More rainbows (May)
to here, w/rb trout

Chipper/baby
duck/
predation

Paper weips

Chester flies

Rainbow Trout

Rattlesnake?

Predation

Raptor ~~Hawk~~-killing ~~was~~ probably came out backwards anyhow. The red-tails & ghouls were good at hiding. The eagles were ~~pery~~ easy, & the peregrines.

Killed the owls at the top of their food chain because they were not afraid - making life easier for the next tier.

Along Kittatinny Ridge in central Pennsylvania, migrating birds of prey have been censused and celebrated for sixty years. By Laurie Goodrich

Joyce Pendola

The migration count has continued annually since 1934, with the exception of the war years 1943, 1944, and 1945. Sixteen species of falcons, buteos, eagles, accipiters, and vultures are regularly sighted. We usually count an average of 20,000 diurnal—or day-flying—birds of prey between August 15 and December 15. At the peak of the migration just after a cold front, one can expect to sight 1,000 or more hawks in one day. Mid-September, early October, and early November are the three main migration peaks. These correspond to the times when the three most abundant species—broad-winged, sharp-shinned, and red-tailed hawks—are passing through. The most popular migrants may be eagles. Bald eagles come through in early September and November, and goldens in November.

The annual count provides an index of long-term trends. Many species declined dramatically during the 1960s and 1970s, when use of organochlorine pesticides such as DDT was widespread. Raptor numbers rebounded after DDT and associated compounds were banned in the 1970s. Of the sixteen species monitored at Hawk Mountain, ten have become more numerous since that time. This increase has been especially pronounced for Cooper's and sharp-shinned hawks, ospreys, bald eagles, and peregrine falcons.

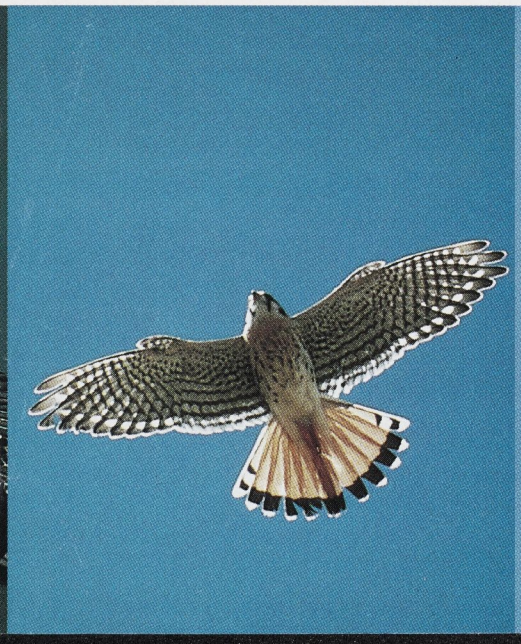
More recently, we have seen declines in numbers of forest raptors, including broad-winged, red-shouldered, and sharp-shinned hawks. The as yet undetermined reasons for these trends may be different for each species, but the counts have served as an early warning system, signaling possible problems in the birds' wintering or breeding ground habitats.

Of the birds of prey that have shown encouraging upward trends over the long term, the most notable are ospreys, which pass over Hawk Mountain from inland Canada and New England and whose numbers have increased steadily from the 1930s to the 1990s. Not as affected by organochlorine pesticides as were coastal ospreys, these inland ospreys increased in number perhaps because of growing numbers of beavers. Ponds created by the mammals provide more water's-edge nesting habitat for the fish-eating osprey. In northern lake regions, maturing forests mean better, bigger trees for nesting.

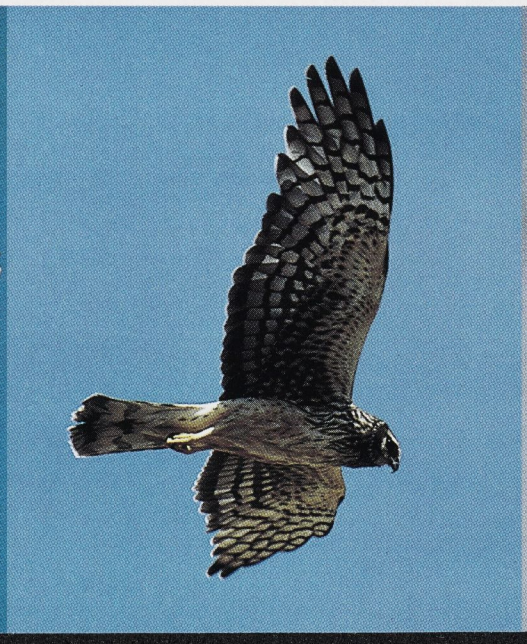
A few species, such as the red-tailed hawk, have been remarkably stable. A widespread, adaptable species, red-tails are at home in a variety of habitats and acclimate well to environments altered by humans. Red-tails migrate south in late October and November and form the mainstay of the late-season viewing. Whenever a strong northwest wind chills the boulder-strewn mountain in early November, a parade of red-tails will follow.

Laurie Goodrich is a senior naturalist at Hawk Mountain Sanctuary, a nonprofit, member-supported organization. For more information on Hawk Mountain and its programs, write Hawk Mountain Sanctuary, RR 2, Box 191, Kempton, PA 19529.

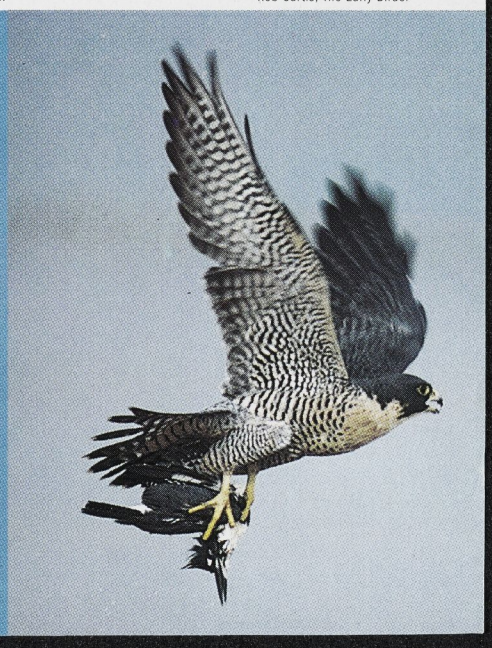
B. K. Wheeler; VIREO



R. J. Erwin; Photo Researchers, Inc.



Rob Curtis; The Early Birder



River of Raptors

The largest autumn hawk migration in the world is ably monitored on a makeshift tower and a rooftop in two Mexican towns. By Jessica Maxwell

On a map, North America looks like a tornado hung between the oceans. Nearly four thousand miles across from Alaska to Newfoundland, it drills and narrows to only fifty-one miles at the Panama Canal before touching down on South American soil. Heavy-bodied raptors navigating the continents, going north in the spring, south for the winter, have little choice but to follow the funnel. They must conserve energy to survive the flight. So the 500-mile coastal plain of the state of Veracruz, Mexico—its thermal updrafts rising like magic carpets between the mountains and the gulf—long ago became the flyway of choice for more migratory raptors than anywhere else on earth.

The numbers are startling. Last fall, nearly 2 million broad-winged hawks passed over this dry lip of Mexico's east coast, as did 1.5 million turkey vultures, hundreds of thousands of Swainson's hawks, 50,000 Mississippi kites, 3,000 kestrels, 2,000 sharp-shinned hawks, and a scattering of other raptors—twenty species and more than 4 million birds in all. In the spring, the tally was closer to 1.4 million, still enough to darken the sky with what locals call the *Río de Rapaces*—the "River of Raptors."

This phenomenon is, by all accounts, a natural wonder, one the rest of the world is only now beginning to recognize, thanks to the efforts of the fledgling Veracruz chapter of a conservation organization called Pronatura, its dedicated young staff, and its highly allergic, but unflagging, twenty-eight-year-old leader, Ernesto Ruelas Inzunza. A national organization with offices in six states, Pronatura was founded in 1981 when, as Ernesto puts it, "the need for a nongovernment organization working on conservation issues was recognized." The first Veracruz office was founded in 1990 in Córdoba. Things didn't work out there, so Ernesto and his associates moved the office to Xalapa (formerly Jalapa), the state's capital, built into the foothills of the Sierra Madre, whose parallel mountain ranges define the central plateau. Officially, Ernesto Ruelas is executive director of Pronatura's Veracruz office, but he drove two hours in the heat on questionable roads to meet my flight at the Veracruz airport.

Migration to this Mexican outpost is arduous, even in a jet. Roughly following the path of a western Swainson's hawk, I flew from Oregon to Los Angeles to Mexico City and on to the city of Veracruz. Then there was the long drive in the dark across the coastal plain and up through the foothills to Xalapa. All that was visible were the ghostly bulkheads of nearby hills; the Gumby forms of roadside cactuses, white in our headlights; and the ruby taillights of the caravan of trucks we'd joined.

"This is one of the few highways in Mexico where the trucks pull over for the cars to pass," Ernesto informed me. This meant that every two minutes for the next two hours he would ride the rear end of the vehicle in front of us until it lumbered to the right. Then, sniffling nervously, he would lean back hard, stiffen his arms as if bracing for the worst, pull into the opposing lane, and

B. K. Wheeler; VIREO

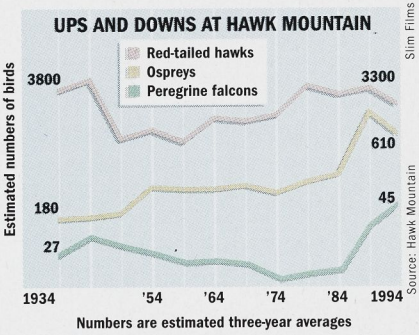
Steve Kaufman; Peter Arnold, Inc.

B. K. Wheeler; VIREO

The Place Where Hawk Watching Was Born

Scott Weidensaul

Hawk watchers at the North Lookout, left. Some species have waxed and waned while others have remained stable, chart, right.



Slim Films

Source: Hawk Mountain

Hawk Mountain, along one of the most prominent flyways in eastern North America, is a place that some hawk watchers affectionately call their "mecca." Even without hawks, the vista at Hawk Mountain can take your breath away, but this is also the site of one of the world's first and longest-running migration counts.

Hawk Mountain Sanctuary, about eighty-five miles northwest of Philadelphia, was founded in 1934 by conservationist Rosalie Edge. During the 1920s and early 1930s, hawk shooting, rather than hawk watching, was the preferred pastime at Hawk Mountain. On peak migration days during the fall, hundreds of hawks were killed, their dead bodies strewn among the rocks where they fell. The ridgetop slaughter continued through 1932, when Richard Pough, a Philadelphia photographer, took photos of piles of dead and dying hawks atop the mountain lookout and sent them to conservation groups throughout the northeast. The photos outraged Edge, who together with Pough and Willard Gibbs Van Name, an associate curator at the American Museum of Natural History, raised $500 for a one-year lease and an option to buy the 1,400-acre property. Edge thus established the world's first sanctuary for birds of prey and launched a process that culminated in federal laws to protect all raptors.

To stop the hawk shooting, Edge hired a young naturalist, Maurice Broun, as the sanctuary's first curator. Broun started the migration count in the fall of 1934, and in so doing pioneered the method of censusing the hawks on a consistent, daily basis. His vigorous public education programs inspired many marksmen to look to the skies with binoculars rather than guns.

Hawk Mountain's North Lookout is an ideal spot for viewing the fall migration of hawks on their way to destinations that range from the southern United States to the grasslands of Argentina. They converge on the spine-backed ridge to ride the wind currents created along its slopes. Updrafts generated by strong northwest winds following a cold front provide the best weather conditions for hawk watching. At such times, the hawks pull their wings in and hug the ridge.

Art Wolfe

Raptors demonstrate flight maneuvers (from left to right): A bald eagle downstrokes in flapping flight; an American kestrel soars; a northern harrier glides; and a peregrine falcon pumps its wings to hoist its kingfisher prey. These four species are among the regular fall migrants at Hawk Mountain.

Birds traveling between Africa, Europe, and Asia find a land of plenty at a continental crossroads.

By Reuven Yosef

Hans Reinhard; Bruce Coleman, Inc.

Hadoram Shirihai

Hadoram Shirihai

More than thirty species of birds of prey rest and refuel at Elat on their way north from Africa in spring. Among them are some 30,000 steppe eagles (top), 40,000 Levant sparrowhawks (middle), and lesser numbers of imperial eagles (bottom).

from 316,000 to 604,000, most of which are Levant sparrowhawks, lesser spotted eagles, and honey buzzards.

In spring, an estimated three million raptors migrate up through the Middle East. Honey buzzards (more than 500,000), steppe buzzards (more than 300,000), Levant sparrowhawks (at least 40,000), steppe eagles (at least 30,000), are the most numerous, but some thirty other species come through in smaller numbers. The majority appear to cross at Elat. To date, migration surveys have been conducted regularly only in Israel; the status of birds of prey traveling through other countries of the region remains vague.

At Elat, the surveys are conducted by the International Birding Center. In contrast to most hawk watch sites, here we see many more raptors in spring. In fall, the birds are fresh from their breeding grounds and do not stop to rest, but in spring, they reach Elat after a 2,500-mile crossing over some of the most inhospitable terrain on earth. For many species, Elat is a welcome oasis and a traditional staging point—a place to rest, feed, and put on fat—before they continue their journeys to Europe and Asia.

Recently, biologist and raptor specialist William S. (Bill) Clark and I established a full-scale raptor-banding operation at the Elat Banding Station. This station, which has long been banding migrant songbirds, is the only one of its kind in the Middle East. The program has already given us valuable data on the birds of prey using the eastern Mediterranean flyway and is helping us find out where they go after leaving Elat. Individual raptors banded at Elat have been recovered 4,000 miles to the south in South Africa and almost 2,400 miles to the north in central and eastern Russia. All recoveries of our banded Levant sparrowhawks to date have come from their Eurasian breeding grounds, some 900 to 1,200 miles away, but the wintering grounds of these birds remain a mystery. Similarly, marsh harriers, Montagu's harriers, booted eagles, and black kites have been found in Eurasia.

At first, the large numbers of birds reported by Israeli surveyors were met with skepticism by many European ornithologists. This was the case in 1982, when 89,000 lesser spotted eagles were counted in central Israel; criticism only increased the following year when the same survey found a record 142,000 of these birds. The population estimates for this species (based on data from only western Europe) had ranged from 844 pairs to 40,000 pairs. But the cumulative consistency of the migration survey data suggests that many pockets where raptors nest are yet to be discovered. Russian ornithologists doubted the number of Levant sparrowhawks reported at Elat until this past year, when they discovered previously unknown breeding areas for these birds along the Volga River. Migration surveys conducted at specific bottlenecks like Elat may prove to be a better indicator of raptor populations than counts undertaken at the birds' breeding grounds, which although widespread are often physically remote or hard to reach because of regional politics.

The Levant sparrowhawks, having fed well on common turtledoves and the occasional plump wading bird at the bird sanctuary, take to the air as the first rays of dawn reach over the Edom Mountains. They will fly north along the Great Syrio-African Rift Valley, then over some of the lowest places on the face of the earth, the Dead Sea and the Sea of Galilee. The sparrowhawks' route continues into Lebanon and Syria and through the breadth of Turkey. In smaller groups, they will fan out on both sides of the Black Sea and reach their breeding grounds to the north, another migration completed. In fall, they will head back to Africa, together with a new generation of Levant sparrowhawks.

Reuven Yosef is the director of the International Birding Center at Elat. For information on monitoring and banding programs, write to Yosef at IBCE, P.O. Box 774, Elat 88106, Israel.

Fishing (July?)

C+R – Skwiepigeon

maybe ~~so~~ believed,
once, that fish considers
this a sporting contest

(Jules?) (Ours) (~~Gosnt~~)

Open with the piece on young pheasants: how do they see into my shadows?

(or old cock)

July

The good fortune of
all streams the one I
most like to fish, not
quite tough enough to
discourage me, not easy enough
so that I know I'll
catch a fish.

(Bobi big brown)

Scientists buck odds in combatting disease

By TRACY ELLIG
Chronicle Staff Writer

8/25/96

As scientists, politicians and business owners clamor for solutions to a devastating trout disease, their voices sound small and tinny before an immense void of human knowledge.

Whirling disease, discovered 21 months ago in the Madison River and blamed for a loss of 90 percent of the famed river's rainbow trout, is unlike anything that's ever confronted fishery managers in Montana or elsewhere.

Fishing business is in a tailspin in Ennis because of whirling disease, Page 21

As scientists look for ways to deal with the disease and as politicians rustle up hundreds of thousands of dollars for the work, one question helps put the problem into perspective, helps measure the challenge: Is there any precedent for the successful management of a disease once its been identified as harming a population of wild fish?

The answer is discouragingly simple — no.

But it is an answer that points more to human ignorance than failed efforts.

Typically in efforts to fight diseases in wild fish, "There is really no good baseline information on which to say there is hope or not," said Dick Vincent, a former Montana Department of Fish Wildlife and Parks regional fisheries manager. Vincent skipped retirement after a 31-year career to work on the governor-appointed Whirling Disease Task Force.

One of the most important pieces of information needed in any battle against disease in wild fish is long-term, consistent population records of fish in a river.

Without a long-term record of how many fish populate a river, it's difficult to known if something is killing them, or, if some management practice is helping them.

"You may lose half the fish and still think it is good because you haven't looked at it (over a long period of time)," Vincent said.

Such long-term records are rare. In most parts of the nation, "there isn't the historic population data one would really need to prove any factor has affected (a fishery)," said Roger Herman, director of the National Fish Health Research Laboratory in West Virginia. Much of the ground-breaking work on whirling disease was done at the lab. It was here the lifecycle of the parasite that causes whirling disease was first understood.

(More on **Whirling**, Page 11)

Fishing bus. & in the research

Lab to be housed at Montana State

By TRACY ELLIG
Chronicle Staff Writer

July

A 2,000-square-foot laboratory for the study of wild trout and whirling disease is expected to arrive on the campus of Montana State University in the next few weeks.

The prefabricated structure will find its home at the end of South Fifth Avenue, said Dorothy Bradley, head of the Montana Water Resource Center.

The building will be used entirely for laboratory space and will be shared by MSU, the Montana Department of Fish Wildlife and Parks and the U.S. Fish and Wildlife Service.

The vast majority of the money for the $200,000 building is from funds redirected by U.S. Fish and Wildlife Service at the request of Sen. Max Baucus, D-Mont.

Sen. Conrad Burns, R-Mont., also did his share by having $200,000 diverted from the Yellowstone National Park wolf reintroduction program to whirling disease research. He has initiated legislation that would set aside $900,000 from the next federal budget for the lab as well.

The lab will allow biologists to study whirling disease without fear of infecting local waters. Caused by a microscopic parasite, whirling disease is so named because fish showing symptoms swim in a circular, or whirling, manner making them more susceptible to predators and less likely to effectively feed.

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A heartfelt thank you to our children for hosting our 50th Wedding Celebration and to all out family and friends who sent cards and especially to those who honored us by their presence. Because of you our celebration was a joyful, memorable occasion. God bless you.
Melvin & Peggy Maichel

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Bozeman Daily Chronicle

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SUBSCRIPTION RATES

1 MO. 3 MO. 6 MO. 9 MO. 12 MO.

Whirling/*from page 1*

Montana, however, has the records. For 30 years, Vincent collected data on the Madison. No other river in the nation has that much population data. It is why Montana fisheries biologists can say the rainbow trout population has dropped from 3,300 fish per mile to 300 per mile in the Madison.

There is also data on how the Madison's rainbow population is affected by water temperature, water flow, angling regulations, closures and the stocking of hatchery fish. All of this information puts biologists in a good position to test ways of managing the disease.

Maybe a genetically resistant strain can be introduced, maybe there is a way for young fish to avoid the parasite that causes the disease, maybe, maybe, maybe — at least Montana is in a good position to know.

"I think nature will pull this off," Vincent said. "I just don't know the time frame."

Though there is slim evidence of human intervention succeeding in managing a disease in wild population, there is evidence of Mother Nature taking care of herself.

In the mid-1970s, water crashing down a spillway on the Libby Dam caused "gas supersaturation" in the Kootenai River. In layman terms, the water became bubbly, air bubbles got into the skin of rainbows and whitefish, the fish died, said Patrick Graham, director of the Montana Department of Fish, Wildlife and Parks.

The whitefish adapted to the situation by spawning in tributaries that didn't have the bubbly water. Whitefish typically spawn in the main stem of a river. "It is a fairly dramatic example of how a fish can change its behavior under severe pressure," Graham said. "We had tributary spawning whitefish. They don't exist anywhere else."

Nature can do remarkable things if given a chance. What concerns Vincent is that Montana's politicians, fishermen and businesses will grow impatient.

"If we are careful, I think we can assist nature in the process," Vincent said. "My fear is we that may take a harder hand and start stocking hatchery fish."

Montana is the only state to manage all of its river fisheries as wild — hatchery-raised fish are never put in Montana rivers. It has done so since 1974. For much of the nation, management involves stocking rivers year after year with hatchery-raised fish, creatures that are often short-lived compared to their wild kin. Stocking policies explain, in part, the lack of good population data in those states.

"If you manage through other methods, like stocking, you get different scenarios and your needs for data are different," Vincent said. "If all your streams are ruined ... that is a different management technique ... you just throw fish in."

Neither Graham nor Vincent want to just throw fish in, something Graham calls "the illusion of a quick fix."

"You change fish when you rear them in an artificial environment (a hatchery). The species you are rearing loses a lot of adaptability," Graham said. "Montana is one of the last reservoirs in the lower 48 of wild populations, that is why we take this so darn seriously."

So far, anglers and businesses dependent on the money they spend have been impressively patient, Vincent said. But he wonders what it will be like in four years if whirling disease is still holding rainbow populations down.

"People will want something to fish for, and I can respect that," he said. "But if you want big fish, you have to have wild trout."

If Montana returns to stocking fish, anglers can expect to catch trout eight to 12 inches long. "The trophy and medium to large fish are wild. And if that is what people want, this is the only route," Vincent said.

Tobacco/*from page 1*

The FDA says teens' favorite cigarette brands are also the most heavily advertised, including Camels and Marlboros. That's why advertising restrictions are at the heart of the crackdown — but they're restrictions adults will feel too.

Drivers will see no more flashy cigarette ads on roadside billboards: all tobacco billboards must be only black-and-white, with no pictures.

No cigarette billboards at all are allowed within 1,000 feet of a school or playground. Ad executives predict there will be no outdoor tobacco ads in all of Manhattan, and fewer than 30 in metropolitan Boston.

There will be no more Joe Camel ads in magazines like Rolling Stone or Sports Illustrated. The same black-and-white rule applies for any magazine read by 2 million teens or whose readership is 15 percent youth.

FDA Commissioner David Kessler said the new rules will help children who are told not to smoke but constantly confront billboards

mixed messages," he said in an appearance on PBS' "The NewsHour With Jim Lehrer."

Ad restrictions aren't the only curbs:

■ Cigarette vending machines will be banned from grocery stores, restaurants and any other place where a teen might wander. They still will be allowed in bars and casinos that let in only people who can prove they're over 18.

■ There will be no more brand-name sponsorship of sports such as the former Virginia Slims tennis tournament or a Marlboro auto-racing team.

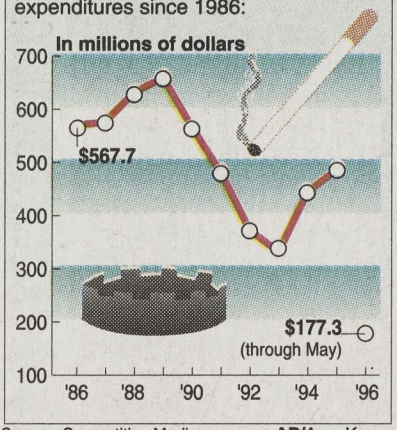
■ And no more T-shirts or hats bearing cigarette brands or logos, what Health and Human Services Secretary Donna Shalala calls "walking advertisements."

It may be a while before Americans notice any difference: The tobacco and advertising industries previously challenged the regulations in court when they were in the planning stage.

Lawyers for R.J. Reynolds To-

Selling cigarettes

Cigarette advertising is a prime target of President Clinton's crackdown on the tobacco industry. Advertising expenditures since 1986:



Source: Competitive Media Reporting and Publishers Information Bureau

AP/Amy Kranz

Kessler noted that the Justice Department has reviewed the regulations and believes they are constitutional.

Tobacco companies are afraid the FDA's move will hurt their defense in more than 200 lawsuits by smokers who say they were

Conservationist ala

CHOTEAU (AP) — A Wyoming man appears to be preparing to file hard rock mining claims on the Rocky Mountain Front, and conservationists are alarmed.

There has been some exploration on the front for oil and natural gas, but hard rock mineral activity there is almost unheard of. There is virtually no history of gold or silver mining on the front.

North American Exploration crews have been doing the probing

since June f
Thermopolis
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"This isn't
Mark Good,
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Island Range

The expl
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Quick/*from page 1*

"If you care at all about people, you know this is not something you jump for joy about," said Saunders. "I'm sorry it had to come to this point. I hope some healing can begin now."

Saunders testified he felt personally betrayed when Quick attacked the principal hiring process with claims that he had somehow received earlier jobs through favoritism or rule-bending. He said

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Bob Brown
really worl

Fishing tackle as medicine kit
for open it it, ~~and~~ so also.
I'm no collector, but fishing
tackle is fun. You pull out
an old fly to model
to a new one, & you remember
the fish you caught on
the model. Graphite is hard
to love except for its
efficiency, but reels are
still interesting, lovely
handmade, kook eccentric.
Best is the oldest - Hardy,
Greenheart, etc. It's beautiful
because other anglers have
it beyond reason.

Jane

Stephen J. Bodio

MONTANA, MAGDALENA AND FRIENDS THAT FISH

ILLUSTRATIONS BY RUSSELL CHATHAM

"Hunting in your own back yard becomes with time, if you love hunting, less and less expeditionary."
—TOM MCGUANE

Tom's back yard, of course, is the Boulder River. Mine, for many years, was the vast, dry Big Empty of the Gila country in New Mexico. It's a magnificent, hairy chunk of land that ranges from about 4,000 feet above sea level to nearly 11,000 at its highest peak. The bottoms have a flora and fauna influenced by the Sierra Madre—vermilion fly catchers, red-faced warblers, Scott's Orioles, javelina, walnuts, agave. The peak's inhabitants would be familiar to any Montanan—elk, mule deer, black bears, Steller's jays, ravens, Clarke's nutcrackers. If I picked my route, I could theoretically hike for 140 miles in one direction without crossing any pavement.

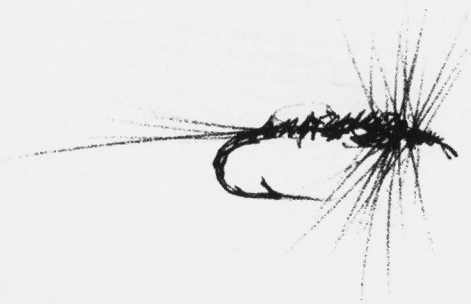
Living where the Rockies blend into the Sierra—or, if you prefer, where Montana meets Mexico—has abundant charms, but blue-ribbon trout water has never been one of them. I've always found it a bit odd that New Mexico's most famous fishery (about six hours from my little Magdalena rock house) is the tailwater of a dam. No matter how good the fishing is, I find it impossible to get excited about driving six hours to fish under a dam, with anglers standing side-by-side as far as I can see.

The Gila does have trout. High up in the cold, wet forests of Willow Creek, you step carefully. It's hard to believe that there are no grizzlies, but the last one was killed here in the late twenties. A smaller native remains—jewel-like Gila goldens, little, nearly extinct relatives of the cutthroat. They shouldn't be bothered. Lower down in the western drainages you begin to pick up other species. New Mexico writer Dutch Salmon has written eloquently of the Middle Gila River box, where you can catch big browns, smallmouth bass and channel cats on three consecutive casts of the same streamer.

But the Gila, four hours away on winding backwoods roads, is still too far away to count as home water. The tall mountains south of Magdalena have streams that run high in spring runoff, if the snowpack was decent, and again after the summer rains. All but one, several hours south, go completely dry in between, and even that one sinks into the desert and disappears. Real local fishing around Magdalena (other than one experiment fishing for big goldfish in a cattle tank, using a 4-weight Orvis rod—a little too silly and desperate) came to mean fishing in the Rio Grande.

Which was, in retrospect, a Good Thing. The years between 1979 and the present saw the rise of modern, high-tech, obsessive fly-fishing, not to mention the rise of fly-fishing as the chic pursuit for boomer-yuppies—a bloodless, expensive blood sport. With my New England background, cane rod, father's Hardy, and an impeccable tradition of brook trout, salters and striped bass, I might have become an insufferable snob. Fortunately (for many reasons other than fly-fishing) I was too poor to travel much for many years, and so had to learn how to be a local.

In fishing, being a local meant unlearning years of fancy fishing prejudice and learning that stalking monster catfish can be just as artful, nature-friendly and difficult as casting a perfect dry fly. I came to love the drowned jungles along the Big River's ditchbanks for their sounds and smells and sights and inhabitants, from eagles to herons to huge rattlers. I ate small catfish and returned the few very



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Spinning Ethic (The light-tackle thing.)

carried to an extreme,

perhaps, in

Lee Wulff 20/20

Airport bonding Hemingway

to ~~fo~~ heavy tackle

fresh rebels.

Jere w/a .410

(July)

Flagging the alfalfa for pheasant nests.

(Fishing) (May

Luce & Higgins

Met Luce in class & was
underpaid. Didn't he
appreciate the art of all this?
& Didn't he know what we
were doing for the
resource?

But he wrote writing
about the resource. He was
writing about 2 individuals,
human trust, & one's obligation
to the other.

[The resource/population is important. Nature is populations,
not individuals.]

July?

Cluster flies

Problem: Find crack.
Crawl in.
Try to get out.
(must breed in here somewhere)

Solution: leave windows or doors open.
(moral here: don't fight it)

Cluster flies —

~~to~~ specialists in tight

places. Crawl in, what?

crawl out. Total life.

They ~~[illegible]~~ I know food,

like. They just fly at

the window, bang, bang,

bang. Same inhuman ~~energy~~

resistance.

July

Paper wasps

~~I liv~~ Can live with them — admire them, in fact. They work hard, don't bother anyone who leaves them in peace, and stick out-but shafts in troublemakers. I like them. Anna ~~doesn't~~ reckons that they might make a mistake. In fact they have only stung me when I was lowering down their nest to make my wife happy

By Richard Conniff

'Dragonflies are an odd combination of beautiful things'

Don't be misled by their dainty appearance: these ornaments of summer are aggressive predators, amazing fliers and bizarre suitors

Dew-covered skimmer called *Ladona* rests on a wood lily. Skimmers are commonly found around quiet water.

A hot summer morning at the Slaughter Ranch in southeastern Arizona, everything lazy and slow. The pond by the house is stippled with small green knobs that look like water lily buds but turn out, on closer examination, to be the golden eyes of a hundred hungry bullfrogs. The surface is clotted in places with mats of yellow algae. There is no wind to stir the willows. Only the dragonflies are moving. "There's *onusta* coming around that tree," a dragonfly enthusiast calls out in a nasal voice. Then he corrects himself. "No, that's *saturata*, with *multicolor* just out ahead."

"You sound like you're calling a horse race," another collector says.

"And it's *saturata* by a head!"

"By a frons!"

It occurs to me that a racetrack isn't quite the right metaphor. Too many other things are happening here. Territories are being gained and lost, rivals run off, mates wooed. I watch a member of the species *Anax junius*, built like a 747, patrol overhead, then hesitate in midair to seize a fly and gnash it. The racetrack announcer coils and swings, his net whistling through the air. He extricates his catch, its huge wings held together between thumb and forefinger, and presents it to the youngest member of the Dragonfly Society of the Americas, an 8-year-old in a web vest and round, wire-rimmed glasses named Ben Lane.

It's a brilliant blue-and-green creature, the length and breadth of the boy's hand. Its eyes are opalescent pools. The racetrack announcer explains that *Anax junius* means "lord and master of June" and the hunting behavior is called "hawking."

It becomes clear, the longer Ben holds the dragonfly without being eaten alive or lifted into the treetops, that the most dangerous thing about dragonflies is the danger of mixed metaphors. Dragons, horse races and hawks are the least of it.

Southern folklore holds that dragonflies are servants of snakes and revive them, Lazarus-like, from the dead.

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The showy dragonflies are named for the way they skim along the surface of a pond or just above the shore. There are 96 skimmer species in North America. Many are capable of great maneuverability and speed.

Hence the name "snake doctor." Dragonflies are also called "devil's darning needles" because they supposedly are capable of stitching together the lips of wicked children in their sleep. Other nicknames include "eye stickers" and "mule killers."

It probably figures that a syringe-shaped insect with a five-inch wingspan and eyes lit up like Christmas ornaments might seem vaguely menacing. But we know better now. The deadly-looking hind end is not a stinger. It's a kind of tow-truck grappling hook in the male, and in the female, an ovipositor, or egg-laying device. Although dragonflies (a term that commonly includes their close kin the damselflies) are members of the order Odonata, meaning "toothed ones," their teeth can deliver nothing worse to humans than a good pinch. The dragonfly's bomb-bay mouth is built for catching and grinding up stuff like mosquitoes at a rate of about 300 a day.

Fertile dragonfly eggs turn brown after they are laid. The cream-colored egg floating on the surface is sterile.

Female damselfly (bottom) deposits fertilized eggs in plant tissue while still-attached male stands guard.

This may be one reason the dragonfly is currently enjoying something like a social rehabilitation in this country. Several years ago, some of its admirers formed the Dragonfly Society of the Americas. The most devoted members dig ponds or plant old bathtubs as dragonfly breeding sites, and New York City's Central Park even has a dragonfly preserve (though it is closed for renovations). At the Cape May Bird Observatory in New Jersey, the clouds of dragonflies passing through have at times been so thick that hawkwatchers couldn't see. So the observatory now offers guided dragonfly workshops.

It has dawned on a few heretics that dragonflies are more colorful, more fiercely predatory and ultimately more interesting than birds. You can get close enough to them to watch what they're doing. With a net and good reflexes, you can also catch them and hold in your hand some of the most ancient and adept aerialists in the history of the planet—or at least you can swing and miss and know you have met your match.

One morning when I was just getting acquainted with the dragonflies around my New England home, I went to visit Virginia Carpenter of the Nature Conservancy in Rhode Island. Four of us, armed with nets, were soon patrolling knee-deep down the Queen River, where the Conservancy is conducting a population survey.

Carpenter (p. 78), who is shorter than her net, wore her blonde hair braided in back. She has written a regional field guide to dragonflies, one of the few now available in this country. She's been chasing these insects for 15 years. This means she has roughly 299 million years of catch-up work ahead. The dragonfly has been evolving since sometime before the pterodactyls. Fossils show that in its glory days it had the wingspan of a crow. "There! There! *There! Gomphus!*" Carpenter yelled. She swung and missed. "Didn't get 'em."

The dragonflies made us all look inept. Lisa Barton, a Conservancy administrator I came to think of as "Lisa the Lunger," charged upriver with her net, plunging across the shallows and flogging the bushes as she sank in the mud. It was her first hunt, but she managed to catch dragonflies. About all I could catch were jewelwing damselflies. They were everywhere, with their velvety black wings and metallic green bodies.

Damselflies are generally smaller than dragonflies, Carpenter explained. They are comparatively weak aviators, fluttering almost like butterflies, whereas their dragonfly cousins cruise like helicopter gunships. When perched, dragonflies spread their four wings out to the sides; damselflies almost always fold their wings up over the abdomen. Dragonflies are also distinguished by huge wraparound eyes; in many species, the eyes meet in a seam at the back of the head. Damselfly eyes are more widely spaced, like a hammerhead shark's.

This stretch of the Queen River was narrow and gravel-bottomed, rushing quietly through the woods. I stood

in the water, towering over a grassy patch where jewelwings danced in the midday sun. The peaceable setting made their lives seem carefree and inconsequential. I caught one, then let it fly off my hand, and my entire being was suffused with the warm feeling I have come to recognize as the Jolly Green Giant syndrome: me big strong fellow, likeness of God; you little pissant. Yea, truly, I was green in the ways of the odonates.

Carpenter spotted a couple of jewelwings in a dogfight just above the surface. "You see those two males fighting? They both like the same female. She's sitting on the grass. They're very aggressive. And look over there—that's quite a courtship dance between a male and a female." I watched the males bully each other, making dizzy loops and spreading their wings as if they could puff themselves up to grizzly-bear size. The intensity of their lives began to dawn on me.

For a male damselfly, a suitable perch overlooking a few square feet of water is a territory. Defending it against relentless male competition is the best way to get a mate. If he can hold a choice breeding site, the male may become what animal behaviorists call a "super stud." Females will dawdle past, sultry and coy. Some scientists call this a "Lolita-style soliciting flight."

To court a female, the male faces rakishly away on his perch and trails his back wings down like a cape. He then lifts his hind end and shows off his colors. She presumably gets the message. By coincidence, the jewelwing (*Calopteryx maculata*) is the species in which a Brown University researcher named Jonathan Waage discovered the bizarre details of what happens next.

Before the male even gets started, he must, in effect, have sex with himself, transferring sperm from a storage reservoir at the tip of his abdomen to the copulatory complex at the base of his abdomen, near the thorax—a procedure otherwise unknown in insects, though it is common among spiders. During mating itself, the male latches on just below the female's head with the tow-truck apparatus at the end of his abdomen. He clutches a blade of grass with his legs and holds himself cantilevered out, supporting them both. She wraps her legs around his hind end and bends her body under his in a sort of loop, until her own hind end connects at roughly his midsection. Some species commonly fly in this "wheel" position, and it can be a romantic sight. Calico pennant dragonflies actually have a string of valentine hearts down the length of the abdomen, red in the male, honey gold in the female.

But Waage demonstrated that sexual aerobatics are the least complicated part of mating. During copulation, the male makes regular undulating movements of the abdomen. By dissecting couples killed in flagrante

Immature dragonflies are deadly hunters. A larva waits for a mosquito wiggler (top, left) to stray into range, then seizes it (bottom) with a retractable lip. Above, a larger European larva devours a froglet.

delicto, Waage discovered that these undulations are not geared primarily toward insemination. Instead, they represent a methodical effort by the male to root out the sperm of any other males who have previously mated with the female. The male organ is equipped, like a Swiss Army Knife, with an array of attachments minutely evolved for this task. Waage found that jewelwing males were 90 to 100 percent effective at removing the sperm from previous matings. Thus the male can be certain that the eggs the female deposits in his territory will be his own offspring.

But males being males, doubts linger. Anyone who has spent time at a pond will have noticed one dragonfly flying with another in tow. In my ignorance, I'd always assumed they were enjoying some form of nonstop romance, an odonate waltz, round and round the pond. In fact, tandem flying is a form of desperate male clinging, called "contact guarding." The male hangs around lest another male swoop in and do unto his sperm as he has done unto his predecessors'. In some species, the male merely hovers possessively during egg-laying. In others, he remains attached and seems to swing his bride like a golf club as she pitches forth her eggs. The female presumably puts up with this because he protects her from the even more tiresome attentions of other would-be suitors. She gets 12 to 15 minutes of undisturbed egg-laying, versus 2 minutes on her own.

Having just emerged from its larval skin, a green darner waits for its body to harden and gain strength.

The afternoon grew fat and hot, and the dragonflies zigzagged high overhead. "Look up there. It's a bunch of *Epitheca princeps*," said Carpenter. "It's a big monster, two or three inches long. We call it 'the prince.' It's a beautiful thing. Look at them just cruising around, having a good time, picking off deerflies. There's a squadron of them. Come to mama," she begged, raising her net. They dipped and banked but kept their distance, and by midafternoon, having aggravated banged-up knees and bad backs with our log climbing and our Lisa-lunging, we abandoned the hunt, dreaming of beer and ibuprofen.

Despite their reputation as aerialists, dragonflies spend most of their lives underwater. In the larval stage, typically lasting one to three years, they are drab and, at a glance, unimpressive creatures, sprawling amid the underwater foliage or on the bottom. But they are also the scourge of all pond scum. A friend writes that as a boy he used to bring home a murderers' row from a local pond—water tigers, diving beetles, water bugs, back swimmers and of course dragonfly larvae. He'd start with 20 things in his aquarium, "and after a week there'd be only one thing, and it would be fat."

The original rearguard action

Dragonfly larvae have a secret weapon to make sure that they are the one fat survivor: anal jet propulsion. They use the rectum to breathe water in and out across gills in the abdomen, and they are capable of ripping off a blast that will rocket them two or three inches through the water and away from any predator. Damselflies are too refined for this happy talent; they have a more delicate three-finned tail assembly.

One day I watched a damselfly larva scanning the underwater world with its big, wide-set yellow eyes. When a quarter-inch minnow approached, the eyes followed it, then the head turned, then the entire body slowly turned around. The larva yearned for that fish, the way a cat longs for a moth dancing just out of reach.

Dragonflies and damselflies both possess a killer lip. Normally it stays folded underneath the head, where it looks like a beard, one-third the length of the body. The larva can unfold the lip and shoot it out in a hundredth of a second, seizing a fish or tadpole with two grasping hooks at the tip. Immature mosquitoes are among the favorite prey. In Southeast Asia, where dengue fever remains a threat to public health, scientists recently discovered that dragonfly larvae are a good remedy. Two

Configurations of smoke blown around a dragonfly in a wind tunnel show how turbulently the air flows by the insect's flapping wings. The vortex created over each wing can exert the uplift of a miniature tornado.

of them in a water storage container killed all larvae of the mosquito that causes the disease—up to 800 individuals in a week.

When they're done eating pests, dragonfly larvae do something chemical pesticides often don't: they go away, and in great style. The larva climbs out of the water and splits down the back. Out of the skin a dragonfly emerges. While still soft and glossy, the dragonfly pumps itself up to stretch out its wings and abdomen, till it is often triple the size of the larval skin.

This is the most vulnerable stage in the dragonfly's life. At the Slaughter Ranch, I watched one gather its strength on some debris a few feet offshore. Then a phoebe swooped down from a willow and gobbled it up for breakfast. But once it dries and hardens into its adult shape, a healthy dragonfly can usually outwing almost any predator.

When dragonfly enthusiasts meet over beer, the talk invariably turns to how some prized dragonfly has eluded them and to new schemes for evening the odds. "I asked for a gun for my birthday," I heard an insect taxonomist remark one night. "I could load the shells with dirt and bring one down."

Richard Conniff's book Spineless Wonders: Strange Tales From the Invertebrate World, *published by Henry Holt & Co., will be available this November.*

"I know hunters who have trouble hitting a duck," someone replied, "and you think you're going to hit a dragonfly?"

"How you gonna retrieve the specimen?" another doubter wondered.

"You need an odonate dog."

"If you do hit a dragonfly, you'll blow it to pieces."

"All I need are the genitalia," the taxonomist declared triumphantly, genitalia being the key to species identification. There was a pause during which everyone present considered the odds against training a dog to retrieve dragonfly genitals. Then the conversation shifted mercifully to other schemes.

Capturing dragonflies alive and unharmed used to be a common summertime game for boys in Japan. They tied small weights on each end of a silk thread, then threw the device in the air in front of a passing dragonfly. With luck, the dragonfly confused the weight for a mosquito, attacked, and got tangled in the thread. Not long ago I chose a more newfangled form of child's play, strapping a couple of Rambo-style bandoliers across my chest and wading out into a local pond carrying a Super-Soaker XP 95 water gun loaded with soapy water. I'd been told this would temporarily foul the dragonfly's flying gear. Unfortunately, you must hit the dragonfly first. Every dragonfly I fired on saw it coming and ducked. I soon had a slick of soap bubbles spreading

Still water reflects the mirror image of a common European meadowhawk pausing for a moment's rest.

out ominously around me. Feeling like the captain of the Exxon *Valdez*, I quit and went home to read up on what makes dragonflies such elusive aviators.

Dragonflies are among the fastest insects on wings, having been clocked at 35 miles an hour. They can lift more than double their own weight, an achievement human aircraft cannot approach. They can take off backward, accelerate at warp speed, execute an unbanked turn in forward motion as if on a pivot, come to a dead stop in an instant, hover, and even somersault in the heat of combat. The U.S. Air Force has put them in wind tunnels to see how they do it, and despaired.

Dragonflies outpower all other winged insects; one-third to one-half of their body mass is devoted to flight muscles. But their flight system is one of the most ancient on earth. Each of the four wings is like a seesaw with an off-center fulcrum. One set of muscles attaches to the inside end. The other set angles out to attach to the wing on the outside of the fulcrum. These muscles rock the wing up and down, achieving a modest 30 to 50 beats a second.

On insects built along more modern lines, like the housefly, the main flight muscles are not attached directly to the wings at all. Instead, the first muscle set pulls down on a plate in the insect's back, causing the hard body surface to buckle inward and forcing the wings into their upstroke. The buckling simultaneously stretches the second muscle set, connected at the front and rear of the dorsal plate. These muscles then automatically contract, causing the body surface to pop back into its normal position and forcing the wings down. Houseflies thus manage 200 wingbeats a second.

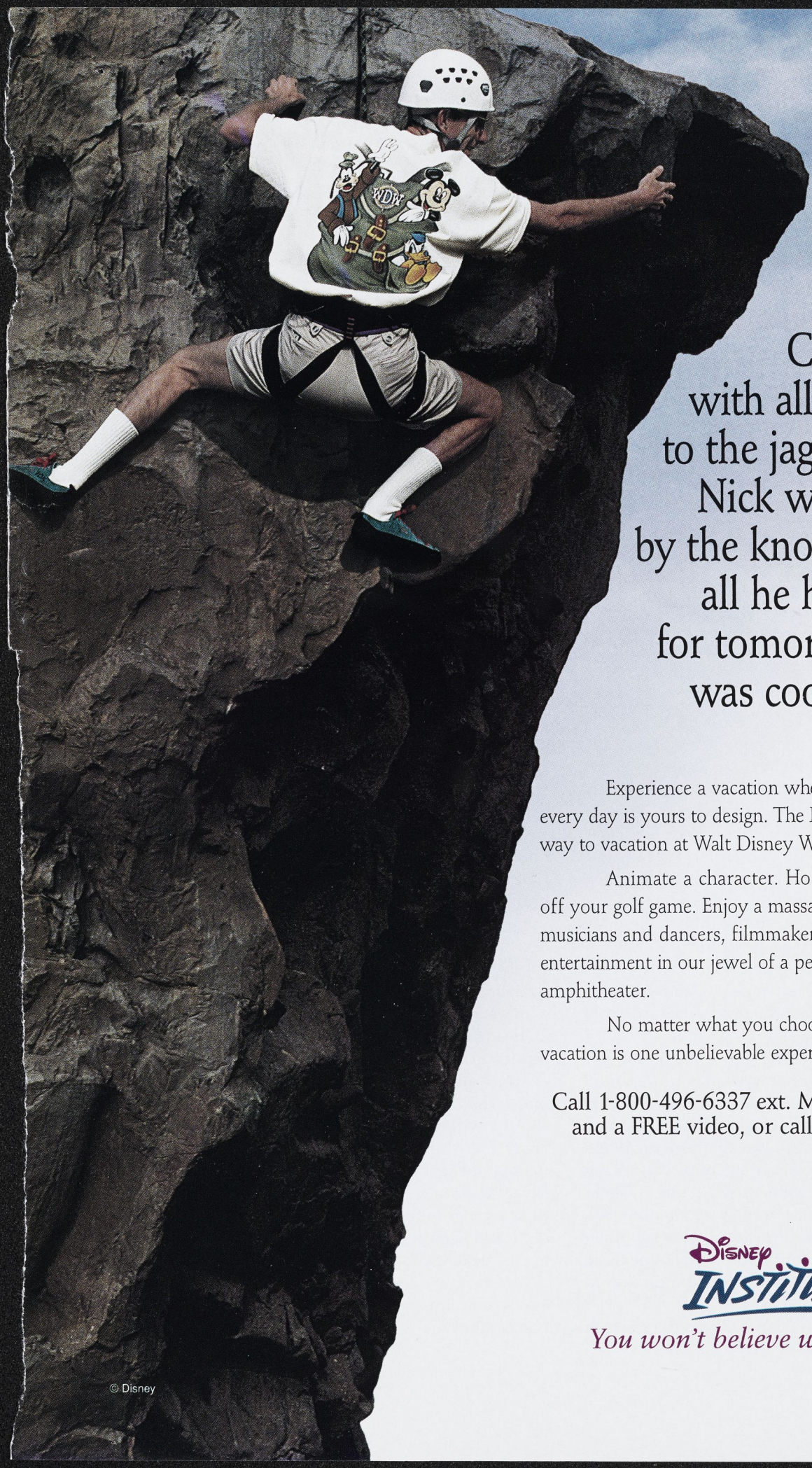
Why dragonfly wings have an edge

But dragonflies routinely catch and eat houseflies, not the other way around. So what gives? The dragonfly's wings, which look like brittle cellophane, are in fact intricately cross-braced, top-to-bottom and front-to-back, and it can bend them to produce almost any aerodynamic effect. It can beat all four wings in unison for quick bursts, or it can beat the front and back pairs out of phase for a slower, weaving flight pattern. Fine hairs on the upper wing surface, combined with the stubby antennae between the eyes, allow the dragonfly to read and control minute changes in airflow. On the leading edge of the wings, small thickened areas, called stigmas, may act as stabilizers.

All these adaptations make dragonflies masters of what aviation engineers call unstable aerodynamics. Whereas we strive to minimize turbulence over the wings of our aircraft, the dragonfly's wings deliberately generate and exploit turbulence. Wind tunnel tests of dragonflies showed a vortex over each wing, with the uplift of a miniature tornado.

Not only can the dragonfly outmaneuver almost anything else on wings, it can see better, too. Each of its bulbous wraparound eyes contains up to 30,000 lenses, and its field of vision extends to nearly 360 degrees. Dragonflies sometimes do things that call their visual acuity into doubt. For instance, species that have evolved along rivers often patrol highways instead, or they may lay their eggs not in a shimmery pool but on the polished hood of a car. But they can see other dragonflies and go to them from a distance of almost 100 feet. A dragonfly perched in the grass can spot a gnat three feet away, zip out, grab it, then retreat to its perch to eat, all in just over a second, and do it 300 or 400 times a day. But let's cut to the bottom line: they could see me coming from a mile away.

Having failed thus far to catch a dragonfly, I headed out to the New Mexico-Arizona border, where the Dragonfly Society of the Americas was having its annual meeting. The spiritual leader of the group, Nick Donnelly, is a 63-year-old geology professor who looks like a parish priest. His white hair is scuffed up carelessly over a pink scalp. When he speaks, he casts his small blue



Clinging with all his strength to the jagged rock, Nick was comforted by the knowledge that all he had scheduled for tomorrow was cooking class.

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Wading in a Rhode Island brook, dragonfly expert Virginia Carpenter gamely tries to down dragonflies with a stream of soapy water. Soap is supposed to mess up the insects' flying gear—if you can score a direct hit.

eyes heavenward, or closes them and purses his lips, as if almost tasting some ineffable dragonfly truth.

Donnelly started out as a birder, but he lost his faith when he perceived that arguments over bird sightings tended to be won by loud voices, not hard evidence. Moreover, most of the species that birders in this country argue about were already known and studied more than a century ago. "Dragonflies," Donnelly told me, "are an odd combination of beautiful things, a number you can master—about 500 species in North America—and the chance to discover something new. In North America, we're still finding on average one new dragonfly species a year. You just can't do that in the bird world or the butterfly world."

A dragonfly convention consists of 40 or 50 lungers and thrashers armed with nets who meet in a motel parking lot early on a Saturday morning, then scatter across the landscape. They reassemble at night and speak a language known only to themselves. When someone asks how big a species is, the speaker does not reply in inches or even centimeters. "About as big as *Erythrodiplax connata*," he says, and everyone nods. Another speaker describes how he nearly died of hypothermia climbing a mountain in Papua New Guinea and brought one prize back down—"a weird montane *Ischnura*, densely hairy and kind of fat."

Almost no one gets paid to study dragonflies, which do not damage crops, cause disease or otherwise call themselves to the attention of agencies that fund research. So what we know about dragonflies is often the work of amateurs risking hypothermia in New Guinea or getting their brains baked in the Arizona sun, usually on time stolen from their jobs, their families or both.

Most of the members of the society are avowedly dragonfly collectors, not merely dragonfly watchers. They go out equipped with glassine envelopes into which they carefully tuck the dragons and damsels they catch. They spend their nights preserving specimens in acetone, straightening abdomens and untangling thorny legs for a museum-standard presentation. Often the only way to know for sure what species you are looking at is to collect it and examine it under a microscope.

All of biology begins with collecting. You have to know what things are before you can begin to understand anything else. "We're trying to do serious science," Steve Valley remarked one day when we were out flailing our nets over the surface of New Mexico's Gila River. "I do a lot of behavior studies, flight season things, geographical studies for my state. I'll mark dragonflies and go back to see what territory they're defending the next day and get longevity statistics."

The society is currently assigning common names to every odonate species in North America. Like bird names, they are appropriately colorful—gilded river

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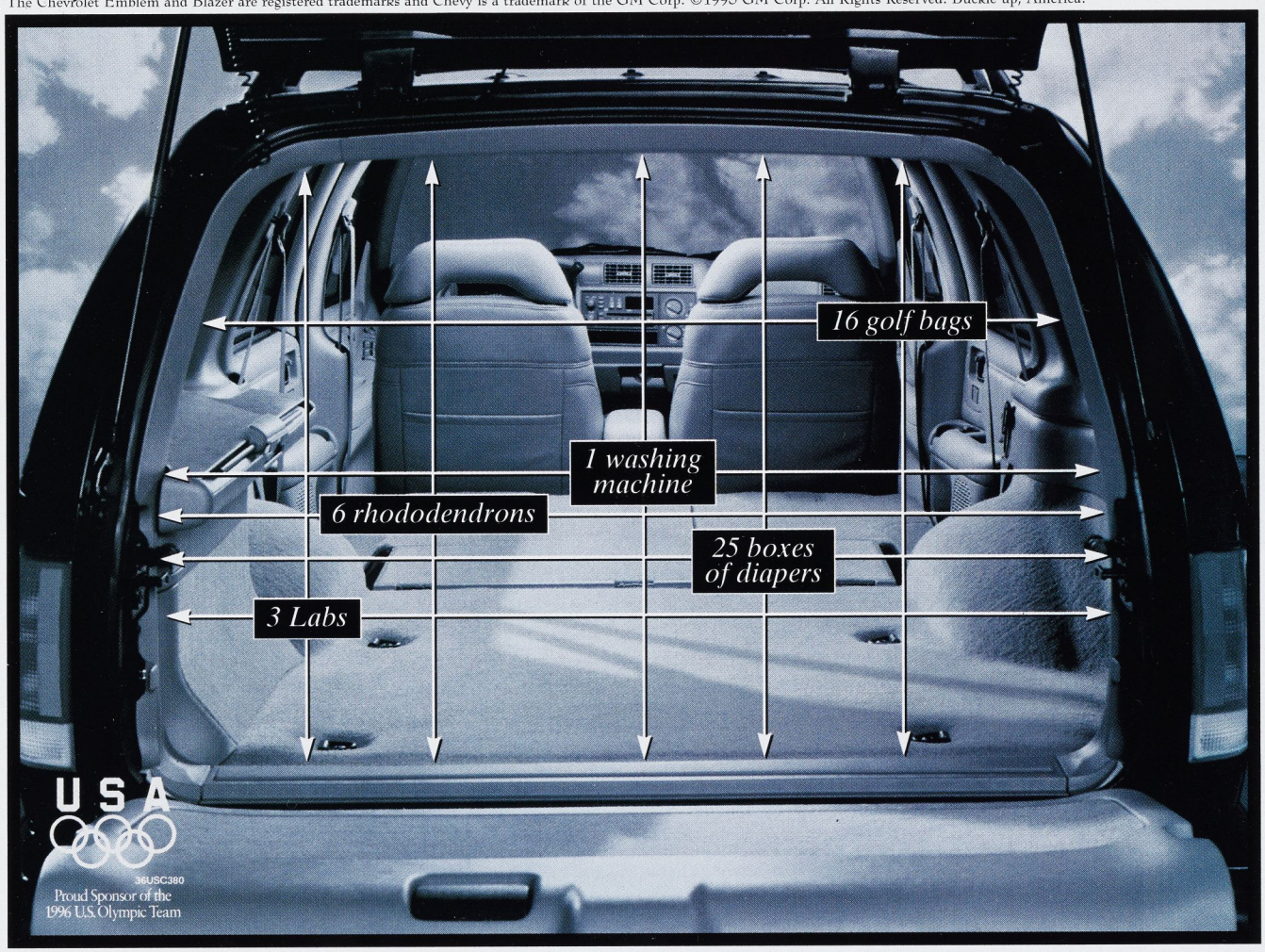

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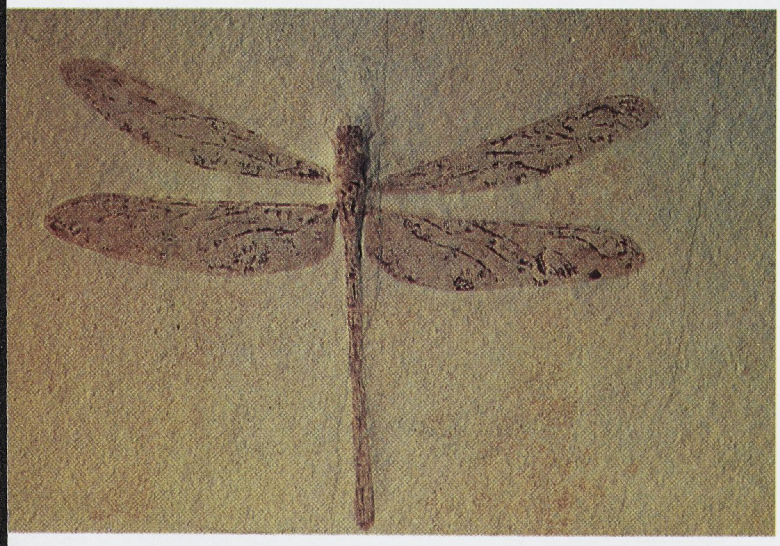

Preserved in exquisite detail, dragonfly fossil found in limestone deposit appears eager to take flight again.

cruiser, beaverpond baskettail, sandhill bluet, cardinal meadowhawk. But people like Valley worry that the birders may bring their hands-off ethic with them. The note of defensiveness in his voice is a response to people who frown on collecting any form of wildlife.

Dennis Paulson, a museum director in Tacoma, Washington, who is both a birder and a dragonfly collector, acknowledges that certain species—those that are threatened by human activities or restricted to narrow habitat ranges—should not be netted. Aside from that, he says, collecting is harmless. "Every dragonfly you catch is going to die very shortly anyway. If you're worried about populations, and not individuals, there's no way in hell we could collect every dragonfly in a population. We're not good enough, we're not out there long enough and there aren't enough of us."

But there's nothing wrong with letting a dragonfly go, assuming you can catch one in the first place. So I took my first swings on the Gila River at a dragonfly named *Brechmorhoga mendax*. I'm not sure why scientists gave it that name, which means "liar," except that it never went where I thought it was going to go when I started my swing. The other collectors advised me to wait till *B. mendax* was already flying past, then swing from behind where its vision is weakest. But you cannot really blindside a dragonfly. I tried to come in overhead, flapping the net down on the surface, a technique called "pancaking." I caught a fish. It was not a keeper.

I sought out the wisdom of an old master, Steve Valley, who said, "I miss most of the ones I swing at, too. They've been doing this for a couple hundred million years, and nobody beats 'em for maneuverability. Think of all the visual data they've got coming in, and the flight corrections, and the stopping on a dime and then just disappearing. I'm out there because I enjoy being outdoors, and I love watching dragonflies fly."

So I relaxed a little. Next day, I was alone on the Gila downstream from an area where the tan-and-yellow cliffs stood in columns like massive tree trunks. I was shin-deep in a riffle when a dragonfly the color of a flying goldfish cruised through at eye level. I watched it come and go, always just out of reach. It was lovely.

Then it came straight at me and I crouched in readiness. It was like a baseball pitch, Mother Nature on the mound. The ball had incandescent red eyes that seemed to glare and taunt from 50 feet out. It moved like a slider and a curveball and a change-up all combined. There was every possibility that it would stop six inches beyond the maximum extension of my net and zoom straight back in the opposite direction. I held the sock of the net against the handle, to minimize drag. The dragonfly kept coming. I swung, letting the white netting free, and listened to it whistle through the air. At the end of the swing I flipped the handle with my wrist so the sock hung down over one side. The dragonfly was buzzing angrily within my net.

I'd like to say I let it go. But I had faced it eyeball to eyeball in its own territory and won, and I felt that it was mine. The scientist in me (or maybe it was just the hunter-gatherer) asserted itself. I found that I could catch different dragonflies with different strokes, and by day's end I had filled a dozen glassine envelopes.

The preservation process was a disappointment. The acetone held the enameled colors of the thorax and the abdomen reasonably well. But it could not preserve the magnificent eyes. They went from opalescent pools, in my favorite specimen, to the flat, opaque color of rust.

I expect I will catch and keep other dragonflies. There are a couple of river estuaries near my house that have never been surveyed, and an entomologist at the state university wants to know what's there, with sample specimens. But I also love catching them to hold in my hand for a few moments. The eyes are misty and deep, like a fortune-teller's ball. Colors flash across them. Black patches like pupils seem to stare back, as if considering who I am and where I stand in the great scheme of things. Looking into those eyes is like looking back in time. I remember that dragonflies were here before some of our ancient mountains. They witnessed the coming and going of the dinosaurs, the arrival of those second-rate aerialists, the birds, and the evolution, just yesterday, of the human race. When I let a dragonfly go now, it no longer makes me feel like a giant. ♜

Distinctive bull's-eye pattern on its forehead gives a common green darner the uncommon look of a cyclops.

Game + Fish Management [Work into the Mountain stream?] July?

"You can fish anywhere you want": public vs private management

freedom vs quality.

↓

deteriorates by

a) crowds

b) degradation of environment

c) poor fishing.

Used

(From Ross Brewer)

Not far from us there is a federal wildlife refuge that has increased duck nesting success from 18% to 72% by trapping skunks and raccoons. Even pintails are succeeding. Mallards, coot, canada geese, shovelers, + all the teal.

(Benton Lake refuge)

CRP has also helped, + ducks nest in it even a mile or so from CRP.