

Yellowstone Science

A quarterly publication devoted to the natural and cultural resources

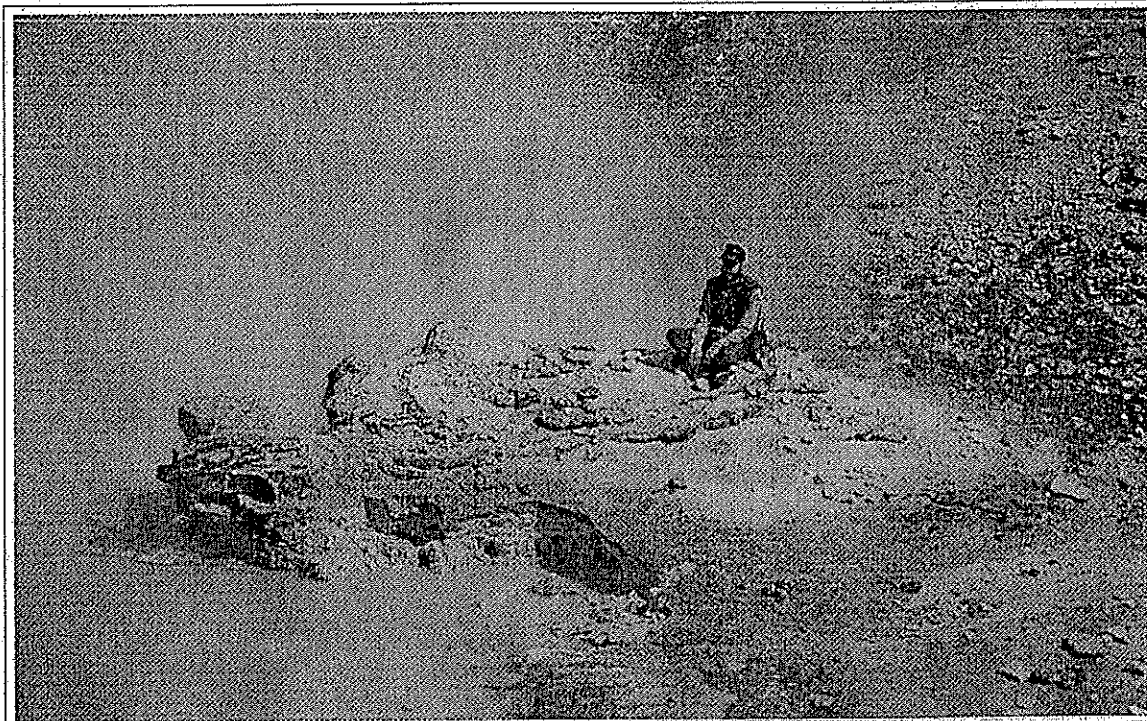


Documenting Landscape Changes
Using the Snow Database
Harlequin Ducks

Volume 5

Number 2

Photo by Sue Consolo-Murphy



Rick Hutchinson observing an eruption of Excelsior Geyser.

The Gravity of Snow

I had long planned this issue to focus on Yellowstone's climate and how it affects the park and its inhabitants. An article on the snow database, and how it can be used as an index to winter severity. An interview with Dr. Mary Meagher about her long-term collaborative project to document the changes (or relative lack thereof) in the park landscape through the re-taking of early photographs of Yellowstone. An article on harlequin ducks, one of many animal species that (like most human visitors) comes only seasonally, attracted—and ultimately, driven away—by the changing of the weather. And a review of a book about intrepid early explorers and rangers who braved the elements to document and protect park resources, entitled *Yellowstone's Ski Pioneers: Peril and Heroism on the Winter Trail*.

Lest we ever be complacent about the dominance that climate exerts upon Yellowstone, we received a harsh re-

minder when winter reached out its cold, powerful fingers to grasp from the earth two of our own present-day scientific explorers. Roderick Hutchinson—Rick, to us—park geologist and 27-year veteran of Yellowstone's staff, and his visiting colleague, Diane Dustman from Boston Dynamics, a computer software company, were on a foray to document thermal activity in the Heart Lake Geyser Basin when they were killed by an avalanche on March 3, 1997. Peril and heroism on the winter trail, indeed.

I did not know Diane, though like all of the park's cooperative researchers from around the world, she surely loved Yellowstone, and we are grateful that she offered her professional skills and expertise to benefit the park's science program.

I knew Rick for 15 years, and count myself privileged to have shared many journeys with him, to and among his beloved thermal basins. He relished the quest for knowledge, and he shared some

of his scientific adventures by contributing to *Yellowstone Science*. His most recent article, which appeared in the first issue of this magazine that I edited, described the evolution of features near Astringent Creek. Well do I recall accompanying Rick to this wild area, standing on the opposite end of a measuring tape from him with the turbulent, boiling mud pot between us. On another trip, we were thrilled to discover a previously unrecorded natural bridge near the headwaters of Sour Creek. On each journey, Rick took photographs and detailed notes. The documentation of his geological explorations will be used by other scientists and protectors of park resources for many years to come.

Friends and families of Rick and Diane take comfort in knowing that these two scientists loved their work and being out in the wildness of Yellowstone. Their legacy, and their heroism on the winter trail, will not be forgotten. SCM

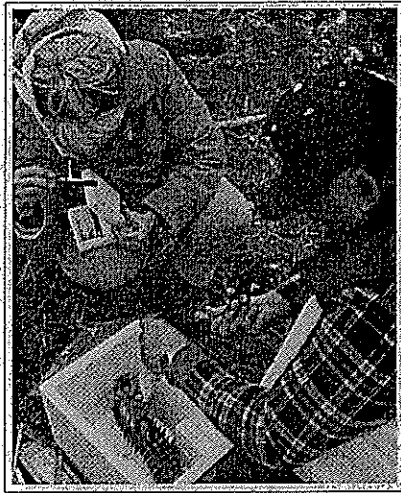
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Editor
Sue Consolo-Murphy
Art Director
Renée Evanoff
Associate Editor
Sarah Broadbent
Assistant Editor
Mary Ann Franke
Printing
Artcraft Inc.
Bozeman, Montana

On the cover: Male harlequin ducks perched above the fast water of one of Yellowstone's streams. See Terry McEneaney's article on these "noble ducks," page 2. Cover photo by author.

Above: Dr. Mary Meagher and an associate take bison blood and tissue samples in the field. Mary discusses bison and her book, Yellowstone and the Biology of Time, in an interview on page 12. NPS photo.

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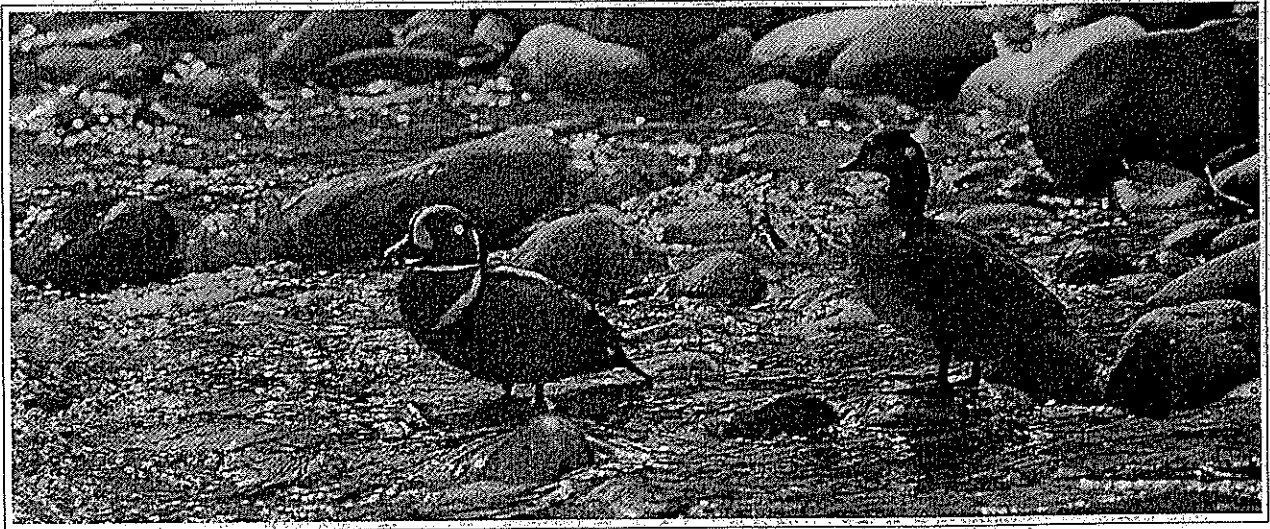


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Harlequins: Noble Ducks of Turbulent Waters

by Terry McEneaney

Photos by Terry McEneaney



— Harlequin Lord and Lady —

The setting is a rainy summer day along the rocky coastal shores of the Pacific Northwest. The liquid horizon is dotted with familiar objects such as western gulls, bald eagles, breaching whales, fishing boats, ferries, and oil tankers. Our senses confirm that this is the ocean, due to the omnipresent smell of fish and salt-water. Our attention is focused on sounds of fog horns, pounding surf, and strange mouse-like noises that resemble a squeaking squeeze toy. Closer than the distant kelp beds, near the turbulent breaking waves of sea foam, we find the mouse-like sound is coming from two small objects just out from shore. At first glance they appear to be apparitions, but after wiping the rain and the surf spray from our eyes, we come to the conclusion that these are ducks. Not just any generic

species of duck, but a brace (or pair) of harlequin ducks (*Histrionicus histrionicus*).

Native peoples and European settlers who inhabited the northern North American coasts gave the bird different names based on personal experiences and associations: blue streak, canne de roche, rock duck, circus duck, painted duck, mountain duck, sea-mouse, squealer, lord and lady, and totem-pole duck.

Because of the influence of the English language and culture, the name that stuck most often was reminiscent of nobility, the "lord and lady of the sea," in reference to the harlequin's elegant coloration and regalia. The male harlequin (still called the lord) in colorful breeding plumage is beyond reasonable description. The lord is a gray-blue, almost purple-attired duck

slightly larger than a pigeon or rock dove, with chestnut-colored sides, two chestnut streaks on either side of the crown, and neon white crescents and spots on the head, breast, and back.

It is the male of this species from which the name "harlequin" is derived—a likeable clown with beautiful yet unique attire, gestures, postures and behavior. It is no wonder this bird received the tautonym *histrionicus* in reference to its theatrical acting ability. The harlequin is the consummate bird entertainer of the natural world, combining pantomime with comedy. One can spend hours observing these fascinating ducks. The information presented here is the culmination of ten years of field experience studying harlequin ducks in Yellowstone, including their ecological role, distribution, and popula-

tion status. I also discuss census techniques, survival threats, conservation measures, and anecdotal tidbits.

The female harlequin, or lady, is nearly opposite to the male in coloration, yet both have the energy reminiscent of wind-up toys. The female is slightly smaller than the male and in breeding plumage is a drab, dusky brown in color, with three small, white, asymmetrical facial marks in a triangular arrangement around the eyes. When adult harlequins molt their feathers in the summer, both show duller plumages than previously described for breeding adults. During the summer molt, the white spots on the head of the female become even duller, and the male totally transposes from a bird of sensational colors to a drab brown plumage nearly identical to that of the female.

Life History of the "Totem-Pole Duck"

In addition to size and coloration differences in the sexes, there are weight and behavioral differences. The male (674 grams or 1 1/2 pounds) slightly outweighs the female (529 grams or 1 pound). The bill of the harlequin is small, short, and totes a large, fused nail at the tip of the bill, making it ideally suited for securing a specific diet. Both sexes have gray bills and feet, with the bill of the male slightly more blue-gray during breeding season. The webbed feet are extremely large for the size of the duck, making it ideally suited for its environment. Harlequins are also equipped with relatively long, stiff tails and small, rudder-like wings that assist in steering and propulsion both

on the water and while in flight.

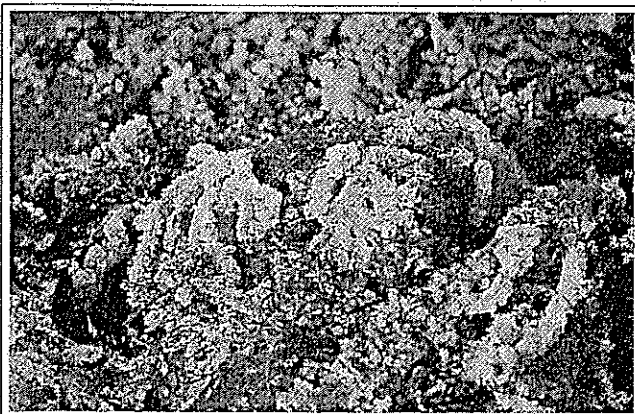
A question asked is whether this is an inland duck that moves to the sea, or a sea duck that moves inland. Harlequin ducks are sea ducks, aligned in the Mergini Tribe, which is in essence a collective group of sea ducks—their closest relatives are eiders and scoters. Ecologists group sea ducks in a convenient but crude survival category known as "K-strategists"—typically large birds with low reproductive rates and relatively stable populations in predictable environments. Even though they are long-lived, they typically colonize new environments slowly and are consequently ecologically restricted. On the other hand, r-strategists tend to be small birds with high reproductive rates and marked fluctuations in populations that are widely dispersed. They are typically short-lived, colonize quickly, and are found in unpredictable environments. Songbirds are r-strategists, whereas bald eagles are classic K-strategists. Harlequin ducks are more strongly weighted toward being K-selected than r-selected. Their strategy is important as we assess the future survival of the species, particularly as more human-induced variables enter the picture.

Harlequin ducks can live up to 18 years and have high adult survival, low reproductive rates, and small population sizes. They first breed at the average age of three years, and don't breed every year. They display a tendency to return to the same place every year, although if their nest is disturbed or destroyed, they will not re-nest that year. Globally, harlequin populations appear to be large, although

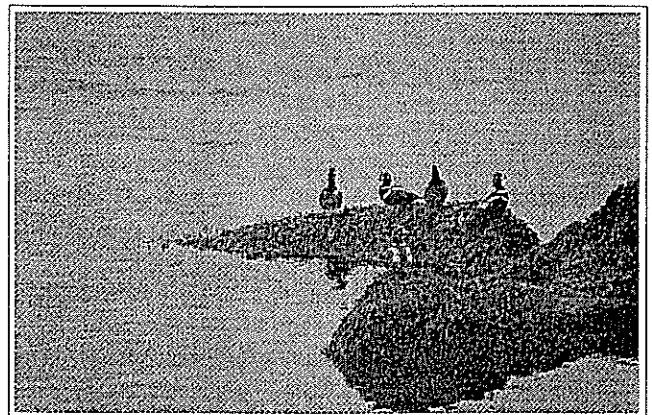
the orders of magnitude are quite different depending on the locality. For instance, harlequin ducks are listed as endangered in eastern Canada and as a Category 2 species under the Endangered Species Act in the United States. In the intermountain west, and particularly in greater Yellowstone, their numbers are extremely low, and just the slightest change in magnitude of the adult population could be detrimental to the species.

The harlequin duck is one of a kind because of its adaptations and the niche it fills in the environment. Two species of ducks in the southern hemisphere utilize a similar niche: blue duck (*Hymenolaimus malacorhynchos*) in New Zealand, and torrent duck (*Merganetta armata*) in South America. But the harlequin is the only genus and species of its kind in the world and is restricted to the northern hemisphere.

During winter, harlequin ducks are found mainly along rocky shorelines of northern sea coasts, and rarely in the interior of the country. They feed on a variety of foods, including crustaceans, mollusks, sea urchins, roe, and occasionally small fishes. During summer, harlequins are typically found in turbulent, fast-moving freshwater rivers and streams lined with rocks or cobbles. Riffles, rapids, cascades, torrents, and even waterfalls are their domain, where they feed primarily on submerged aquatic insects, although I have seen them feed on worms, crickets, grasshoppers, and salmon flies on rare occasion. Harlequins can be found on relatively calm water, but it is very atypical.



The winter diet of harlequin ducks on the Pacific coast consists of a variety of foods, including roe (fish eggs).




The ducks begin courtship activity in spring along the rocky shoreline of the Straits of Juan de Fuca.

As April fast approaches, we return to the rocky shores along the Pacific coast to resume the fascinating story of the painted duck. Along the ledges and rocky points we witness a behavior that has been happening all winter, but this time it is more intense; the unique head-nodding and chasing characteristic of a courting male. Environmental factors, such as the length of light in a day (known as photoperiodism) coupled with temperature, begin to stimulate hormonal production—the nesting season is near. By this time of year, the pair-bonded couple has stored up large quantities of fat, often underneath the skin on the breast. The fat will be used as extra fuel for the journey, courtship activity, breeding, and production. Paired adults at least three years of age become restless and are the first to leave; migration has begun. They will soon be followed by others just coming into adulthood. Younger birds not capable of breeding spend their adolescence on the sea until they too are hormonally ready for the journey.

Migration, that ancient, instinctive ritual that stimulates animals to move, is still not well understood. In the bird world, harlequins are considered anadromous migrators, passing from the sea to fresh water at stated seasons to breed and then return to the sea. (Salmon also perform this same type of migration.) What routes do harlequins take to Yellowstone? How long does it take? These questions are part of the mystique of this unique bird. Speculation has it that they travel mostly by following water drainages, since they have an affinity for moving water. Yet to reach their final philopatric breeding areas in Montana and Wyoming, they have to cross land barriers such as the Continental Divide. How long it takes to complete the journey is again speculation. It is thought to take up to several days, particularly to and from areas like Yellowstone, in the far interior of the continent.

Harlequins in Yellowstone

In late April to early May, mated pairs start arriving in Yellowstone. I once witnessed a pair of harlequins in the Black Canyon of the Yellowstone, early in the crepuscular hours of the morning, that I



Western Pacific Harlequin Subgroup

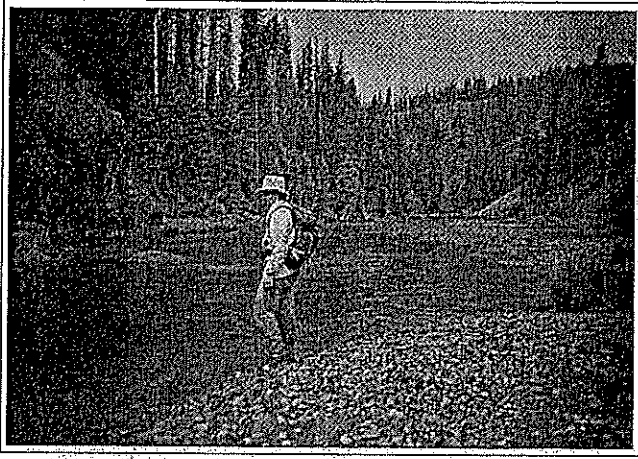
There are basically two populations of harlequin ducks in the northern hemisphere. The Atlantic group is subdivided into the Greenland-Iceland subgroup and the eastern Canada-United States subgroup. The Greenland-Iceland subgroup summers inland and winters and molts on the coasts of these islands. Vagrants may make it to places like Great Britain, Norway, and Italy. Their populations are estimated to be 5,000 to 10,000. The eastern Canada-United States subgroup includes harlequins breeding inland in Labrador, Newfoundland, and on the Gaspé Peninsula of Quebec. They are typically found wintering from Newfoundland south to Maine, with far fewer south to Rhode Island; vagrants occur as far west as the Great Lakes and as far south as Texas and Florida. Populations in eastern North America are estimated to be fewer than 1,000.

The Pacific population is also divided into two subgroups. In the Russian Far East group, harlequins breed in the interior from the Chukchi Peninsula west to Lake Baikal and south to Sakhalin. These birds winter along the coast from the Kamchatka Peninsula to Japan, including the Aleutian Islands. Vagrants have been found as far south as China. Population levels are unknown, but their numbers are believed to be substantial. The western North American subgroup breeds from interior Alaska and the Rocky Mountains of Canada and the United States, as far south as central Wyoming, with another finger extending south through the Cascades and the Sierras as far south as Yosemite. The winter range of these birds stretches along the Pacific coast from the Aleutian Islands to the coast of Washington, with vagrants making it as far as southern California; a recent record exists from northwest Mexico. We have only one substantiated record of a harlequin duck wintering in Yellowstone. The western Pacific subgroup is estimated to be at least 100,000 ducks, possibly as high as 200,000. Although these high figures have been published, they are not factual and should be treated with caution.

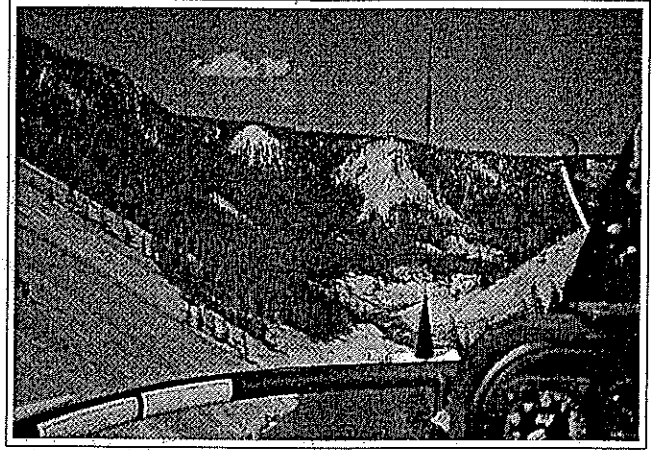
am convinced had just arrived for the season. The birds were resting on a gravel bar and were so tired they were both sleeping soundly. This is very unusual for harlequins, for usually they are on the lookout, even through the corners of their eyes. I figured they must have travelled that night.

These mountain ducks live on the move in an environment on the move. Action is

omnipresent, whether it is the ducks themselves or the fast-moving water they call home. Although a female accompanied by a male is not difficult to detect, she can be difficult to see because of her small size. Glaring sun on the water helps camouflage these ducks, as does their habit of hiding behind rocks and logs to avoid predators. I often look for what I call a "rock on a rock," for harlequins are mas-



The first harlequin duck surveys were conducted on foot and were very labor intensive. Here an assistant surveys the Snake River.



Helicopters have helped us to better determine populations, production, and distribution of harlequins in the park.

ters at blending into their environment. You will find even colorful males are hard to see at times.

Once here, harlequins travel from one location to another either by flying close to the water or by floating in the whitewater. To avoid predators they will take the plunge through rapids, cascades, and drop pools, or hide in eddies and back pools, especially if accompanied by young. Pairs or single birds will even sometimes skip fly over the surface of the water in order to overcome natural obstacles. The novice harlequin watcher should also realize that this bird has tremendously acute eyesight. It is well aware of any new motion or object in its environment, enabling the colorful male to avoid excessive predation. At times it pretends to be sleeping, but the harlequins I have watched over the years hardly ever sleep by my definition. Documenting predation is difficult, but I have seen a bald eagle feeding on a male harlequin duck. This was quite a rare sighting. Based on behavioral responses by harlequins that I have witnessed, it is safe to say that mink, long-tailed weasel, coyotes, and river otter are also highly feared predators.

Nesting season typically begins in mid-June and can extend into July. Males far outnumber females in the population, thus ensuring all available females an opportunity to nest. However, successful nesting, doesn't always occur, due to the constant problem of being flooded out or having the nest destroyed by predators.

When females are ready to nest they seek out safe, secluded and relatively undisturbed areas. Their nests are well hidden and can be on the ground, in a log jam, or in a tree cavity. Ground nests are simple hollow depressions lined with grasses; cavity nests consist of a hollow with wood shavings. They lay a clutch varying from five to ten cream-colored eggs. When the eggs are laid, the female plucks gray-brown down feathers from her breast to cover them, which aids in camouflaging and keeping the eggs warm when she is out feeding or escaping a predator. The male harlequin plumage starts to turn a duller color around the time the female initiates incubation. Incubation is approximately 30 to 32 days. Once incubation begins, almost all the males depart for the coast before serious molting of the feathers begins. Sometimes, what appear to be lone male stragglers can remain in the park until the fall. However, this is rare; usually it is only females that remain here until autumn.

Like anadromous fishes, harlequins return to the sea after a short breeding period, possibly using similar travel corridors. Once the male reaches the coast, he molts with flocks of other molting adult males and non-breeding individuals. The cycle for the male is completed.

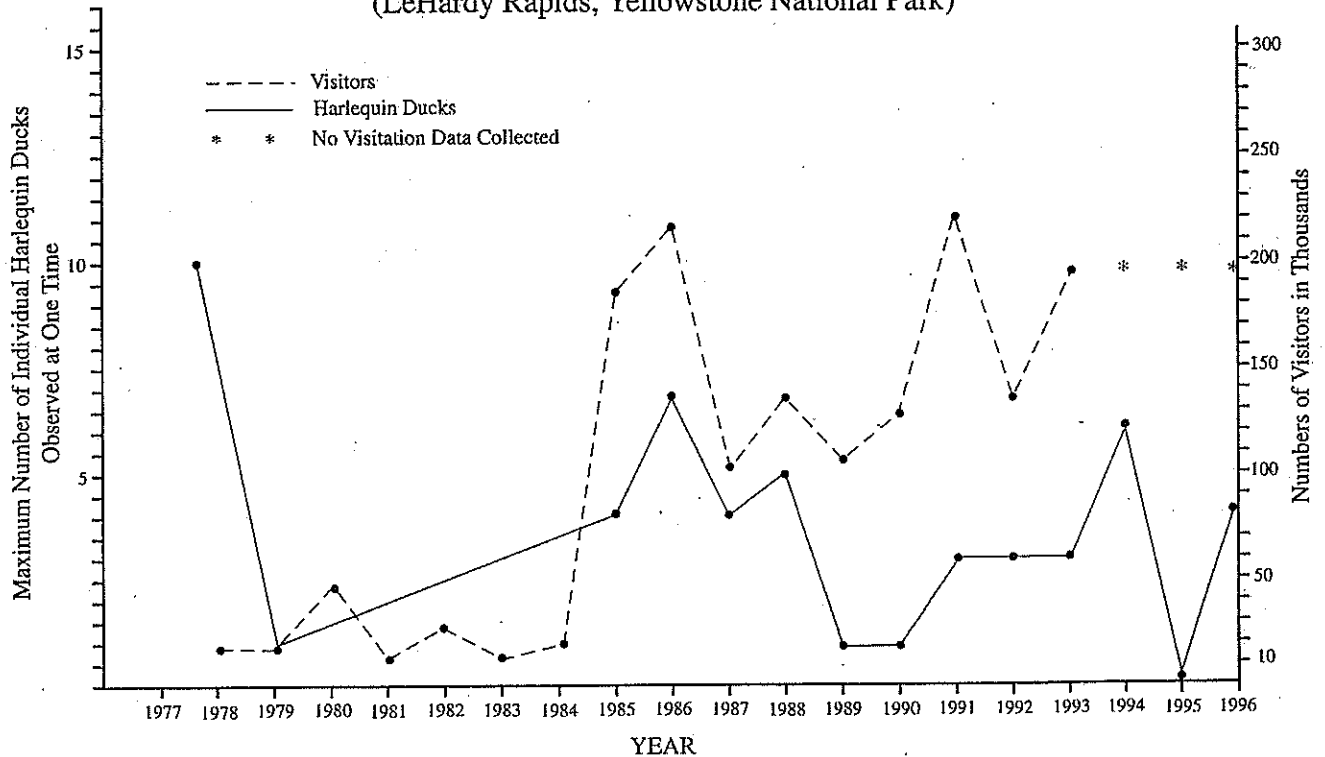
The female, meanwhile, resumes incubation and raises the brood by herself. Because of their cryptic plumage, the female and the brood are not easily detected, frequenting backwater areas at first, then feeding in the main stream

channel when the young are larger. The female keeps the brood close to her at all times. However, predators and disturbance can force young ducks through cascading water, moving broods to less secure areas increasing the chances of predation or displacement. Between mid-August and early September the female leaves her young and heads for the coast, usually by herself, to complete her molt. The young soon follow the same path, returning to the sea.

Although I have been observing harlequin ducks in Yellowstone since 1968, the first parkwide census did not begin until 1986. At first, I used ground reconnaissance to determine population numbers and distribution. However, pioneering work took off beginning in 1988 when I first employed the use of helicopters. The helicopter has become an excellent tool for determining populations, production, and distribution. Although this technique is relatively expensive, it enables me to cover large, inaccessible areas in a short period of time.

Through the combination of ground and aerial census techniques I have been able to determine the distribution of harlequin ducks in Yellowstone. In addition, approximately 16 to 20 pairs of harlequins have been documented to nest in the park in any given year. The number of adult pairs, monitored over time, provides the best information on population trends, whereas production is too variable to adequately assess population vigor.

HARLEQUIN DUCK/VISITOR NUMBERS (LeHardy Rapids, Yellowstone National Park)



Monitoring at LeHardy Rapids

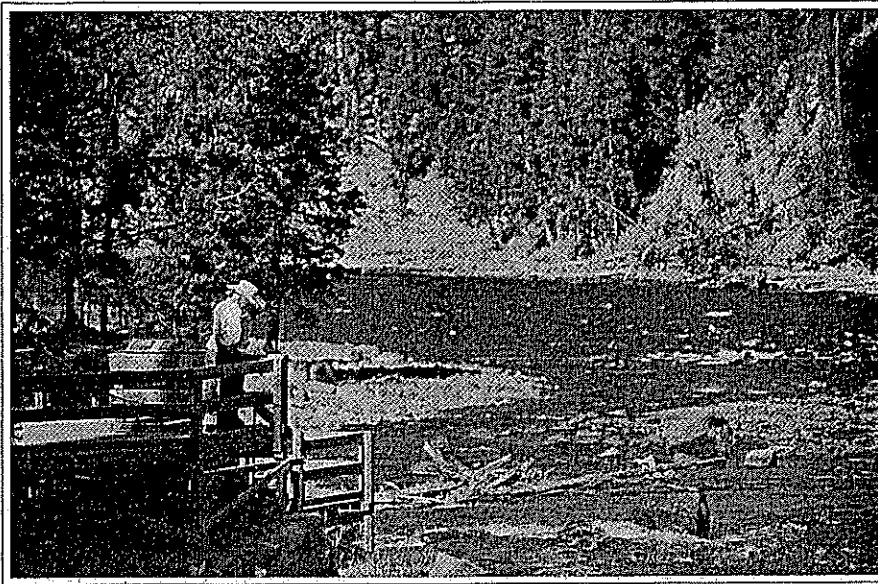
LeHardy Rapids, located three miles north of Yellowstone Lake in the Yellowstone River, is a traditional resting, feeding, congregating, and pair-bonding area for harlequin ducks. In recent years, harlequins have not been observed regularly at the rapids, causing concern among biologists and the public. At the same time, the area has become a popular place for park visitors interested in seeing spawning fish jump the rapids. In 1978, the Yellowstone fisheries staff (then the U.S. Fish and Wildlife Service) began monitoring human use at LeHardy Rapids. From 1978 to 1984, human visitation varied from 12,200 to 45,600 visits per year. Beginning in 1984, a boardwalk and observation platform were installed to prevent environmental damage. In 1985, two signs were installed on the Grand Loop Road advertising LeHardy Rapids. Because of these signs, visitation jumped from 26,800 visitors in 1984 to an eye-opening 185,500 visitors in 1985. Since then, visitation has consistently exceeded 100,000 individuals per year,

reaching a record high of 220,400 visitors in 1992. In addition, a second boardwalk was installed connecting both pullouts.

To assess what was going on I designed a simple monitoring study. During 1991 to 1993, the LeHardy Rapids boardwalk and trail were closed to the public from May 1 to June 7. The dates of the closure corresponded to when harlequin ducks traditionally used the area. Lake District resource management staff assisted with the closure and monitoring. During the closure, or control period, the two location signs were covered with black plastic to divert attention from the area, and educational closure signs were installed. Snow and wooden barricades also discouraged use of the area. During this closure period we collected information on visitor compliance and harlequin numbers. Then from 1994 to 1996, during the same May 1 to June 7 period, LeHardy Rapids was open to the public, but with limited entry restricting people to specific areas of the boardwalk.

Our findings from the study were: (1) the harlequin duck sample sizes throughout the six-year period were too small to permit statistical analysis; (2) harlequin ducks are not restricted solely to LeHardy Rapids; (3) in addition to human-induced variables, environmental variables can affect the outcome; (4) harlequins do use LeHardy Rapids, but only on occasion and most often when there are fewer visitors and the visitors restrict their movements; and (5) harlequin ducks seek out secluded areas where there are few people.

Our management recommendations were to keep LeHardy Rapids signs covered with black plastic and not promote the area until June 7; allow visitors to use only the main pullout until June 7; restrict visitors to the boardwalk and allow them no further than the observation platform; leave room for harlequins to feed, rest, and escape visitors; discourage the use of other pullouts and sections of the boardwalk through signed closures and snow and sign barricades; and report all harlequin duck sightings.



LeHardy Rapids on the Yellowstone River, and the boardwalk that provides access to thousands of visitors annually.

Several other harlequin studies have been done recently in other areas of North America. A study on the Maligne River in Jasper National Park found that closing the popular boating river during May and June helped restore harlequins to the river. A May and June closure of McDonald Creek in Glacier National Park to boating has played an important role in protecting brood survival. Studies in Prince William Sound found harlequins to be the number one bird species affected by the supertanker Exxon Valdez oil spill. These are concerns in Yellowstone as well, especially if a fuel truck were to spill petroleum in a river, or if river-rafting and kayaking were per-

mitted on some of the park rivers used by harlequin ducks.

The life of the painted duck is intertwined with natural hazards. In summer the hazards are associated with rivers and streams: predation, flooding, nest destruction, disturbance, and siltation; in winter the hazards are associated with oceans: severe storms, winterkill, and predation. Through evolution, most species can adapt to these natural hazards. Looming on the horizon, though, are human-induced hazards that will test the harlequin ducks' ability to adapt to a quickly changing environment. On one front are people who want to share their lives with the environment: wildlife watchers, nature

photographers, anglers, general tour groups, boaters, and kayakers. As harmless as these groups may seem, their presence can be detrimental to species like harlequins; especially if they use the birds' habitat in large numbers, they are competing for the same environment. On another front are extractors whose livelihoods rely on the environment: wood-products workers, water users, oil extractors, and consumers. As important as these industries may be, they too can be detrimental to harlequins if something goes awry. Excessive hunting, pollution, water extraction, stream siltation, clear-cutting, and oil spills can pose serious threats; what the future holds in store for harlequin ducks is anyone's guess.

We should treat this one-of-a-kind bird as a very sensitive species. One of the closest genetic relatives to the harlequin duck is the Labrador duck (*Camptorhynchus labradorius*), now extinct. No one at the turn of the eighteenth century realized how vulnerable Labrador ducks were to human intrusion and persecution; they presumably disappeared due to overhunting and egg-collecting.

Any ornithologist worth his or her weight thinks of the future. When I think of the harlequins' future, I recall the words of Carl Sandburg who wrote, "Here is the place I am now, where I look back, and look ahead, and dream and wonder."

I, too, dream and wonder. I dream and wonder if a place like Yellowstone can withstand the onslaught of people that love it so much. I also dream and wonder whether sensitive species like harlequins can retain their place in the greater Yellowstone ecosystem. This bird is adapted to rough waters. If we respect it and give it some room, it will survive. For these are no ordinary birds, these anadromous migrators, these harlequins, noble ducks of turbulent waters.

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Terry McEneaney is the ornithologist for Yellowstone National Park. He has explored the far reaches of the park over the last ten years in search of harlequin ducks and numerous other birds, is a member of the Harlequin Duck Working Group, and the author of several books on the birds of Yellowstone National Park and Montana.