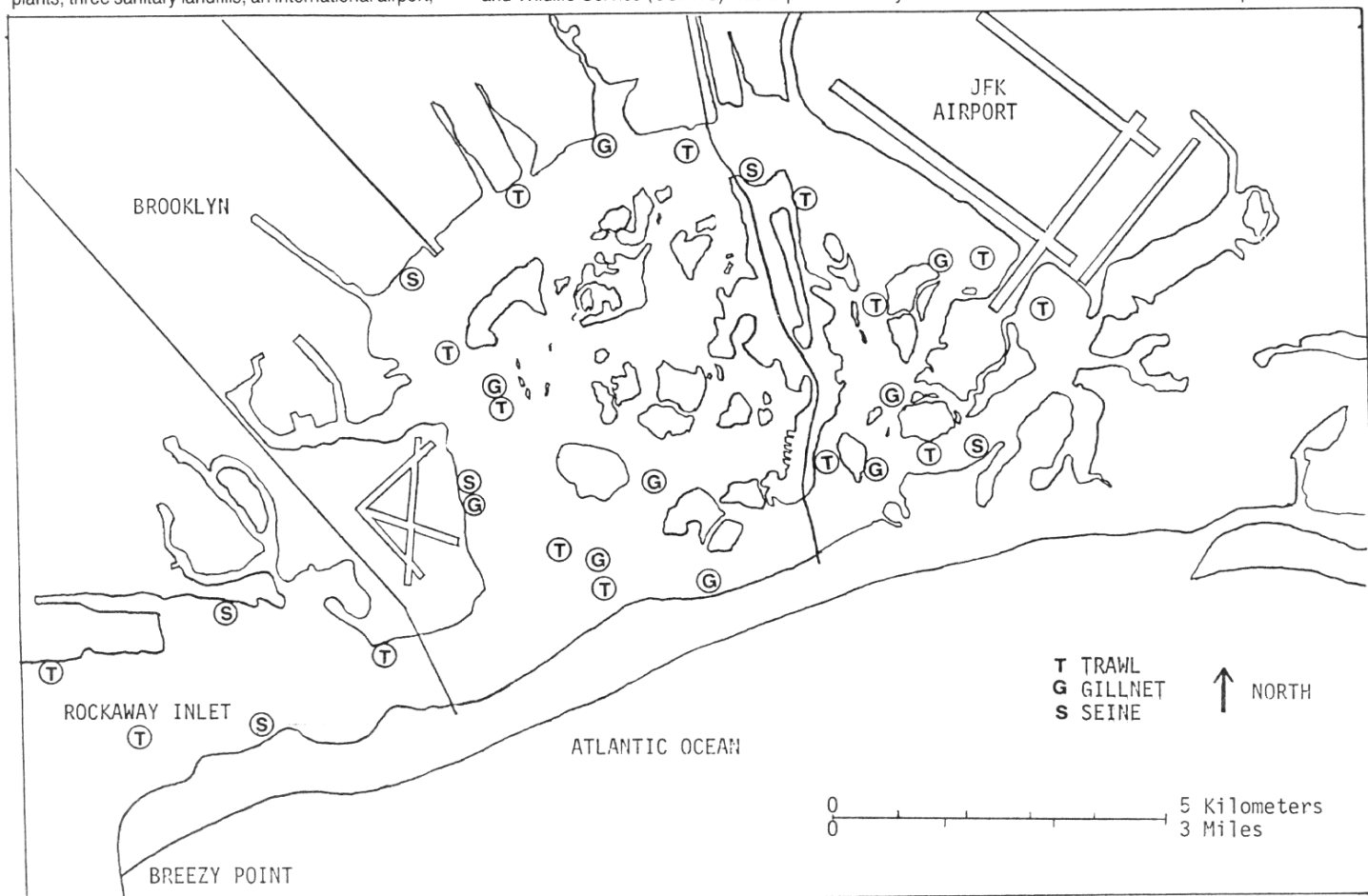
With this vast fisheries resource, fishing for sport and food has long been a favorite recreational activity in the park. Weekend fishermen line the railings of bridges and piers while others venture out in personal boats or charter fishing boats in hopes of a good catch. Continued pressure however, from development on neighboring lands, the possibility of potentially toxic materials leaching from landfills, and scientific studies reporting contaminated fish in adjacent waters raised concern over the environmental quality of the Jamaica Bay fishery and demonstrated the need for a comprehensive fisheries study.

An existing Interagency Agreement between the National Park Service and the United States Fish and Wildlife Service (USFWS) was expanded in July

of 1985 to include a one year finfish inventory of Jamaica Bay. In conjunction with the inventory, fish species were collected for laboratory analysis, and a fishing survey questionnaire was developed. The 25' research vessel utilized in the project is owned by the National Park Service and was specially designed by the USFWS and engineers from the shipbuilder, Boston Whaler, Inc. The open stern has been fitted with an aluminum deck, which keeps the 30' otter trawl net clear from the boat's outdrive. 1000 lb. capacity power winches do most of the work in hauling the trawl net, while radar, a recording depth finder, marine radio, and other accessories aid in navigation. The boat is named after Herbert Johnson who was instrumental in developing the Jamaica Bay Wildlife Refuge in the early 1950s.

The one year finfish inventory on Jamaica Bay was conducted by employees of Gateway's Office of Resource Management and Compliance and a Biologist from the USFWS. The crew sampled the bay once each month throughout the year. Fifteen trawling stations were chosen to reflect an overall geographic distribution as well as the varied sediment types found throughout the bay. The otter trawl was towed for a five minute period into the tidal current. Once the net had been hauled aboard the location was noted, and each fish counted and measured. Other information such as breeding activity and evidence of disease also was recorded. At each sample station the levels of dissolved oxygen, pH, salinity, and temperature were determined.

In order to sample the upper water layer, 100' gill nets were used. Nine gill net stations were selected throughout the bay. Each net contained four 25' panels, which provide a mesh opening ranging from 1/2" to 2 1/2". The nets were held in place with 10 lb.





The research vessel, Herbert Johnson, leaving port for data collection on Jamaica Bay, part of Gateway National Recreation Area in New York City.

anchors, marked with floats, and set perpendicular to the shoreline or shoal bank. They were retrieved after 24 hours, and the data were recorded. A 50-foot, hand-held seine net was used to sample along the shoreline. One sweep was made at each of the six chosen sample stations. Again, water quality parameters and fish data were recorded.

These sample techniques proved effective and netted good catches throughout the year; thus far, 46 different species of finfish have been recorded. Fish specimens numbering 146 and representing 13 different species were sent to a USFWS contract laboratory facility for PCB analysis. In addition to the finfish numerous species of invertebrates were captured. Although not recorded for purposes of this study their presence is important as a food source and demonstrates the diversity and productivity of Jamaica Bay.

The fishing survey questionnaire is the final phase of Gateway's fishery study, and it was designed to identify the recreational catch population of the bay. Five hundred surveys are being conducted by non-uniformed NPS employees at various locations around Jamaica Bay. The questionnaire covers length of time spent fishing, fish caught, the rationale for fishing and choosing a fishing location, and the consumption of fish caught. The last five questions relate to the demographic and social conditions of the fishing population. Once all the surveys are completed, computerized and analyzed, the park will have a picture of who is catching what fish and where the fish are being caught. Coupled with the finfish inventory and PCB lab analysis, this information will tell park managers which people, places, and times to target, should a public health hazard exist. New York State's Department of Environmental Conservation has recognized the public safety issue and has conducted research throughout New York State to determine the contaminant levels in finfish and the risk factors associated with their consumption. The State Department of Health has issued several public health advisories ranging from limited consumption to prohibiting possession. High PCB levels in the

Hudson River striped bass is perhaps the most noted because of its commercial fisheries value and popularity in sport fishing. As pressure for recreational fishing and fish consumption continues, careful consideration will be needed to manage Jamaica Bay's fisheries resource. This project is the first step in that direction. The completed fisheries report will be available early in 1987.

Lane is a Natural Resource Specialist and Tanacredi is a Research Ecologist at Gateway NRA.

research notes

In 1984, the Delaware River Basin Commission (DRBC), a federal-interstate agency with jurisdiction throughout the river basin, and the National Park Service initiated a cooperative water monitoring program focusing on the upper and middle sections of the Delaware River – the waterway that forms the boundary between Pennsylvania, New York, and New Jersey.

These two river sections include the Upper Delaware Scenic and Recreational River (UDSRR) and the Delaware Water Gap National Recreation Area (DWGNRA) . . . both parts of the National Wild and Scenic Rivers system. The areas, both administered by the National Park Service, span nearly 120 river miles and serve 300,000 recreationists yearly.

A U.S. Environmental Protection Agency report on the program, describing the program's development, the monitoring parameters, location and frequency of sampling, use of the parameters to screen water quality, determination of monitoring priorities, and program administration, was published in July, 1986, as an EPA Water Quality Program Highlight. Material for the report was furnished by John Karish, NPS Mid-Atlantic Regional Chief Scientist, Richard C. Albert of the Delaware River Basin Commission, and Charles Sapp of U.S. EPA's Region III.

For copies of the report, contact E.F. Drabkowski, EPA, MDSD, WH-553, 401 M Street S.W., Washington DC 20460. (202) 382-7056.

External Development Affecting the National Parks: Preserving "The Best Idea We Ever Had"

By Thomas W. Lucke

Wallace Stegner once described America's national parks as "the best idea we ever had." How to preserve and protect the unique qualities and superlative resource of these parks from adverse impacts caused by development beyond their boundaries was the topic of a Conference conducted from Sept. 14 to 16, 1986 at Aspen Lodge, Colo., which, with its sweeping view of Long's Peak and Rocky Mountain NP, was more than an appropriate setting. Organized by the National Resources Law Center of the University of Colorado School of Law, the Conference was attended by 85 participants, 18 of whom were NPS employees.

During the two days following a keynote address entitled "The Future of the National Parks: Recreating the Alliance Between Commerce and Conservation" by Professor Robin Winks of Yale University, a number of scholars involved with NPS issues gave presentations. They included Alfred Runte, author of *National Parks: the American Experience* and Professor of History at the University of Washington; author and naturalist Robert Cahn of Leesburg, Virginia; T. Destry Jarvis of the National Parks and Conservation Association; Alston Chase, author of *Playing God in Yellowstone*; Professor George Cameron Coggins of the University of Kansas School of Law; and Michael Mantell of the Conservation Foundation.

Congressional activities regarding park protection were detailed by Judy Erickson, Legislative Assistant to Sen. David Durenberger (Minn.); the Department of Interior's position on the question of external threats and adverse peripheral development was given by Steve Gleason, Deputy to the Under Secretary, and Allan Fitzsimmons, Special Assistant to the Assistant Secretary for Fish, Wildlife and Parks. NPS speakers included Molly Ross of the Air Quality Division, Supt. James Thompson of Rocky Mountain NP, and John Varley, Chief of Research at Yellowstone NP.

Two case studies concerning development activities outside park boundaries that hold potential for significantly affecting water and wildlife resources and values within park boundaries were presented and discussed. They were "Challenges of the Greater Yellowstone" by Bill Bryan, Board Member of the Greater Yellowstone Coalition, and "Restoring the Biological Integrity of Everglades National Park" by Estus Whitfield, Senior Analyst with the Office of the Governor of Florida.

The Conference purpose was to explore park values requiring protection, to examine possible threats to those values posed by external activities, to identify and weigh the legal and management issues involved, and to suggest possible approaches for improving park protection. Judging from the response of many of the participants, that purpose was achieved.

As to weaknesses in the Conference, several participants felt it would have been helpful if private developers or representatives of extraction and developmental interests had been present to put forth their concerns and perspectives on the concept of park protection.

The handbook developed for the course is available for \$30.00, and audio tapes of all the sessions are available for \$75.00. They can be obtained by writing to Katherine Taylor, Natural Resources Law Center, University of Colorado School of Law, Campus Box 401, Boulder, Colorado 80309-0401.

Radio Telemetry Use in Smallmouth Bass Habitat Research

By Brian L. Todd, Victoria Mendiola Grant and David I. Foster

Previous studies of the recreationally important smallmouth bass in streams of the Ozark National Scenic Riverways (ONSR) indicate complex relationships between food and habitat. These relationships often are ignored by commonly used habitat evaluation procedures. A variety of habitat types apparently is essential for providing both food and cover for different life stages of the species.

Several study approaches, such as underwater observation and electrofishing, have been used to determine which habitats smallmouth bass prefer. But because of sampling limitations, the information gained was incomplete. Observations were limited to one or two seasons, and we were unable to observe the same fish through time or follow the fish's habitat selection around the clock. In order to gain a more complete understanding of the habitat utilized by smallmouth bass, research biologists at ONSR, in cooperation with biologists at the University of Missouri at Columbia, decided to use radio telemetry to determine which habitats are preferred.

Radio telemetry is a method by which the location, and consequently the movement, of a radio-tagged fish can be continuously monitored. A radio signal is emitted from a tiny transmitter that has been surgically implanted in the gut cavity of the fish. A directional antenna is used to pin-point the fish's location by determining where the signal is strongest. The transmitters are 1.5 cm long, 0.5 cm wide and weigh 4.0 grams. Their transmitting range is 150 m and they will last for three months. Each transmitter emits a different frequency so that individual fish can be identified.

Since July of 1985, 34 adult smallmouth bass have been radio-tagged. From these 34 fish over 4,000 fish locations were obtained. The last transmitters will go off the air in February of 1987, thus concluding the field work portion of this project.

Preliminary findings pertaining to cover, one of the components of habitat, showed that during the summer, the fish tend to stay within one pool, preferring open water in the early morning. During the day, log jams and boulders were preferred, while a diversity of cover types including boulders, log jams, single logs, open water and vegetation beds were used at night. Peaks in movement occurred soon after sunrise and again at sunset, with little movement between noon and sunset. During the fall, the smallmouth bass preferred cover types similar to those used in the summer, but moved less. In the winter even less movement was recorded; the fish remained around the boulders day and night. Although no distinct pattern for spring cover type selection was apparent, movement increased sharply. About half the radio-tagged fish left their "home" pool and moved from pool to pool. The maximum amount of upstream movement recorded was 7.7 km, while the maximum downstream movement monitored was 5.4 km.

As it developed, a wide array of cover types are used throughout the day and throughout the year. Conventional methods of estimating habitat selection may have underestimated the importance of one or more of these cover types. Radio telemetry also can be used to determine preferred depths, velocities and substrates.

Glen Canyon Environmental Studies: Pathway to Better Management of a Non-native Ecosystem

By Steve Hodapp

From its completion in 1964 until 1983, Glen Canyon Dam was operated to fulfill three primary goals: (1) minimizing releases in excess of 8.25 million acre feet (the amount required by the 1922 Colorado River Compact for release from Upper Colorado River Basin States to Lower Colorado River Basin States), (2) maximization of power revenues, and (3) filling of Glen Canyon reservoir. Short- and long-term impacts to Glen Canyon NRA and Grand Canyon National Park resources in the downstream river corridor were generally not considered in dam operations.

In the early 1980s, two events resulted in reconsideration of the manner in which the dam had been operated. These were: (1) the filling of the upper basin storage reservoirs and (2) a 1981 proposal by the Bureau of Reclamation (BR) to add two generators and increase maximum powerplant discharge from 31,500 cfs to 40,000 cfs. This rekindled the sentiment of the environmental and river-running community which had never recovered from the initial Glen Canyon Dam battle in the 1950s.

The compromise solution born from this BR proposal was an agreement to proceed with rewind of the existing eight generators, basically a maintenance function which would provide only a 5-percent increase in maximum powerplant discharge, along with initiation of a research project to study the impacts of existing and potential future powerplant releases. In December 1982, a tri-party, interagency agreement was signed (U.S. Fish and Wildlife Service, BR, and NPS) to create the Glen Canyon Environmental Studies (GCES). The agreement provided for BR to provide all funding and for all agen-

At ONSR radio telemetry has worked well. However, river width and depth, sources of signal interference (i.e. utility lines, electrical generating stations and some engines) and other factors can influence the accuracy of the location estimate. As with any new technique, a pilot study should be undertaken to determine the feasibility of the technique. In the pilot study several types of radio transmitters, receivers, antennas and methods of radio-tagging should be evaluated. The results of this initial study will allow the researcher to adjust his project design in order to be more complete and efficient.

Radio telemetry has traditionally been used in the terrestrial environment, however, biologists now are tracking animals such as molluscs and aquatic turtles in an attempt to take a "second look." Research biologists at ONSR and the University of Missouri at Columbia feel that radio telemetry is, and will continue to be, a valuable tool in researching our aquatic resources.

Todd is a Graduate Research Assistant working towards a Master's Degree from the University of Missouri at Columbia. This telemetry project constitutes his thesis work. Grant is a Resource Management Specialist at St. Croix National Scenic Riverway. She was formerly stationed at ONSR. Foster is the Research Biologist at ONSR.

This research project was funded by the Missouri Cooperative Fish and Wildlife Research Unit, the National Park Service and the Missouri Department of Conservation.

cies to jointly provide input on project direction. In addition, in that agreement BR agreed not to exceed the historic powerplant discharge of 31,500 cfs.

The GCES are a series of technical studies to determine the long- and short-term impacts of dam operations. The project has been subdivided into four major subteams: biological (both aquatic and terrestrial), recreational, sediment transport, and dam operations. Each of these subteams is composed of a number of researchers pursuing specific studies designed to determine the effects of different flow regimes on their particular resource of concern. In all, over 70 researchers are pursuing about 40 different studies (see Table 1). Researchers include: universities, graduate students, other Federal agencies, State agencies, private contractors, and NPS personnel. The primary area of NPS researcher involvement is studies focused on potential impacts to vegetation, boating safety, and avian habitat.

Unlike most government-sponsored studies, the major obstacle to testing of the various hypotheses has not been funding, but rather ensuring provision of an adequate time period of fluctuating flows. Due to extreme runoff in the Colorado River basin, there have been only 4 months over the 3½-year study period with fluctuating flows simulating those of "normal" dam operations. (Use of the term normal is still being redefined due to filling of the upper basin storage reservoirs in 1983.)

After the individual research reports were completed in the fall of 1986, they were being assimilated by an interagency team into four comprehensive subteam reports. The National Academy of Sciences has been contracted to provide technical input into this assimilation process and to ensure that study assumptions are fully considered.

A final report, integrating results of each of the subteam reports, will be completed by April 1987 and forwarded to the Secretary of the Interior who will make the ultimate decision on the dam release pattern. Any "major" change in operations would require NEPA documentation. This 1987 deadline coincides with the scheduled renegotiation of WAPA firm power contracts to provide fixed amounts of electricity to various utilities.

Any flow regime selected will require trade-offs among competing resource values. The NPS recommendation for an operational regime will be based on how well specific flow scenarios meet the hierarchical objectives proposed for the revised Colorado River Management Plan (see below).

Draft Prioritized Objectives for the Colorado River Management Plan

1. Protect and enhance existing populations of native aquatic organisms or allow for reestablishment of extirpated native species.
2. Maintain the Colorado River alluvial deposits by mitigating accelerated erosion due to man-induced processes.
3. Perpetuate the Colorado River riparian ecosystems and natural successional processes taking place within them.
4. Maintain the diverse wildlife communities that developed within the modified Colorado River riparian habitat.



Table I.
Reports to be Generated by the
Glen Canyon Environmental Studies

GROUP I – BIOLOGICAL STUDIES

A. Terrestrial

1. Impacts of the 1983 High Flows on New High Waterline Riparian Vegetation (NPS)
2. Description of Beach Edaphic Factors and Invertebrate Biology (NPS)
3. Impact of the High Flows on the Old High Water Line Plant Community (NPS)
4. Impacts of Fluctuating Flows on Grand Canyon Birds (NPS)
5. Analysis of Recent Vegetation Trends in the New and Old High Water Plant Community (BR)
6. Description of Factors Affecting Establishment of the Perennial Riparian Community Within the New High Water Zone (NPS)
7. Impact of Flows on the Reptiles of Grand Canyon (NPS)

B. Aquatic

1. Instream Flow Microhabitat Studies in the Lees Ferry Area (FWS)
2. Thermal Modeling of the Colorado River Through Grand Canyon (BR)
3. Mainstream Colorado River Fishery Study (AZ Game & Fish)
4. Tributary Fishery Studies (AZ Game & Fish)
5. Fish Reproduction Studies (AZ Game & Fish)
6. Fish Movement Studies (AZ Game & Fish)
7. Lees Ferry Fishery (AZ Game & Fish)
8. Cladophora Biology Study (No. Arizona University)
9. Gammarus Biology Study (No. Arizona University)
10. Analysis of Water Quality Parameters in the Mainstream and Tributaries (AZ Game & Fish)

GROUP II – RECREATIONAL STUDIES

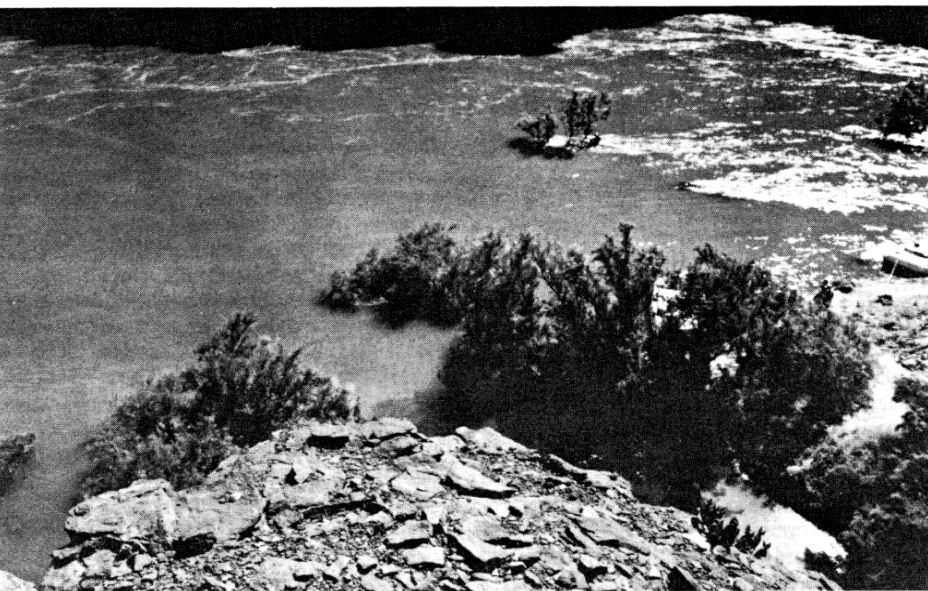
1. Correlation of Reported and Non-reported Accidents with Flow Level (NPS)
2. Utilization of the River Use Simulation Model to Predict Effects on Trip Structure (NPS)
3. Attribute Surveys (4 parts – Day-use Rafting, Whitewater Rafting, Fishing, Guides) (Private Consultant)
4. Contingent Valuation Surveys (3 parts – Day-use Rafting, Whitewater Rafting, Fishing) (Private Consultant)
5. Economic Modeling of Recreation Use

GROUP III – SEDIMENT TRANSPORT AND HYDROLOGY STUDIES

1. Model Development to Predict Suspended Sediment Transport (BR)
2. Survey of Colorado River Bed Material (USGS)
3. Analysis of Short- and Long-Term Geomorphic Relationships Affecting Beach/Bar Stability (USGS)
4. Critical Beach Topographical Surveys (BR)
5. Rapid Hydraulics Study (USGS)
6. Analysis of Historic Records from Gaging Stations Within Grand Canyon (NPS)

GROUP IV – OPERATIONS STUDIES

1. Colorado River Storage Project Constraints (BR)
2. Colorado River Water Law (BR)
3. Operations of Glen Canyon Dam (BR)



19.3 Mile Camping Beach is shown in the top photo as it appeared in June 1983, when the river flow was 60,300 cfs, and in the bottom photo as it looked in October 1983, when the water flow was down to 25,000 cfs. The high June runoff has scoured most of the tamarisk except for a few bedraggled plants and left the beach essentially barren.



5. Maintain the current water quality of the Colorado River.
6. Maintain specific features of the post-dam riverine system that are essential for river running and/or that enrich the experience.
7. Perpetuate the recreational trophy trout fishing in the absence of further impact by trout to existing native aquatic ecosystems.

This hierarchy of resource values has been established based on laws and policies directing resources preservation at Grand Canyon NP. These laws and policies include the 1916 Organic Act as amended by Public Law 95-250, which emphasizes resource preservation over visitor use, NPS management policies, and the Endangered Species Act. This prioritization of resource values is expected to raise interesting questions from a policy standpoint. For example, is an exotic riparian community (objective number 3) really more important than the whitewater rafting experience (objective number 6)? The surprising answer for a natural park such as Grand Canyon is yes. A further explanation of these objectives will

help provide a context for priorities.

The first objective speaks to protection of native species, in particular, the endangered humpback chub and, hence needs little explanation or justification to support its high priority. Objectives 2 through 5 relate to the riparian habitat along the Colorado River which has been identified as an important ecological niche within the park. The unique aspect of this riparian community is that in pre-dam times, the alluvial deposits, locally known as beaches, were barren of vegetation. This resulted from the spring runoff, which scoured beaches during the average annual floods of 100,000 cfs.

In post-dam times (except for relatively brief periods of flooding following the 1983 filling of the upper basin reservoir system), dam releases have been less than 30,000 cfs. The previously barren beaches have become available for colonization by plants and animals. The plants are mostly alien, as would be anticipated in a disturbed environment, but many of the birds are species that had experienced

Continued on page 22

Improving the NPS Natural Resource Management Process

By Philip E. Nibali

During June and July 1986, an analysis of Regional Annual Natural Resource Reports and Park Resource Management Plans (RMP) was undertaken in the National Park Service Washington Office. The purpose of this informal study was to look for ways to increase the consistency and the utility of the Reports and Plans, and to identify approaches to improving the natural resource management process in general. A variety of related documents, including the guidelines for Report/Plan preparation, copies of pertinent

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significant habitat loss elsewhere in the southwest due to riparian habitat destruction. At the same time, mammals and herptofauna have extended their habitat from the old high water vegetation community (mesquite-acacia) above the 100,000 cfs waterline to the new high water vegetation (tamarisk) above the 30,000 cfs waterline.

Therefore, we view preservation of beaches which are essential in providing a substrate for this habitat (as well as camping opportunities for river runners) as the most important component of this riparian system. The vegetation which provides the habitat is secondarily important and finally, the animals themselves. Next we look at the water quality which also has been substantially altered in physical/chemical properties by the dam. Existing parameters are important to current aquatic organisms as well as the river running community from a public health perspective. The recreational opportunities are the basis for the last two objectives. As would be expected, the popular river-running experience is higher priority than the exotic trout fishery.

It appears that the ongoing GCES will at least qualitatively identify the differing effects of various flow regimes on these downstream resources. It is also fully anticipated that maximization of various resource opportunities will require different flow regimes. For example, data could suggest beneficial effects of high spring flows on certain riparian plant species but detrimental effects on certain bird species that nest low to the ground. Some tradeoffs would be required under such a scenario in order to ensure preservation of the most important resource/process.

The decision on benefits of particular flow regimes is expected to be further complicated by the different mandates of the various agencies participating in this interagency study. Due to these complexities, this priority list cannot be viewed as an absolute, but rather as a guide toward management of this system.

If effects of differing flows can be confirmed, the study methodology and potentially even the results may have broad applicability to maximizing protection of important resource values in other artificially regulated river corridors.

Hodapp is Chief, Resource Management and Planning, Grand Canyon NP.

memos, and budget formulation guides, were reviewed.

The study yielded several findings. One was that significant variance exists with regard to many elements of the basic mechanics of these Reports and Plans, making the documents difficult and confusing to use. Page numbering systems were inconsistent, and many project statements were not clearly marked with Regional and park priority numbers; abbreviations and acronyms varied and/or were not explained; and, formats used for the charts that list priorities, and for the reports as a whole, differed considerably.

A second finding was that, overall, Regional Offices were dissatisfied with the numerical method employed by most of them in prioritizing projects. They complained that the numerical method was cumbersome, that it consumed an inordinate amount of time, and that the results were not more accurate or reflective of Regional needs than those obtained from the prioritization process previously used. Another finding was that significant differences have evolved in park RMPs since the issuance of the December 1980 guidelines for Plan preparation.

Based on the review and analysis of the park RMPs, Regional Annual Natural Resource Reports, and other documents, the following conclusions were reached:

One, that if a more standard format for the Plans and Reports were adopted, user confusion and frustration would be reduced – the desired information would be easier to locate and understand. It should be noted here that taking such action would facilitate computerization of the natural resource management process. While development of a comprehensive plan for computerization may result in reduction of the individuality and flexibility parks and Regions have enjoyed, it should aid in timely production of all documents related to the process, as well as more timely appropriation of funds.

Priority Standards Needed

Two, that there is a need for a standard set of general project prioritization guidelines, to be imparted to all field personnel. On the park level, it would probably be best to leave things as they stand: in the hands of resource management staff, with guidance, assistance and approval by superintendents and the Regional Office. Thus, the first-line decision-making authority on natural resource/research matters would be retained at the park level, where lies the most familiarity with local problems, issues and needs. On the Regional level, it was concluded that the numerical method employed by most Regions in 1986 for prioritizing projects should be discontinued. A non-numerical process would lessen the burden in that park staff no longer would be required to assign "precise" numerical values for projects or do the resultant calculations. More reliance would be placed on the experience, judgment, and integrity of the Regional staff. Finally, a goal should be to standardize a reasonable balance of influence on prioritizing between the parks, the Regional Offices, and the Washington Of-

fice and other Servicewide decision makers.

Three, that there is a need for uniform guidelines and procedures from the Washington Office on park RMP review and update.

Four, that the various innovations and approaches taken by the Regions with regard to cooperative programs should be collected, categorized, analyzed, and presented in a coherent fashion to each of the Regional Offices and parks by the Washington Office. Even though the Regional Offices have all received and supposedly reviewed each others' Reports, an effort of the kind proposed would serve to highlight, emphasize, and potentially improve and expand cooperative activities . . . a particularly appropriate exercise in these times of shrinking funds.

Five, that the Director's emphasis on resource management within his 12-point plan provides an excellent opportunity to develop a comprehensive and accountable natural resource management process. There is need for an overall plan, and a proposed schedule of accomplishments. One approach to year-by-year budget requests and initiatives might be to have a particular focus for the year. For example, there appears to be a need for a period of increased emphasis on baseline data collection. This activity serves as the foundation for many other important activities, including determining management direction, developing park plans, identifying resource problems and research needs, and developing and assessing alternatives for management actions. In other years, areas such as exotic species, water resources, or visitor studies might be stressed.

Something is Being Done

Regions and parks have remarked/complained/lamented that they are seeing relatively little return on the time and effort they invest in Report/Plan preparation, in terms of funding and staffing received. Some are skeptical about the value of the Reports and Plans. Even though the funds and staff allocated in these times of extremely tight budgets may be far less than what might seem even minimally necessary to properly manage park resources, it should be reassuring to Regional and park personnel to know that something is being done with the documents they have labored to produce.

One such "something" is a fiscal year 1988 natural resource budget initiative, which was put together by the Washington Office using data contained in the Reports and Plans. The initiative lists the "backlog" of identified, unfunded projects that must be completed to bring the natural resources up to, or to maintain them in, the condition their National Park status demands. Specific objectives of the initiative include: 1) bringing park base programs up to a level where parks are able to conduct the routine, day to day activities required to ensure effective preservation of park resources and any specific short term projects for which they receive regional or Servicewide funding; 2) increasing Regional Office programs to where they can provide the basic cyclic support to park programs identified in their regional natural resource plans plus begin to conduct park natural resource program reviews as part of the Service's Operations Evaluation program; and, 3) expanding Servicewide support capabilities to ensure that all critical project needs are met and that longer term research and natural resource planning efforts are initiated.

Nibali was a student in the Recreation Resource Management program at the University of Maryland when this article was written. He served as a Program Analyst on the Science Support Staff, Washington Office, under a Volunteer in Parks agreement.

Climbing Safety Program Shows Results at North Cascades

By Bill Lester

The 674,000 acres of the combination of North Cascades National Park Service Complex and Lake Chelan and Ross Lake National Recreation Areas (NOCA) extend south from the Canadian Border into the north central portion of Washington state. The park contains nearly 100 named peaks over 7,000 feet and 1/5 of all glaciers in the lower 48 states. Large portions are without trails, and access to major climbing areas is difficult and time consuming. Two of North America's 50 classic climbs are found here, Forbidden Peak and Price Glacier.

The names given to many of the peaks tell much of the story about the first attempts at challenging this rugged landscape: Damnation, Despair, Forbidden, Challenger, Fury, Phantom, Inspiration, Terror and Torment, to name a few.

Until recent times only a few mountaineers ever ventured into the North Cascades. The first ascent of the Pickett Range was not until 1931. Not until the '50s, when logging roads made access easier, was much interest paid to this isolated range.

At the time NOCA was established, 1968, it was estimated that about 1,000 climbers annually were using the area. Ten years later there were still only about 1,300 per year. Many were the same cadre of climbers returning year after year to attempt a variety of peaks. From 1978 to 1983 the accident rate was about 1 serious accident per 323 climbers and 1 death per 1,086. The average accident rate for 1984 through 1986 is one accident per 660 climbers and one death per 8,250.

In 1978 a series of climbing guides began to be published. By 1981, three volumes of *Cascade Alpine Guides* covering the Cascade range from the Columbia River to the Fraser River in Canada, were available. By 1982, climbing activity in the North Cascades had doubled and has increased at an average of 18 percent per year since. In 1986 there were more than 6,500 climbers.

The climbing boom had begun. Climbers were arriving at the backcountry office with guide books in hand asking for directions to the trailhead. Climbing was not part of the park operation other than an occasional climb. What climbing information we did get came from rangers climbing on their days off. We had little or no credibility with the climbing community.

In the spring of 1983 a strategy was developed to get a handle on backcountry safety problems, both for the visitor and the staff.

The first step was to assign one backcountry Ranger position to full time climbing and crosscountry patrol duties. The lead technician also spent about 50 percent of his time climbing. The park now had a half-time climbing team.

A Backcountry Safety Action Plan, quickly dubbed SAP, was part of the strategy. Each member of the backcountry staff was required to document all safety problems in his assigned area. The plan required identifying safety problems, a statement of what corrective action was required and who was responsible for the corrective action. All SAP reports were given to the entire staff. Serious problems or hazards were

radioed to the Backcountry Center to be immediately available to the visitor. All pertinent items were posted on the trails conditions board and on the "Climbing Notes" board.

The third part of the strategy was to have park Rangers climb and become familiar with the more popular routes. Climbers were contacted at base camps and on the routes. Safety and minimum impact techniques were the main topics. They were informed that most of the accidents were happening to experienced climbers who failed to take basic precautions, including failure to rope up, inadequate protection, and over extending themselves.

In 1984 a second climbing Ranger position was added, giving North Cascades a full time climbing team. Our credibility with climbers improved as we added to our knowledge of routes and climbs. Our overall knowledge of safety problems and hazards in the backcountry increased exponentially. Climbing rangers were assigned duty in the Backcountry

Center on Friday evenings and Saturday mornings (when most climbers come through) to answer climbers' questions and to encourage good safe climbing practices. *Climbing Notes*, a climbing newsletter describing climbing route conditions and safety measures, was started. Every opportunity to talk with climbing groups was taken. All members of the backcountry staff were expected to become involved in the safety of themselves and the visitors.

By the end of the 1986 season we are enjoying good credibility with climbers. Rangers are asked for by name for information about routes and conditions. The climbing accident rate is at its lowest level ever and knowledge of safety problems and how to prevent injuries and death is better than it has ever been. Climbing in North Cascades remains a hazardous sport.

Lester is a backcountry Ranger at the Marblemount Ranger Station, NOCA.

Accident Frequency Rates

Years	# Climbers	# Accid.	# Fatal.	Freq. Accid.	Freq. Fatal.
1978-1980	4,110	15	7	1 per 274	1 per 685
1981-1983	7,842	22	4	1 per 356	1 per 1,960
1984-1986	16,500	23	2*	1 per 717	1 per 8,250

*One climber killed by a falling rock while on route into the climbing area.

Regional Chief Scientists

Anderson, William H.
NATIONAL CAPITAL REGION
1100 Ohio Drive, S.W.
Washington, D.C. 20242
8(202)342-1443

Dottavio, Dominic
SOUTHEAST REGION
75 Spring St. S.W.
Atlanta, GA 30303
8-242-4916 (404) 221-4916

Karish, John R.
MID ATLANTIC REGION
Ferguson Bldg, Room 209-B
Pennsylvania State University
University Park, PA 16802
8(814)865-7974

Kilgore, Bruce
WESTERN REGION
450 Golden Gate Ave.
P.O. Box 36063
San Francisco, CA 94102
8-556-4968 (415) 556-4968

Ruggiero, Michael
MIDWEST REGION
1709 Jackson St.
Omaha, NE 68102
8-864-3438 (402) 221-3438

Huff, Dan
ROCKY MOUNTAIN REGION
P.O. Box 25827
Denver, CO 80225
8-776-9425 (303) 236-9425

Larson, James W.
PACIFIC NORTHWEST REGION
83 S. King St.
Suite 212
Seattle, WA 98104
8-399-4176 (206) 442-4176

Soukup, Michael
NORTH ATLANTIC REGION
15 State Street
Boston, MA 02109
8-835-8805 (617) 565-8805

Fletcher, Milford
SOUTHWEST REGION
P.O. Box 728
Santa Fe, NM 87501
8-476-6412 (505) 988-6412

Lovaas, Allan L.
ALASKA REGION
2525 Gambell St., Room 107
Anchorage, AK 99503-2892
8 (907) 271-2612

Please address requests for information to appropriate Regional Chief Scientist.

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