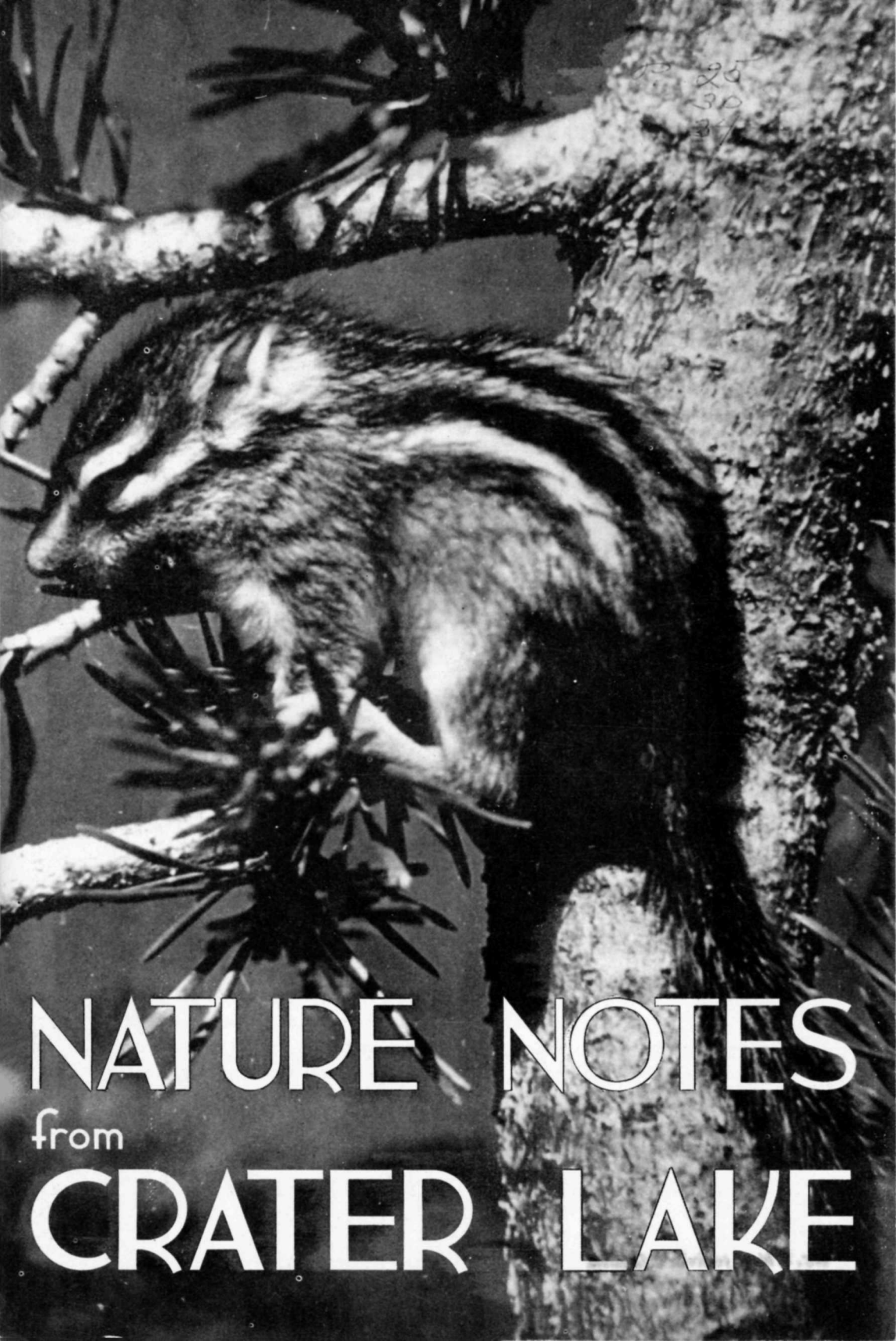




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NATURE NOTES
from
CRATER LAKE

NATURE NOTES FROM CRATER LAKE

National Park Service
Crater Lake National Park

Crater Lake Natural
History Association

Volume XX – 1954

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INTRODUCTION

In line with one of the objects of the Crater Lake Natural History Association, namely, "to aid in the distribution of information on all subjects pertaining to the park", this 1954 number of CRATER LAKE NATURE NOTES is offered to the public. Reprinting of articles appearing in this publication is encouraged. It is requested that acknowledgment of the source be made by giving the name of the author and of this magazine.

A dedicated National Park Service naturalist staff has presented a very successful program of talks, field trips, exhibits and other informational service in the park during the past summer. The material presented herein is the result of activities on the part of the staff which are seldom brought to the notice of the public – the gathering of new information about your park. The results of such efforts serve to document the talks, exhibits and other presentations by the naturalists to the public.

The Crater Lake Natural History Association was founded in 1942 to promote and assist the naturalist program offered the public in the park, to further the investigation of subjects of popular interest and importance and to aid in the distribution of information on all subjects pertaining to the park. Toward this end it sponsors CRATER LAKE NATURE NOTES and operates a publications sales counter, the proceeds from which are used entirely to support this work. A list of items for sale may be obtained by writing to the Executive Secretary, Crater Lake Natural History Association, Box 97, Crater Lake, Oregon.

Harry C. Parker
Park Naturalist

Cover Photo: Young Chipmunk. From Kodachrome by Welles and Welles

BEARS ARE WILD ANIMALS

By Donald Van Tassel, Ranger Naturalist

"Where can we see a bear?" is one of the most frequent questions at Crater Lake National Park, and there is a good reason. Among the informative leaflets given those entering the park is one that says, "PARK BEARS and other animals are WILD." This and similar posters greet them at every bulletin board in the park, and the theme is repeated by Rangers during the day.

According to Roland D. Walters (1953. Observations and census of the black bear in Crater Lake National Park. Nature Notes from Crater Lake 19:26-28), there are about forty-



Photo by Welles & Welles

one bears that make their homes here. About half are adults over two years old. The brown and black color phases are more or less equally represented in all ages. All of these are Olympic black bears, Ursus americanus altifrontalis (Elliot). Most of the bears avail themselves of the garbage left by picnickers in the campground containers and other refuse cans located elsewhere around the park.

Anyone who stays in a campground can see a bear — by flashlight! And he can tell about the one that interrupted his sleep, because bruin made quite a racket during his rounds of the garbage cans, his nose tempting him into trouble. The next morning the careless camper finds opened, or carried away, such items as tin cans and sugar sacks. Usually at least one ice box has been broken into.

The artificial source of food sometimes brings a few bears into view in daylight. But unless they are fed purposely, they remain shy of humans and, consequently, out of trouble. Members of the National Park Service hope that bears in our parks can be persuaded to give up panhandling and earn their own living again.

In this park, continual vigilance is maintained in order to detect bears which presume upon cars or people as a source of food, a practice which they have no doubt learned from some one of the minority of visitors who disregard the warnings and slip "cutie cub" his first tidbit. Trapping and removing dangerous bears to remote areas of the park, or the extreme necessity of destroying one of these animals, are undesirable tasks for the personnel here dedicated to preserve life. We must endeavor



Bear Trap Closed
From Kodachrome by John Mees

ging beside the road, I found him digging out ants and other natural foods from a rotten stump near Goodbye Bridge.

Fate was less kind to the other cub. A porcupine rewarded his curiosity — or hunger — with a nose full of quills. Early attempts to catch him and remove the quills failed, and by the time he was caught, his temper had grown short and his coat shabby. More time was spent at the campgrounds looking for easy food. Of course he was fed and chased, photographed and teased — until he became intolerant and would bristle his coat and snarl.

One day he argued with the garbage collector over who should have the garbage. He had been caught twice before in the bear trap, but this time he was taken to the far northeastern corner of the park. There he was turned loose and encouraged not to come back. The temptation was too strong, however, for he was back in two days. We hope that his boldness is at least subdued, so that no extreme measures have to be taken.

During mating season this year, the male bears displayed unusual excitement by stamping their front feet when humans were near. One three-year-old male surprised the garbage collector by swatting at him, for no apparent reason, tearing open the back of his hand. This is the only human injury caused by bears in the park so far this season. The park policy of making the visitors aware and warned of bear traits is definitely paying off.

Bill Rosenbalm, who has worked with the garbage truck for three years, has noticed about twelve new cubs this year: four pairs of twins, one single and a healthy set of triplets, two of which are black and one is brown.

also, however, to safeguard the life of the indulgent visitor and of the law-abiding one who might follow to suffer from the actions of an artificially fed bear.

This year a happy exception to the rule was one of two yearling cubs which appeared long before the Rim Campground opened. They panhandled along the road, but were often chased by rangers throwing rocks to discourage them. As the summer developed, one was seldom seen by visitors after the middle of July. To my surprise one morning, instead of seeing him beg-

One interesting antic he reports is that of a large bear which rolled a garbage can some twenty or thirty yards away from the garbage truck by backing away and pawing it toward himself.

Bears are wild animals. Feeding them is an infringement of park regulations. But more than this, such actions are not easily reconciled to the bear's natural existence, which must be maintained for complete freedom on the part of these animals and for us who would like to observe them. We therefore hope that you will help to establish this situation by resisting temptation.

UNUSUAL EAGLE EXPERIENCES

By John Mees, Ranger Naturalist

On July 23, 1954, while I was on duty in Sinnott Memorial, a bald eagle, Haliaeetus leucocephalus (Linnaeus), was observed in the water approximately 20 yards from the shore to the east of the viewpoint. Using field glasses, I could see the eagle moving through the water with the aid of his wings. I could not see whether or not the eagle had a fish in his talons and do not know how it got into the water.

After the eagle reached shore it flew into a nearby tree, where it stayed for about a half-hour. Later it was seen soaring above the rim of the lake. Dr. D. S. Farner (1952. *The Birds of Crater Lake National Park*. University of Kansas Press. xi, 187 pp.) mentions a similar incident.

On August 7, 1954, A. E. O'Nion of Danville, California, brought to my attention an unusual incident which happened while he was fishing from a rowboat on the lake. A short distance from him was another party of fishermen. One of the members of this party hooked a small fish, apparently in the eye. All eyes were turned toward the man showing his skill at catching the first fish of the day and were watching him reeling in the line with his prize.

Nobody noticed a bald eagle, soaring above, which had spotted with its keen eyes a crippled fish in the clear blue water below. When the fish broke the surface of the water the eagle swooped down over the water in a dive, grasped the fish



Bald Eagle

From Kodachrome by Welles & Welles

in its talons when it was only a few feet from the boat and flew away to a nearby tree. Needless, to say, the fishermen were surprized – even dumbfounded – by such a strange experience. They went home empty-handed as far as fish were concerned, but with an unusual fish story.

HUMMINGBIRD ANTICS

By Edward A. Burnham, Ranger Naturalist

Just a few dozen yards below the summit of Garfield Peak I was startled by a sudden swoosh and a shrill note as a streak went by only a few feet in front of my head. I had just finished planting a flower marker sign on the trail to the top of Garfield Peak. It was Monday, August 16, at about 4:20 p.m.

I kept on hiking and once again – zoom – right in front of me swished the small blurred object! I watched as it arched into the air, turned and headed straight for me. This male hummingbird began a series of plunges from 40 or 50 feet up, emitting a sharp note at the bottom of the arc as he passed.

In early spring in Southern California I had watched and heard, on several occasions, the courtship flight of the male Anna hummingbird. He zooms high above the female and then darts down in an arc, making an explosive sound directly over her. But here I was near a mountaintop in the middle of August, very late in the season for any display of territorial behavior, and I have yet to be told I resemble a female hummingbird!

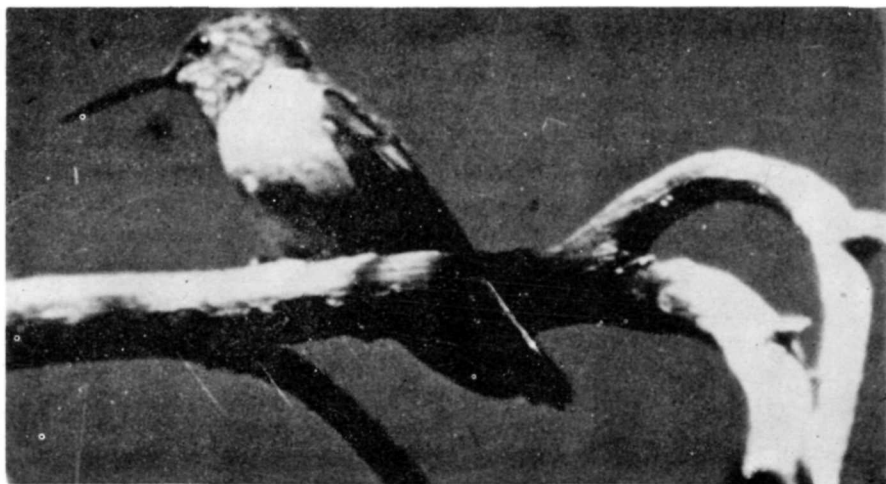
This kept up for about three minutes. Each zoom caused me to duck, even though I realized that the small object was only a tiny bird headed in my direction. Then he disappeared. I feel fairly certain that he was a rufous hummingbird, Selasphorus rufus (Gmelin). I wonder what he took me for?

SO MANY TINY BIRDS

By Donald Van Tassel, Ranger Naturalist

The hillsides above Castle Crest Wildflower Gardens were covered with many kinds of colorful flowers. One could hear the buzzing of the busy bees. But such large bees. No, they couldn't be, they were tiny birds – dozens of little zooming hummingbirds, flashing by like jet airplanes and oh, so busy. Thus, I became acquainted with one of the tiniest birds in the park and in the United States.

They proved to be the rufous hummingbird, Selasphorus rufus (Gmelin), which is by far the most abundant hummingbird in the park, as in all of Oregon. The dazzling copper-red gorget flashing in the sun and the rufous



Rufous Hummingbird

From Kodachrome by Welles & Welles

or reddish-brown back proved to be his marks of distinction. The females and young are much more difficult to recognize.

In addition to the beautiful iridescent coloring, I was fascinated with their continuous activity. They must be very nervous, as they are always on the move, seldom stopping to rest. The average camera is quite unequal to their size and speed. When they are not darting from one flower to the next, they are chasing each other in great frenzy.

This year I noticed that the rufous was first apparent in large numbers about the middle of July, feeding in the blossoms of big huckleberry, Vaccinium membranaceum, Dougl., a little above Castle Crest Gardens. By the first of August, the young were all flying, and the scarlet gilia, Gilia aggregata, (Pursh) Spreng., red monkeyflower, Mimulus lewisii Pursh and columbine, Aquilegia formosa Fisch., helped provide for the increased numbers. They seem to prefer tubular flowers, such as those on members of the figwort family, which their long bill is capable of penetrating. This year the Castle Crest wild flowers were very abundant, which no doubt accounts for the appearance of so many hummers.

I happened to have occasion to be on all of the main trails during the first week in August. I noticed female and juvenile rufous hummingbirds along each of them, although I seldom saw the males.

During the launch trip around the lake on the morning of August 8, a female rufous power-dived my wife, who was wearing a bright red sweater. It hovered only about two feet above her head before it flew off toward the Phantom Ship, which was nearby.

The calliope hummingbird, Stellula calliope (Gould), is also found in the park, but these birds are relatively scarce here and are found mostly

at the lower elevations. The calliope is the smallest bird in the United States, not much larger than a large bumble bee. It is also very colorful, the gorget having a rayed or striped rose-purple effect, in contrast to the solid flame-red of the rufous.

Beautiful flowers and fascinating birds are a grand combination. I personally invite you to take any one of our trails, around the first of August, for this impressive treat.

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PORCUPINE ENCOUNTERS

By John Mees, Ranger Naturalist

The yellow-haired porcupine, Erethizon dorsatum epixanthum Brandt, is frequently seen waddling slowly beside our park highways, especially at night. When in a hurry, however, this fellow can ramble along at about two to three miles an hour. This speed was estimated by clocking a porcupine from an automobile while I was traveling the Rim Drive near Dutton Ridge. The porcupine was held on the highway by the stone retaining wall, thus providing a good opportunity to time him while he was moving in a fairly straight line.

It is often said that a porcupine is an animated bundle of quills. He is armed with twenty to thirty thousand of these barbed needles which form his main, and almost only, means of defense. This equipment is adequate for protection against the great majority of enemies. An interesting correlation with low birth rate can be found here, for porcupines are almost always born singly. A rare occurrence of twins is suggested by the observation of an adult with two youngsters in the Castle Crest area during July, 1947, by Ranger-Naturalist Gordon P. Walker (Wallis, 1947).

A vigorous slap by the porcupine with his powerful tail can send quills well into the nose and face of any animal inexperienced in dealing with these creatures. I have observed several small porcupines along Dutton Ridge and they have invariably kept their tail between themselves and me when they were cornered.

A few natural enemies of the porcupine become expert at killing them without picking up a collection of quills. The porcupine is usually forced into a corner and snatched by the nose. With a quick flip it is turned onto its back and then attacked at the soft, unprotected underparts.

Early in the summer of 1952, two hollow porcupine "shells," consisting of nothing but fur and quills, were found near Castle Crest. Proof as to the identity of the animals that had killed them could not be found, but bear tracks were seen in the snow around the carcasses. Since numerous bears were seen in the same area at various times, it seems quite possible that these animals were responsible for the fatal encounter. A similar skin was found in the Castle Crest Wild Flower Garden in the early spring of 1946 (Wallis, 1947).

During the month of July, 1953, I was so surprised by a porcupine along the banks of Sand Creek that I nearly lost my footing, which would have meant a sudden dip in the creek. Luckily only the porcupine slid down the loose talus slope into the stream. This porcupine apparently disliked swimming and refused to swim across the stream. Instead, he floated along with the current until he was able to climb back onto the same bank. Wallis (1947) reports having met a porcupine while walking on the stream bank in the steep canyon of Patton Creek. This particular animal, upon being disturbed, plunged into the water and seemed to cross to the other side with no trouble at all.

Episodes such as these with porcupines make the study of our local inhabitants an absorbing experience. With a little patience, you also will surely have interesting encounters during your stay in the Park. And perhaps you will learn some new and unusual feature of the wildlife in the park.



Yellow-haired Porcupine

From Kodachrome by Richard M. Brown

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TWO NEW BIRD RECORDS

By Robert C. Wood, Ranger Naturalist

On the morning of August 22, 1954, while leading a field trip along the lower part of the Garfield Peak Trail, I first heard and then saw an adult male goldfinch, Spinus tristis (Linnaeus). The bird was in bright yellow plumage and was at a distance of between fifty and one hundred feet as it fed on the ground and made several short flights.

The other, more spectacular, observation was made on the afternoon of September 3, 1954. While on duty at Sinnott Memorial, I observed a bird of unusual appearance circling over the lake shore directly in front of and below that observation point. It continued to soar, with some flapping of its wings, above the shore of the lake between Sinnott Memorial and the foot of the lake trail until it was high overhead. It then glided off in a southward direction.

I believe the bird to have been a jaeger, a pelagic bird seen infrequently along the coast and only rarely inland. It was quite dark above, white below, and had a noticeable black cap. The most striking features of the bird were its elongated central tail feathers and its long, tapering, pointed wings. The shape of the tail feathers indicate that the bird was either a parasitic jaeger, Stercorarius parasiticus (Linnaeus), or a long-tailed jaeger, S. longicaudus (Vieillot); its trim appearance and graceful flight would seem to indicate the latter bird.

The jaeger was observed with eight-power binoculars in good light for about five minutes.

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BREEDING ACTIVITIES OF CRATER LAKE BIRDS

By Robert C. Wood, Ranger Naturalist

During the summer of 1954, several nesting records of interest were added to the park's ever-increasing store of ornithological information. Nests were found, each for the second time only within Crater Lake National Park, for two species. These were the ruby-crowned kinglet, Regulus

calendula (Linnaeus), and the Pacific nighthawk, Chordeiles minor (Forster).

On July 16, between lower Munson Meadow and the road to Annie Spring, at an elevation of about 6,200 feet, I discovered the ruby-crowned kinglet carrying food to a nest crowded with five nearly-grown young. The nest was situated in a lodgepole pine, near the outer end of a dense mass of branches about ten feet above the ground. It was so well hidden as to be only barely visible



Nest & Eggs of Pacific Nighthawk
From Kodachrome by Richard M. Brown

from below. The bulk of the nest was made up of dead lichens, with much deer hair woven through it. A few bits of rabbit fur and red string were scattered around the top and sides. Feathers lined the interior, one of them apparently coming from a mountain bluebird. The nest measured four inches in greatest diameter and three and one-half inches in depth; the cup was only one and three-quarters inches wide and one and one-half inches deep. The empty nest was collected later in the summer and is now in the park collection (CLNP 632).

The other "find of the year" was the discovery by Mrs. Stine, wife of Ranger J. Francis Stine, of a nesting nighthawk about one-third mile southeast of the Lost Creek Ranger Station (Stine and Stine, 1954). The two eggs were found on the ground in a tiny clearing from which the pine needles and pebbles had been pushed aside. The site was a few feet from a small group of lodgepole pines, typical of that relatively open woodland. Discovered on July 18, the eggs hatched a day apart, on the 27th and 28th. By mid-August, the two downy young could still be found by a careful search of the area within several hundred feet of the nest.

On July 19, a pair of violet-green swallows, Tachycineta thalassina (Swainson), were seen entering the same cavity in one of the Wheeler Creek pinnacles that was evidently used in 1953 as a nesting site. Mountain chickadees, Parus gambeli Ridgway, nested in a cavity at the top of a four-foot mountain hemlock stub in the South Entrance utility area. On June 30, several young and one of the adult birds were found in the hole. The parent made no effort to escape but showed its agitation by hissing and pecking at the wall of the cavity. A red-breasted nuthatch, Sitta canadensis Linnaeus, was seen on June 23 carrying fragments of wood out of a hole twenty feet up in a dead mountain hemlock near Duwee Falls.

Western tanagers, Piranga ludoviciana (Wilson), were again abundant in the vicinity of Park Headquarters and were especially numerous around the Lost Creek Ranger Station – until early August, when they became much less noticeable. An earnest attempt was made to locate a nest, since one has never been found in the park, but observation of females and singing males produced no results in this respect. While searching in the vicinity of lower Munson Meadow on July 12, one male was observed pursuing another, suggesting territorial behavior. On the 14th, a half-mile outside the south boundary, a pair of western tanagers were seen going to what appeared to be a nest in a dense tuft of needles at the outer end of a ponderosa pine branch about twenty-five feet above the ground. On subsequent visits, however, neither bird was seen. Three of four nearly-grown young tanagers were observed while being fed by a female near Castle Crest Wildflower Garden on August 7.

Other records of juvenal birds being fed by parents during this summer are: a gray jay, Perisoreus canadensis (Linnaeus), at Cold Spring Campground on June 23; several ruby-crowned kinglets in the lodgepole pine forest a mile northwest of Lost Creek Ranger Station on July 19; three hairy woodpeckers, Dendrocopos villosus (Linnaeus), near lower Munson Meadow on July 23; a Steller jay, Cyanocitta stelleri (Gmelin), at Annie Spring Campground on July 28; and an olive-sided flycatcher, Nuttallornis borealis (Swainson), being fed a large dragonfly along the Lake Trail on August 11. With the exception of the last, all of the birds were actively following the adult.

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ONCE IN A LIFETIME

By Carlton Smith, Ranger Naturalist

On June 29, 1954, the day dawned bright and clear. Early in the morning, Assistant Park Naturalist Richard Brown and I were driving down the highway toward South Entrance when suddenly, rounding one of the sharp curves, we came upon a group of parked cars. We proceeded to a turn-out and then returned to the scene on foot.

"What has happened?" brought an immediate chorus, "There is a baby in there among the trees." "A what?" We were then able to find out from one of the people present that there was a baby deer in the area. The first

group of people had seen a Columbian black-tailed doe and two fawns. When they stopped to take a closer look, the doe and one of the fawns jumped off into the woods, while the other fawn remained near the edge of the highway.

We watched from a distance as the cameras clicked and the movie cameras droned on. After all the people had left the area, we took a closer look at the fawn. There it lay, directly in front of us, probably no more than a day or two old. It was nestled in a clump of huckleberry, its head resting on an old log. On either side of the clump of huckleberry were young mountain hemlock trees, about ten or twelve feet high.



Fawn in Huckleberry Patch
From Kodachrome by Richard M. Brown

Waiting for the sun to highlight the fawn, hoping it would not move, and trying to appear nonchalant as the cars passed by truly taxed our patience. Finally the stage was set, and Richard Brown began to take pictures of the fawn from a distance of fifty feet. With the camera showing only a few pictures remaining, Dick proceeded to move closer to the fawn, finally approaching within a few feet. During this entire time, the fawn appeared as motionless as a statue. After the roll of film was used up, I decided to see how motionless it would remain. Moving my arms outward, I gradually approached the fawn. Still no movement. Slowly I moved my hand outward as if to pet the animal. Not an eyelash fluttered. The only movement was the slight heaving of its body as it breathed. We were able to approach within a foot of the fawn.

Finally we went on our way, allowing the fawn to return to its mother. On our way back, later that same morning, we stopped at this place again, but there was no trace of the fawn.

After recounting the incident to my family that evening, we decided to return to the spot that night. Approaching cautiously, we saw a doe about 1,000 yards from the original point. Would we be able to see the doe with its two fawns again? Slowly creeping up to the area near the huckleberry mat, we peered breathlessly through the brush into the place where we had originally seen the fawn. We gazed upon an ordinary clump of huckleberries; no fawn was to be seen that night or any succeeding night. Truly we had been lucky in seeing the "once in a lifetime" view of a very young fawn that morning.

THE NUTCRACKER AND THE BABY CHIPMUNK

By Edward A. Burnham, Ranger Naturalist

On Saturday afternoon, July 31, 1954, at 2:55 p.m. I was on duty at the Information Building — normal, routine duty. In came a sobbing, small girl, carrying a little blue toy wagon. In the cart was a tiny bundle, a baby chipmunk.

"One of those great big birds with the long bill picked him up, tried to fly away with him and then dropped him. He's going to die!" Strong emotions were very evident.

Further questioning, with answers backed up by her father, placed the chipmunking at the Lodge end of the Rim Campground. The "villain" with the long bill was a Clark nutcracker, Nucifraga columbiana (Wilson).

The little fellow lay flat in my hand, eyes closed, trembling violently for such a tiny chap. Cupping him in both hands for a few minutes and gently stroking his head and back seemed to help overcome some of the terror. A gentle examination showed no evidence of any injury — just scared and no mama around.

Finally he opened his eyes, looked around, then poked his head up under my shirt cuff. This wasn't quite safe enough, so he crawled up inside the right sleeve of my blouse to the bend in the elbow. There he stayed until we closed the Information Building shortly after five o'clock. During this period, whenever writing was required, it perhaps appeared as though I had a broken right arm. Appearances can be deceiving.

Still up my coat sleeve, he rode down to Government Headquarters where I had to remove my coat and ease him out of his newly-found refuge.

Assistant Park Naturalist Richard Brown suggested eye dropper feeding with milk. We warmed a small bottle of milk under hot running water in the Naturalist Laboratory. As Ranger Welles held the little chap, nose just visible, I gave him the milk by letting it run down Ralph's thumb onto his nose. He rapidly caught on and finally took the dropper into his mouth. Soon he fell sound asleep. He'd had a rough day!

Ranger and Florence Welles took the youngster to their trailer for two days. There he was fed by eyedropper at short intervals. After the first twenty-four hours he eagerly took hold of the dropper with both front paws while he was drinking his milk. It was decided that the little fellow is an Allen's chipmunk, Eutamias townsendi senex (Allen).

An attempt was made to find the original home and mother of the chipmunk, with no success. On the following Tuesday, Mrs. William Loftis, wife of the Park Engineer, took over the upbringing of the little "orphan." A cage of wood and wire was built. A rumpled up diaper was placed in the bottom as a nest or sanctuary. One week after he was brought into



From Kodachrome by Welles & Welles

the Information Building he had learned to lap his milk. He was "off the bottle!" At the time of this writing he is eating banana nut bread and taking peanuts when offered, but hiding them under his cage cloth rather than eating them. His small ears, which had been lying back on his head, are now standing up.

As if to verify this nutcracker-chipmunk story, on August 4th, on the road in front of Government Headquarters, another Clark nutcracker was interrupted as he attempted to pick up a baby Mazama pocket gopher, Thomomys monticola mazama Merriam.

The problem now is that our little chipmunk friend has become adapted to a human environment. How will he make out when we let him go back to his own natural habitat? Often baby animals are picked up and brought to rangers in many of the National Parks by kind-hearted people who believe them to be lost or abandoned. Usually it is to the best interest of the young animal to be left where he belongs — in his own wild state where his mother will raise him and care for him.

Mr. and Mrs. Loftis have recently released this little chap, and he seems to be making out quite well on his own. Currently he is living in the wall of the Loftis' residence, entering by a very small outside hole. We hope he passes the winter successfully. Perhaps we may be able to find out what becomes of our little "orphan chipmunk" in a later issue of Nature Notes.

A CERTAIN BADGER

Florence Welles

On one of my husband's days off, he and I were returning from Klamath Falls. When we approached the Chiloquin turn-off we could see, lying

motionless in the road, an animal my husband instantly recognized as a badger. We stopped as quickly as we could, and stepped out of the car.

It was then that we had the privilege of seeing what we had always heard and read about the badger. He slowly stood up in the manner of a groggy fighter who had been knocked out but still had the drive to go on. He was breathing heavily and bleeding a little from the nose. While we were wondering about the extent of his injuries he slowly made his way off the highway and into the grass.

We photographed and watched him for some time, thinking that if his wounds should be fatal we could still take him along. But gradually his breathing became quieter. He growled very meaningfully when my husband came nearer to him than he wanted. We noticed that there seemed to be both squirrels and gophers living near where he was resting quite naturally now. So we left him. Three days later Naturalist Richard M. Brown examined the area thoroughly to see whether or not he had survived, and we can assume that he did, for no trace of him could be found.



From Kodachrome by Welles & Welles

I WAS ROBBED!

By John R. Rowley, Ranger Naturalist

Unable as I am to understand the Clark nutcracker's grating vocal repertory, this story is subject to certain inaccuracy.

You see, a Clark nutcracker of unquestioned sobriety was struggling with a white-bark pine cone located at the tip of a particularly flexible limb. On one occasion, this large grizzled bird was thrown almost upside-down as he was grasping the tough cone with both feet and prying with his crowbar-like bill in an effort to dislodge the seeds of this unwieldy

cone.

Whoops! — then it happened. The cone fell loose from the branch. The Clark nutcracker struggled for an instant in regaining his composure before gliding down after the escaped cone.

At this point, the "villain," who had watched the procedure with apparent detachment, entered the stage. Nutcracker number two was first to reach the now more stable cone and continued with the job of gouging seeds from under the scales.

The first bird, with savoir faire, withdrew to a lower and sturdier branch, fluffed its feathers, and gazed into space with an appearance of complete unconcern.



Nutcracker on white-bark pine
From a Kodachrome by
Welles & Welles

HIGH PLACES

By Edward A. Burnham, Ranger Naturalist

To most of us there come times when we need to seek a quiet refuge, a place where we may be alone. Each has his own idea as to where to find this sanctuary.

A church or cathedral answers the need for some. A sandy stretch of shore with the sound of breaking surf, or a path in the woods along a moonlit stream, brings peace and calmness to others.

I seek and find in the high places the feeling of oneness with the source of all. Alone on a mountaintop one gains perspective. "Lift up thine eyes unto the hills."

LOST CREEK RAMBLINGS

CHAPTER ONE

By J. Francis Stine, Seasonal Ranger

Termites to the right, termites to the left! This was our impression on the night of June 21, 1954. We had just retired in our seasonal quarters at the Lost Creek Ranger Station when this gnawing action started. Upon investigation it was discovered to be produced by two porcupines enjoy-

ing a "feast" of cabin wood. These porcupine visitations were common occurrences during the first month of our stay. Porcupine dinner hours always began around midnight — we retired at 9:30 P.M. — and continued until we interrupted their meals (about 12:30 A.M.).

Did you ever try fumbling around in the dark for your shoes, lighting the lamp and preparing yourself for the brisk evening air, and upon going outside find Mr. Porcupine in comfort half-way under the cabin? Best do as we — return to your bed, pull the covers over your head and leave the porcupines to their last three or four courses.

It didn't take long to make friends with the golden-mantled ground squirrels. We spent many early-morning hours feeding them various bits of food. We found their favorite early-morning course to be cantaloupe. On July 27, we first noticed the young ground squirrels. There were six youngsters in the first family that appeared. We frequently placed food for these ground squirrels on our woodpile.

One morning, July 6, we were startled by a loud chattering. Upon looking out the window, we observed a pair of gray squirrels, Sciurus griseus griseus Ord, crossing the yard toward the woodpile. They investigated the food, but it apparently didn't appeal to them and they went chattering on their way. These gray squirrels were seen frequently until the 20th of July. Gray squirrels are rarely seen within the park boundaries. Previous reports have been for the immediate vicinity of the South Entrance Ranger Station; this encounter, therefore, provides a new locality record for the species inside the park.

A large black bear was a frequent visitor in our camping area. Marmots and conies were observed on hikes to the head of Lost Creek and along the banks of Sand Creek.

During the first part of July, we observed dozens of western tanagers picking up nesting materials. We tried very diligently to locate one of their nests but were unsuccessful. After July 26, we saw only a few in the area and after August 1, none. The rosy finch was also a frequent visitor, along with the nuthatch, chickadee, pine siskin, yellow warbler and red-shafted flicker.

On August 15, while on duty at the entrance station, I saw a fox. He first appeared about fifty feet away, making his way toward our quarters. After his second trip over and after an interval of about ten minutes, he reappeared about twenty-five feet from the station. He walked very slowly across the road and then stopped. He took one look at me, sauntered into the trees and then paused. Looking around a tree trunk, as though he could not believe his own eyes, he seemed to be thinking to himself, "Look what they are putting in cages now!"

CHAPTER TWO

By Mrs. Marcella Stine

On the morning of July 18, my daughter and I were roaming the area about one-third mile south-east of our Lost Creek cabin, when we unexpectedly flushed a bird. After some searching, we discovered two eggs on the ground in front of us. With the help of Ranger Naturalist Robert Wood, we learned that the bird was a Pacific nighthawk.

We made daily trips to the nest as we wanted to be on hand for the hatching of the eggs. They hatched a day apart, on July 27 and 28. They were the darlinest little balls of down we had ever seen. We continued our daily trips to the nest, in order to keep track of them. On August 1, we found them eight feet from the nest. From that day on, we never found them in the same place twice. On the 7th, we noticed that they were full of pin feathers. On the 11th, they were completely feathered out and were very aggressive for such little fellows.

Despite many trips to the nesting area, we had never seen the male parent. We were beginning to think that the mother was a widow. We were very anxious to watch the feeding of the young birds. On the 6th of August, at 7:30 P.M., I heard an adult bird in the air and knew that feeding time was at hand. I rushed to the nesting area, darting from tree to tree as the adult bird glided through the air catching insects. I managed to get behind a large pine, just eight feet from the young birds. For several minutes I watched the adult feed the young, thinking all the while that it was making extraordinarily quick trips back and forth with food. Then, to my surprise, two birds came down with food at the same time. This was the first time that any of us had seen the male for certain.

I went home then, happy to know that the youngsters still had a father to help look after them.

(Through the efforts and cooperation of the Stine family for about a month, Ranger Ralph Welles and his wife "Buddy" Welles were able to take the picture story which follows. - - - Ed.)



Contrary to the books, this
nighthawk sat crosswise on a limb
Photo by Welles and Welles

NIGHTHAWK FAMILY AT LOST CREEK

(See Preceeding Story) Photos by Welles & Welles



1. Lodgepole pine area where the "nest" was found.



2. The adult would sit on the eggs until approached within three or four feet.



3. Then it would flap away, hissing and moaning, to lead them from the nest.



4. Finally, it would fly to a limb, sitting lengthwise, well-camouflaged.



5. Apparently, no preparation is made for the "nest". Nighthawks often lay eggs on roofs of city buildings.



6. Eleven days later, July 30th, only egg shells occupied the original site.



7. A few feet away, the parent bird hovered her small brood.



8. Two tiny balls of fluff.



9. This time, the grotesque efforts to lure the intruders away extended even into the trees.



10. Four days later the babies had grown but were still unafraid. If a hand was placed on the ground near them they would climb into it.



11. August 7th. Pin feathers were beginning to show.



12. August 21st; Three and one-half weeks old. Other young bird was fully fledged and gone.

SNAKES IN CRATER LAKE NATIONAL PARK

By Richard M. Brown, Assistant Park Naturalist

Each summer members of the park staff are asked a few times by cautious visitors, "Are there any snakes here?" or perhaps more frequently, "Are there any poisonous snakes here?" To the second question we are able to answer promptly and happily, "No." To the first we could reply that there was only one snake known for the park — until the summer of 1954 at least, but that is another story which I will come to a little farther along.

The only species of snake ever found alive in Crater Lake National Park is Fitch's garter snake, Thamnophis sirtalis fitchi Fox. Records for the park through 1951 have been adequately summarized by Farner and Kezer (1953). Since that time, ten specimens have been added to our collections, bringing the total to eighteen. Two new localities are represented among these specimens, Whitehorse Bluff (Crater Lake National Park catalog No. 561) and Quillwort Pond (CLNP 562, 596, 641, 642). Other specimens are from the Crater Spring bogs (CLNP 644) and Wizard Island (CLNP 559, 560, 643, 645).

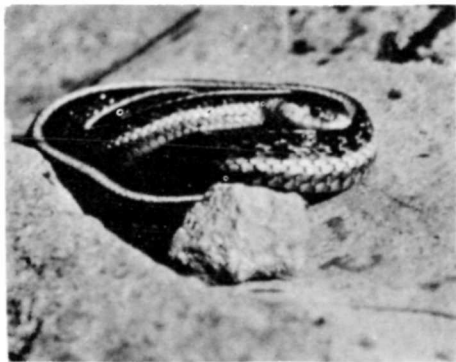
Two of these snakes (CLNP 643 and 645) are particularly fine melanistic individuals, the latter having been measured at $37\frac{1}{4}$ inches. Both were collected by Ranger-Naturalist John R. Rowley at Fumarole Bay, one on August 22 and the other on August 30, 1954, in almost the identical spot. Apparently both are females. These two snakes are extremely dark — essentially black, in fact. Some parts of the area in which the light color pattern would normally appear are barely discernible as a dark blue-gray.

Together with two earlier collections (CLNP 47, 48), these provide four strongly melanistic specimens from Crater Lake; all were taken on Wizard Island. Two or three other specimens from Crater Lake, while not exhibiting the extreme melanism of the four already referred to, are considerably darker than the typical snake of this subspecies and may represent intermediates between these two conditions. Although snakes with the normal coloration have been found in the lake and on Wizard Island, no specimens exhibiting melanism of this pronounced type have been found within the park except inside the lake basin.

I have been unable to find any reference to such extreme melanism for Thamnophis sirtalis in the literature, other than that of Farner and Kezer (1953). However, varying degrees of melanism among essentially typical specimens are apparently well known (Fitch, 1941; Stebbins, 1954).

Farner and Kezer (1953) suggest that "the conformance of this color with the color of the rocks in the environment may be of selective value."

Reference is being made to the dark lava rock comprising, particularly, the lower portions of Wizard Island. This possibility would seem to be supported by the studies of Fitch (1941), who found that brightness and distinctness of patterning in Thamnophis ordinoides were influenced more by the nature of the vegetation in the special ecological niches occupied than by climatic and other physical conditions.



Fitch's Garter Snake

From Kodachrome by Welles & Welles

On August 24, 1954, a snake was found dead on the Rim Drive, about one to two miles east of the Castle Crest Wild Flower Garden parking area, by Mr. Jack Boykin, a park visitor. Although it was in poor condition and lacked a head entirely, Mr. Boykin brought the specimen to Park Headquarters. It has now been identified fairly certainly as a Pacific rubber boa, Charina bottae bottae Blainville, even without the head characteristics, by reaching a maximum count of forty-five scale rows in several attempts. This specimen has been added to the park collections (CLNP 647).

Fitch (1936) reports only two records for this species in the Rogue River basin, one from Warner Gap and one from ten miles east of Ashland. Klauber (1943) refers to six specimens of the subspecies collected at Prospect, about ten miles south of Union Creek Camp.

The Pacific rubber boa has been observed occasionally in the area of Union Creek Camp, about seven miles west of the western boundary of Crater Lake National Park. Dr. Robert H. McCauley, Jr., captured two specimens at this location only a day or two before he visited Crater Lake National Park on August 12, 1953. He had these snakes with him at the time of his visit in the park. The collection, by a member of the Union Creek Forest Camp staff, of a single specimen in that general area during the summer of 1954 has also come to my attention.

Gordon (1939) and Anderson and Slater (1941) report the rubber boa from both Jackson Co. and Lake Co., immediately adjacent to Klamath Co. on its western and eastern sides, respectively. In spite of the several records mentioned above, all in Jackson Co. and including one locality which approaches Klamath Co. and Crater Lake National Park closer than ten miles, neither Gordon nor Anderson and Slater report the species from Klamath Co. itself. This is the first record, to my knowledge, for the species in Klamath Co.

It is interesting to note that Charina bottae is not among the species of reptiles listed by Vincent (1947) as unreported but perhaps to be expected within the park. Yet, of the four species of snakes which are listed here by Vincent, none has ever been reported for the park.

Klauber (1943) and Stebbins (1954) both indicate that the range of the rubber boa in Oregon extends across the Cascade Range. The Pacific rubber boa ranges westward from the Cascade Mountains; the Rocky Mountain rubber boa, Charina bottae utahensis Van Denburgh, ranges eastward from these same mountains. Although specific localities for specimens are not cited by either Klauber or Stebbins, it must be assumed that individuals of both subspecies reach the crest of the Cascade Range in some of the same areas since Klauber states that C. bottae utahensis "intergrades with C. bottae bottae along the Cascades from Puget Sound down to Siskiyou County, California,"

Thus it seems possible that the finding of a Pacific rubber boa on the Rim Drive may represent the natural distribution of the species. Until more records are available for the park, however, the natural occurrence of this snake within the area must be regarded as a tentative assumption. It is of course possible that this individual was brought into the park by a visitor, as seems most likely in the case of the lizard recently reported new to the park (Brown, 1953).

A visitor to Crater Lake National Park may likely never catch sight of a snake within the area, even if some time should be spent in looking for one. For this reason we are particularly pleased with Mr. Boykin's discovery of a rubber boa, and we are grateful for the fact that he was sufficiently interested in his find to bring it to our attention. Of course, he had to be observing enough to notice it on the road, the color of which is rather well matched by that of the snake itself. Undoubtedly he had allowed himself enough time to travel the Rim Drive in a leisurely manner and therefore was very much aware of all that might be seen and enjoyed along the way.

So keep your eyes open for these interesting creatures, not so much to avoid stepping on one, but rather to have perhaps the unusual opportunity of watching one of the rarer animals of the park. If you should be fortunate enough to see a snake during your stay here, it may well be a new record. In any event, members of the naturalist staff will be happy to hear about it.

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WIZARD ISLAND, AN INDEX TO THE PAST?

By John R. Rowley, Ranger Naturalist, and
Wendell V. Showalter, University of Kansas

The age of the trees on Wizard Island in Crater Lake has been used to suggest the least possible time lapse since the last eruption of that volcanic cone (Waesche, 1934; Williams, 1942). Evidence currently available suggests further that Crater Lake has at some time engulfed a higher portion of the Wizard Island cone. The cooling patterns found in the lava on Wizard Island indicate that neither the Wizard Island cone nor the block-type lavas of the western side of the island, which are the more recent, were formed under water (Williams, 1942).

Hence, the last eruptions must have preceded the period during which the island was more extensively engulfed. Establishment of woody vegetation in the area covered by water would have been dependent upon a decrease in the lake level relative to the island rather than the cessation of volcanic activity. Therefore, the trees on the lower portion of Wizard Island should serve as a measure rather of the minimum time which has elapsed since this greater engulfment than of the minimum time which has passed since the last eruption.

Diatoms are members of a primitive plant group, the Algae. Fresh-water sponges belong to a primitive group of animals called the Porifera, or "pore-bearers." Both the valves and frustules of diatoms and the spicules of fresh-water sponges are composed of hard, and very resistant, siliceous material. For this reason, these hard parts of diatoms and fresh-water sponges are frequently well preserved in the fossil record.

Skeletons of diatoms (valves or frustules) and the skeletal framework (spicules) of fresh-water sponges have been found on Wizard Island at considerably higher levels than the present surface of Crater Lake, which averages 6,176 feet above sea level. Hegeness, for example, has found diatoms some forty feet above the lake level (Williams, 1942). The writers collected soil samples in areas protected from erosion, at intervals of ten feet, extending from the margin of the lake to 110 feet above the present lake level. Diatom valves and frustules were present in all the samples. Most of the valves were corroded or broken and gave every indication of age and weathering. In some of the samples, the diatoms were mixed with the spicules of fresh-water sponges.

Some of the diatoms obtained represent genera known to occur only in standing or flowing waters — never in soils. Included here are specimens of Melosira and large forms of Pinnularia (Sovereign, 1955).

Fresh-water sponges do not live in snow seeps or moist earth, but only in standing or slowly-flowing water. Melosira valves and the spicules of fresh-water sponges were both found in samples of soil collected at 100 feet and 110 feet above the present level of the lake (Sovereign, 1955). This means either that the level of Crater Lake has at some time been at least 110 feet above its present elevation or that Wizard Island has been raised in toto — or possibly that a combination of both activities has been in operation to produce this result. In 1954, the summit of Wizard Island was 764 feet above the average lake level for that year.

Counts of seasonal growth rings made for trees on Wizard Island indicate that trees have been growing there throughout the past 800 years (Waesche, 1934). Waesche's report has been essentially confirmed by similar investigations which the writers carried out during the summer of 1954.

The increment borer used to obtain cores from trees on Wizard Island was twelve inches in length. The writers are indebted to the Union Creek District Ranger Station, Rogue River National Forest, for the use of this instrument. With this borer it was not possible to obtain a complete radial sample of growth rings from the larger trees. It was necessary, therefore, to estimate the age of trees whose diameters were greater than sixteen to eighteen inches.

In attempting to approximate the age of these trees by means of partial

samples of the growth rings, there are several important sources of error. One of these is the general decrease in the thickness of growth rings with age — from the center of the tree outward. As is typical, the young trees on the island had thicker rings, especially toward the pith (center), and the old trees had thinner rings in the outer layers, these being the only ones accessible with the borer. Thick rings are associated with rapid growth, thin ones with slow growth.



The increment borer in use

Photo by C. Warren Fairbanks

A second important source of inaccuracy, so-called false (or extra) rings and absent rings, can affect the results even in an actual count of the growth rings from pith to bark. A "false ring" may be formed during a year of unusually irregular climatic conditions, two rings then being produced for the one year. A year of relatively constant climate may result in the failure to form a readily detectable growth ring, thus an "absent ring."

Errors from this latter source would be exaggerated in an estimate based on the rings in a short, partial boring (core). In order to minimize such errors, it is important to base a calculated estimate of age on as many growth rings as possible. In a boring representing a period of many years, these deviations from the expected pattern of growth would tend to cancel out. Therefore, a seven-inch unit of core length was used as a basis for our calculations, this being the greatest core length that could be obtained with the twelve-inch increment borer from trees having a thick layer of bark.

An attempt was made to minimize inaccuracies resulting from the former source — decrease in the thickness of growth rings with age — by the following procedure: For each species, growth rings were counted in the outermost seven inches of several larger (older) trees and in the innermost seven inches of several smaller (younger) trees. An average number of growth rings in each of these two seven-inch units was then calculated for each of the three species. By the additional averaging of these two averages for each species, an average age per seven-inch sample was established for each of the three species.

It was intended that this method should produce three values (constants) whose use would result in the most accurate estimates possible under the circumstances for the true ages of trees in the respective species.

As a check upon this method of calculation, a cross-section was cut from a Shasta red fir which had fallen during the 1953-1954 winter. This tree had a diameter of 25.5 inches, and its total age was counted, not estimated, to be 406 years. Applying the above method of calculation, *e. g.* 189 years per seven-inch sample, a Shasta red fir 25.5 inches in diameter (considered as a 12.7-inch radius) would be an estimated 340 years old. This single check indicates that the ages calculated for Shasta red firs in the table may be on the order of fifteen percent too low. If this should actually be the case, then the age of the Shasta red fir here estimated to be the oldest (701 years) would slightly surpass Waesche's report of 800 years.

With due appreciation of these difficulties, together with such others as reliable diameter measurements and differences in the thickness of growth rings on various radii, we have estimated ages for fifteen of the largest trees, representing the three dominant species, on the lower portions of Wizard Island. The results are presented in the following table.

Tree Species	Average age per seven-inch sample (Years)	Radius of the largest trees found (Inches)	Calculated age (Years)
Shasta red fir, <u>Abies magnifica</u> Murr. var. <u>shastensis</u> Lemmon	189	26	701
		25	675
		24	638
		23	621
		21	567
Mountain hemlock, <u>Tsuga mertensiana</u> (Bong.) Sarg.	222	24	761
		23	728
		23	728
		20	634
		19	602
Western white pine, <u>Pinus monticola</u> Dougl.	214	20	611
		20	611
		19	580
		19	580
		18	550

Data concerning variation in the width of seasonal growth rings, although they may have meteorological significance, have not been included

here because of their fragmentary nature at present. These data, along with the increment borings, are on file in the Crater Lake National Park Library.

If some of the trees now on Wizard Island were living when the lake level was relatively higher, extensive sampling and precise dating of trees at all levels should reveal that the oldest trees are located at some distance, presumably more than 110 feet, above the present water level. Since none of the tree species listed here will tolerate submersion, those on the lower parts of the island would have to have become established after a decrease in water level relative to the island.

At present, the largest trees on the island are located at the lower levels, but it is not necessary that trees of the greatest diameters be the oldest. To the contrary, examination of trees at higher elevations indicates that their growth has been slower than those near water level. Therefore, the oldest trees may well be of lesser diameters. Growth of trees on Wizard Island, it should be noted, is suppressed in general and is not comparable with the growth of the same species under more favorably habitat conditions.

It is, of course, quite possible that none of the trees now growing on Wizard Island represent the first generation since either the exposure of the lowermost portions of the island or the cessation of volcanic activity which would have effectively deterred the establishment of trees above the all-time-high water level. However, the soil contains little organic material, which suggests that trees, other plants, and animals have been sparse in the past, if not essentially lacking prior to the time of establishment of the oldest trees now growing on the island.

Although we did not locate any tree having an estimated age equaling the 800 years reported by Waesche, the estimated ages of several of the trees sampled approached it fairly closely. On the basis of the evidence at hand, it is concluded that an interval of not less than 750 years has elapsed since the water of Crater Lake covered a substantially greater portion of Wizard Island than at present. It has been at least this long, then, since the diatoms and sponge spicules were deposited where these trees now grow.

It must be emphasized that only the Shasta red fir referred to above has been dated accurately and that many of the preceding suggestions are speculative, especially those predicated on the estimates. It is hoped, however, that these speculations approach the facts at least reasonably well.

The writers wish to express their gratitude to Mr. H. E. Sovereign for determinations of the diatoms and sponge spicules, and for his invaluable suggestions.

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CRATER LAKE WATERS

By C. Warren Fairbanks, Assistant Park Naturalist

Each year, some three hundred seventy thousand visitors make their way to Crater Lake National Park. While their reasons for coming, and what they see and remember of the park, are doubtless as many and varied as are the visitors themselves, it is safe to say that, with very few exceptions, the center of their interest is Crater Lake itself. These beautiful waters – their color describable only as Crater Lake Blue – rest in the top of an ancient mountain whose summit was destroyed about 6,500 years ago.

An occasional visitor will step up to the rim, take a quick look, and say to his companion, "Well, we've seen it. Let's go." More often, however, the lake excites curiosity and prompts questions such as, "How did it come to be?," "How deep is it?," "How cold is it?," "Are there fish in the lake?," "Does it have an outlet?" and, "Does the water level vary?" The one of particular interest here is the last.

Although Crater Lake, deepest in the United States, was first seen by white man in 1853, dissemination of information was then so limited that two later, independent "discoveries" were made – in 1862 and 1865 (Runkel, 1953). Also, no serious scientific investigations within the area eventually to become Crater Lake National Park were made until the visit of the Joseph Diller party in the summer of 1886. At this time, the first Geological Survey map was constructed, soundings and temperatures of the lake waters were taken, and foundations were laid for what is now called the geologic story of Crater Lake. It was then that the deepest sounding of 1,996 feet was made.

Since that time, other soundings – notably those of John E. Doerr in 1939, then Park Naturalist at Crater Lake National Park and currently Chief Naturalist for the National Park Service – and studies of lake levels have been made. The earliest water-level records, aside from Diller's of 1886, are largely obscure and of somewhat uncertain accuracy. Several

are derived from names and dates painted by occasional visitors on rocks at the water's edge. Some of these, however, are more or less readily relatable to later-established, known elevations and can be accepted with some validity.

The early picture is further confused by differences, unresolved by data presently available, in basic elevations established by the Diller party as compared with those on the current topographic map. For example, the lake-surface elevation, a figure subject to various types of fluctuations, was recorded for 1886 (Diller and Patton, 1902) as being 6,239 feet above sea level. This amounts to a difference of sixty-two feet from the 6,177 feet given on the most recent topographic map. Furthermore, all elevations of known stable points are of a magnitude greater than those on this 1946 edition — as well as on other available maps dating later than 1886. The disparities on specific points vary from as little as twelve feet to well over one hundred feet. It is understood, however, that elevations of many points throughout the western United States have been revised downward since Diller's work. In order to arrive at a comparable figure, the differences of seven prominent rim points were averaged. This figure, seventy-one feet, was then subtracted from the 6,239 feet given for the lake level. The result is 6,168 feet, a value that falls nearly in the middle of the observed range of lake levels.

The first water gage on the shore of Crater Lake was erected for the Mazamas, a mountaineering club of Portland, Oregon, on August 22, 1896 (Diller and Patton, 1902). Diller states that it "was made of a board $5\frac{3}{4}$ inches wide and 10 feet long, with scale subdivided to tenths of a foot. It was nailed to a log extending from the shore into the water, and zero of the scale was placed just 4 feet beneath the water surface, ... Fearing that this fragile gage might not escape accident from rolling stones and sliding snow, W. W. Nickerson, of Klamath Falls, was requested to insert a bolt in a cliff near the gage and carefully determine the height of the bolt above the water and read the gage."

The Nickerson bolt, a copper pin, was placed in position on September 25, 1896. The precaution was a good one, as the Mazama gage was cast adrift that winter, and the record book, contained in a copper box, was not recovered until five years later, on August 13, 1901. Two of Diller's associates found it in Danger Bay in five feet of water, three and one-half miles from Eagle Cove, the original location (Diller and Patton, 1902). The records were intact.

Diller, by referring to the record book, then painted a scale with the same zero point on a nearby rock face and inserted a pin, now known as the Diller Pin and still in place, at a point eight feet above zero point — four feet above the water level at the time that the original gage was in-

stalled. Diller (Diller and Patton, 1902) relates numerous water-level readings, including several incidental ones previously mentioned, to the Mazama gage. The earliest of these was September 10, 1892, when the water stood at 4.142 feet. The lowest such record reported by Diller was for September 26, 1893, when it was 2.52 feet, or 1.48 feet lower than the 1896 figure.

Since that time, four other gages — including the most recent, placed October 3, 1952 — have been installed and numerous readings taken, although not with complete regularity. It is evident that the earliest records were not related to elevations as were those of later years. Young (1952) indicates that in 1908 a U. S. G. S. benchmark, giving an elevation of 6,179 feet, was set near the water's edge. It was from this benchmark that the levels of August 19, 1916, taken by F. F. Henshaw, District U. S. G. S. Engineer, were established. On the basis of his findings, the zero (datum) for the Mazama gage is placed at 6,173.64 feet above sea level. This places the oldest known related level (September 10, 1892) at 6,177.78 feet, and the 1896 level, when the Mazama gage was installed, at 6,177.64 feet. It is interesting to note here (Young, 1952) that the lake level reported by Diller — 6,178.545 feet, July 1, 1901 — records the lake at its maximum observed stage.

Records of lake level compiled by Ranger W. T. Frost (1937a, 1937b) indicate the level as remaining fairly constant. The greatest annual variation during the period of years from 1908 to 1913 was only 1.55 feet. No records were shown for the war years, 1914-1917. In 1918 there appears the beginning of a prolonged decline, which may actually have begun in the four previous years.

Frost's notations carry through the year 1936 and show a general decrease in precipitation, correlated with the drop in lake level. He stated that the "Lake level is falling at an average rate of .51 foot per year. (Estimated from figures over a 26 year period)." He also stated that the average seasonal variation was 1.55 feet. In this connection, Diller (Diller and Patton, 1902) states that the annual "oscillation is limited to about 4 feet." He says further that "the rising and sinking balance each other so that the lake maintains in general the same level." This appears to be essentially true.

It seems possible that the annual fluctuation quoted from Frost may be somewhat less than total, since the lake is at its highest — usually in May or June — when it is least accessible for obtaining data. This appears to be the reason for Diller's estimate of a maximum of four feet. Paul Herron, boat operator and engineer for the Crater Lake National Park Company, reported that the lake level for the 1954 season remained fairly constant at 6,176.9 feet during the first twenty days of June, after which

it began to recede gradually. The last reading taken prior to the time of this writing was made on August 18; this report was 6,176.26 feet, representing a drop of 0.64 foot in approximately two months. The lowest level, however, should be expected at some time in October, after the beginning of fall rains and snows.

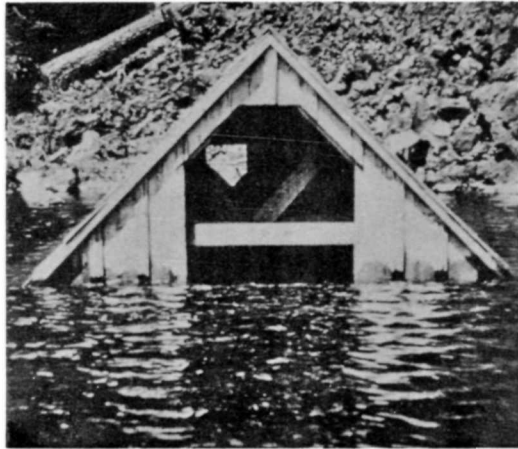
Recession of the lake level during these years, 1918-1936, continued until 1940, when the all-time low of 6,162.3 feet was recorded (Young, 1952). From that date until the present, Crater Lake has risen steadily, for an observed total of 14.6 feet in fourteen years – an average of 1.043 feet per year. The level this year falls within the range of high levels which extended from the 1890's through 1913.

As has been mentioned previously, the highest observed level was recorded by Diller in 1901. This figure of 6,178.545 feet, when considered together with the 1940 low, indicates an all-time observed fluctuation of 16.245 feet.

There is, however, some evidence of a higher level at some time in past. Gordon Hegeness (Williams, 1942), formerly a Ranger Naturalist at Crater Lake National Park, found a deposit of diatoms – microscopic water plants which have siliceous walls – on Wizard Island, approximately fifty feet above the water level. Williams uses this evidence to assume a former high level of that approximate magnitude. The location of this find apparently was not recorded, and analysis of that material to determine its significance has not been possible. Investigations carried out this summer, however, have contributed significantly to our knowledge on this point; the results are reported upon elsewhere in this issue (Rowley and Showalter, 1954).

There is some evidence from another source which indicates a slightly higher level in the past. A definite line formed by the drowning-out of lichens – primitive plants which can gain a foothold on bare rock faces – is observable a few feet above the present water surface.

Young (1952) uses field notes of F. F. Henshaw and of J. S. Brode, another former member of the naturalist staff at Crater Lake National Park,



In the fall of 1942, the sills of this 10-foot-high boathouse stood 18 inches above the lake water level. From a Kodachrome, taken in August, 1954, by C. Warren Fairbanks.

to arrive at the figure of 6,180.9 feet as the probable highest level of the lake, at least in recent decades.

Thus it may be seen that the surface level of Crater Lake fluctuates in response to both seasonal and climatic variations. The former, resulting primarily from differences in the amounts of precipitation and run-off at various times of the year, occur relatively rapidly but are moderate in range. The latter operates over longer periods of time but are ultimately responsible for greater extremes.

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TRIBUTE TO THE CLARITY OF CRATER LAKE

By C. Warren Fairbanks, Assistant Park Naturalist, and

John R. Rowley, Ranger Naturalist

The depth below the surface to which green plants are able to penetrate depends primarily on the availability of light, which is essential for photosynthesis. Turbidity, color, and amount of surface disturbance are the prime factors in determining the depth to which sufficient light for photosynthesis will penetrate. Based in large part upon these conditions, green plants occupy what is termed the photosynthetic zone, the upper six to seventeen feet (two to five meters) of water in most lakes. The growth of mosses at a depth greater than 400 feet (122 meters) in Crater Lake is therefore a tribute to the clarity of its water.

Hasler (1938), a member of the naturalist staff at Crater Lake National

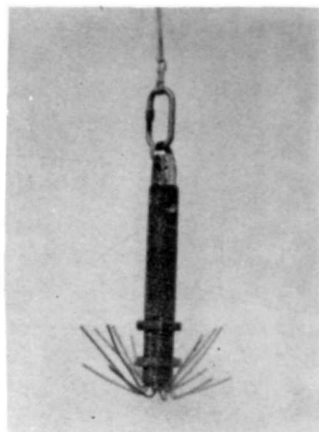
Park during the summers of 1937 and 1938, states that, "The most startling biological finding at Crater Lake was the collection, by dredge, of green mosses...at the astonishing depth of 394 feet (120 meters)." "This is the greatest depth that growing green plants have been known to live in any fresh water body." (Hasler, 1937).

Collections made this past summer, using the grapple pictured, confirm and extend Hasler's findings, which indicated that green plants cover a large part of the bottom of Crater Lake down to a remarkable depth. Mosses were collected by the authors from maximum depths of 384 feet (117 meters) in Cleetwood Cove, 410 feet (125 meters) at a point south of Wizard Island, and 425 feet (129 meters) at a place south of the Wineglass. In fact, very few attempts below 110 feet failed to be rewarding in this respect. Material from this 425 foot collection has been identified as Drepanocladus fluitans (Hedw.) Warnst. by Dr. Francis Drouet, Curator of Cryptogamic Botany, Chicago Natural History Museum, to whom appreciation is expressed for making this determination.

These figures do not necessarily represent maximum depths at which mosses occur in Crater Lake. They represent, rather, near-maximum working depths attainable with the 450 feet of cable available for the operations. Two other factors need to be considered in interpreting these figures: (1) the difficulty in locating a portion of the generally steep-sloping lake bottom that allows full use of the equipment, and (2) the difficulty in then maneuvering a small boat so as to remain over such a spot.

The minimum depth at which mosses occur in Crater Lake appears to be more definable. Hasler (1938) found no moss above a depth of sixty feet, and the least depth at which we recovered mosses was eighty-five feet. In some areas, such as at Cleetwood Cove and Eagle Cove, no mosses were obtained at depths less than 110 feet.

It is difficult to suggest valid reasons for such findings. Wave action could be a factor, although the situation at Fumarole Bay, which is quite protected and in which mosses are not found at lesser depths than elsewhere in the lake, would seem to preclude this explanation. Another possibility is that the species may be light intolerant. Collections of mosses made from a log (Brode, 1938; Fairbanks, 1953), called the "Old Man of the Lake," that has been floating about the lake for many years in a vertical, "dead-head" position, would seem to lend doubt to such a



Peters grapple used by
the authors

conclusion. It appears that this problem will not yield to simple explanation and will have to await further investigation.

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AQUATIC FLOWERING PLANTS OF CRATER LAKE

By John R. Rowley, Ranger Naturalist, and
C. Warren Fairbanks Assistant Park Naturalist

Frederick V. Coville (1897) reported that in 1896, "The Lake itself is wholly devoid of aquatic vegetation. No algae, no mosses, and no aquatic flowering plants were found in its water." Crater Lake is now known to support a large number of small (microscopic) animals and plants, and the lake bottom, at depths of 60 to 425 feet, appears almost everywhere to have a thick covering of mosses. The types of aquatic flowering plants thus far discovered in Crater Lake, however, are limited to a very small number.

During the summer of 1954, six different species of flowering plants were observed in the lake. Water buttercup, Ranunculus aquatilis L. var. capillaceus (Thuill.) DC., occurred in several large beds eight to ten feet below the lake surface in the northeastern corner of Fumarole Bay, on the western side of Wizard Island. One solitary emergent plant was found close to the shore of the island. This individual bloomed on August 17.

Water buttercup was collected by Brode (1938) near this same location in 1935. Until this summer, it was regarded as the only aquatic flowering plant in Crater Lake.

Two other plants were growing, both submersed and emergent, in the same part of the lake. A member of the mustard family, tentatively identified as Pennsylvania bitter-cress, Cardamine pennsylvanica Muhl., was rooted as much as a foot below the surface. When first observed, early in August, none of the fifteen to twenty individuals found had emergent leaves or stems. Later that month, the leaves of several plants had extended above the water. High winds in early September severely damaged these plants, and when last observed, on September 10, none had flowered. Two plants, however, which had been transplanted to an aquarium at Park Headquarters produced flowers and fruits.



Baltic Rush near Wizard Island. Photo by C. Warren Fairbanks.

This little mustard had an enormous amount of root development for its size. This feature is undoubtedly important in its moderate success, thus far, on the rocky and inhospitable bottom of Crater Lake. The tuber-like root and its many smaller rootlets were, in fact, not rooted in the usual sense at all but were merely entwined about these rocks.

Rather extensive groups of a rush, Juncus balticus Willd., were rooted below the water in at least four different spots in or adjacent to Fumarole Bay. In each of these areas, part of the rush growth is above water. This Baltic rush, in common with most other rushes, multiplies both by seeds and by runners (rhizomes) under soil or water. Hence, its spread from the damp, semi-aquatic shore into the water – or vice versa – could be expected. It is likely that the roots of the highest plants were submersed during the spring high-water level (cf. Fairbanks, 1954). Both the Baltic rush and the Pennsylvania bitter-cress are found in several other locations in the park outside the caldera and are common in wet places along the Pacific Coast.

At least one species of willow, Salix coulteri And., and the red elderberry, Sambucus racemosa L. var. callicarpa Greene, were occasionally found near and in the water. Both of these are sometimes considered to be aquatic plants since they are water tolerant; one Coulter willow is rooted in eight feet of water. There is evidence, however, that they are being drowned by the increase in water level since 1940. At that time, the lake was slightly more than fourteen feet below its present average elevation of 6,176 feet above sea level (Fairbanks, 1954). There were no young plants noted in the water.

Fennel-leaved pondweed, Potamogeton pectinatus L., was found grow-

ing in abundance on the bottom at depths of ten to fifteen feet in a channel near the westernmost extension of the Wizard Island block lava flow into Skell Channel. The portion of this channel supporting this pondweed would undoubtedly have been a pool in 1940 when the lake was fourteen feet below its present level. Since the bottom is now twenty feet below the surface and has a layer of diatomaceous ooze as much as three inches in thickness on top, a long period of submersion is suggested.

Sago, or fennel-leaved, pondweed is cosmopolitan in its distribution, being found in fresh or saline waters from sea level to 7,000 feet in elevation. Although this plant has not been observed previously in Crater Lake National Park, its presence now is not particularly surprising.

This pondweed is considered to be an important food for waterfowl. There is a small, pea-sized tuber at the base of its stem. It is abundant in many ponds and lakes, such as Upper Klamath Lake only a relatively few miles to the southeast. It may, therefore, be fairly safely assumed that ducks and other water birds occasionally carry around such plants on their feet. Eventually a hitch-hiking pondweed could be expected to drop off into Crater Lake in a location which would provide protection from wind and wave action and which would supply a sufficiently favorable bottom for its establishment and reproduction. Of course, it may have arrived in some entirely different manner.

In this connection, it might be mentioned that Crater Lake at present has very few areas where the bottom is both sufficiently shallow and adequately protected to offer a favorable environment for colonization by aquatic flowering plants. It is true that a shelf has developed under much of the lake edge at the base of the rim wall. However, the major factors responsible for the formation of the shelf — falling debris from the steep wall above, and wave action — tend to deter the successful establishment of plants. These are undoubtedly among the more important reasons why the waters adjacent to Wizard Island support most of the aquatic flowering plants found in Crater Lake. The greater stability of the debris near the shore of Wizard Island greatly reduces the amount of disturbance caused by this factor in the underwater shelf around the island. The greater irregularity of the shore line around Wizard Island — with its small but numerous inlets, bays, promontories and off-shore islets, especially in the Fumarole Bay area — undoubtedly contributes toward a considerable reduction in the intensity of wave action. These two factors would therefore tend to produce around the island areas much more favorable to the establishment of aquatic flowering plants than any area along the shore of the rim wall.

The concentration of these plants in the Fumarole Bay area of Wizard Island is no doubt also a result of the greater accessibility of this western side of the island to plants. Wizard Island here approaches most closely

the wall of the caldera itself, the distance across Skell Channel at its narrowest being approximately three hundred feet. The water between the island and the caldera shore is also at its shallowest in this channel. Changes in lake level would therefore operate most effectively here in exposing additional land surface which could act as a passageway for migrating plants.

It has been suggested many times (Shelford, 1918) that the quantity of plant and animal life increases with the age of water bodies, especially where the outlet is small. If this is true, the number of aquatic flowering plants in Crater Lake could be expected to increase steadily and perhaps quite rapidly. This would be due not only to the fact that it is a relatively young lake, but also to the fact that the lake level may remain fairly constant, with the exception of seasonal variations, for several successive years. This latter factor would perhaps tend to operate in the same manner as a small outlet and, in any case, would contribute favorably to the establishment of new species.

Thus it is possible that Coville's reference to a complete lack of plants in Crater Lake, although undoubtedly not strictly true, may have been very nearly so in 1896. There is ample evidence, from other regions that have been formed by volcanic eruptions, for radical changes of this sort within a period of fifty years.

Except for the trees that come down to the shore line on parts of the caldera wall and on Wizard Island, the lake appears — even after some exploration — to be quite barren. Who would suspect that from less than one hundred feet to more than four hundred feet below the surface there grows a lush mat of mosses in every place in which we have grappled so far? Furthermore, how many would realize that these mosses harbor an even greater number of smaller plants — algae — and animals?

Specimens of these aquatic plants are deposited in the herbarium at Park Headquarters, Crater Lake National Park. Perhaps you would like to know some of them better but will not be able to meet them first-hand in the lake. You will be welcomed at the park herbarium if you are particularly interested in these plants.

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