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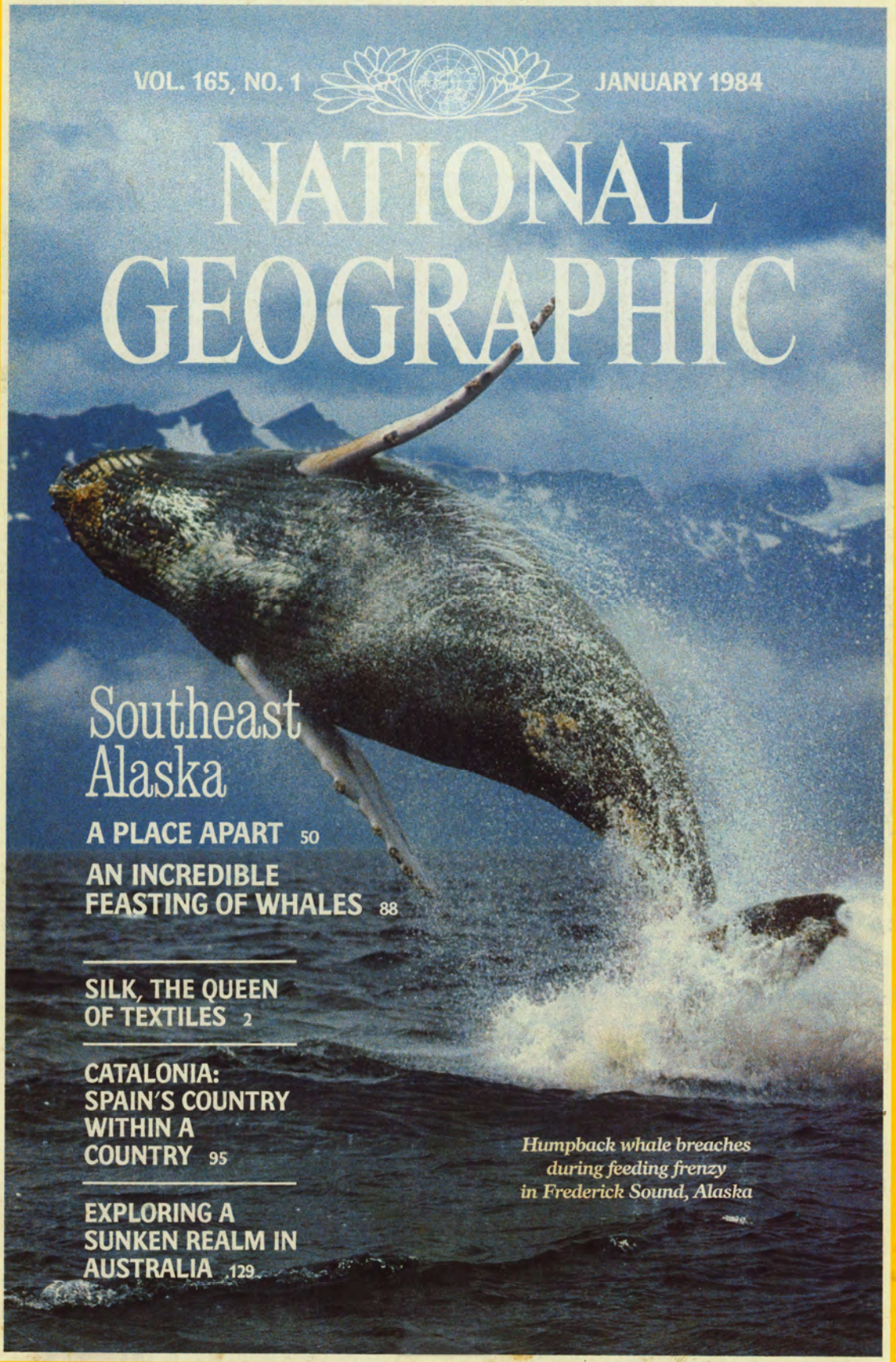


Southeast Alaska

Humpback whale breaches during feeding frenzy in Frederick Sound, Alaska

Exploring a Sunken Realm in Australia

By HILLARY HAUSER
Photographs by DAVID DOUBILET

I WAS EXHILARATED beyond anything I have ever known.

My diving companions and I were crossing one of the clear, shallow, freshwater Piccaninnie Ponds in the state of South Australia. Reeds lining a limestone ridge parted with the grace and drama of a stage curtain as we swam through them. Then the bottom dropped. We were staring into an enormous flooded crack in the earth, about 46 meters (150 feet) long and 6 meters (20 feet) wide. An arrow of noon sunlight charged the blue water, illuminating Piccaninnie Chasm almost to its 57-meter depth. The water was so transparent that I seemed to be floating in midair, certain to plummet to the ground.

These are the sensations that lured photographer David Doubilet and me into the freshwater sinkholes of southeast Australia. Water-filled sinkholes occur throughout the world, but none surpass the freshwater clarity and geologic diversity found in this region.

Beneath a quiet landscape given to pastures, pine forests, and herds of sheep and cattle, we entered a breathtaking limestone realm.

When parts of southern Australia were covered by ocean some 10 to 20 million years ago, the remains of sea creatures carpeted the seafloor and were reincarnated as limestone. The land rose, the sea retreated, and another transformation began. Rainwater began filtering into the porous limestone, which slowly dissolved, forming great caverns and filling underground aquifers. If you could cut a slice from this land, it would look like a giant wedge of Swiss cheese.

When the limestone just below the ground surface dissolves, the land collapses and forms shallow ponds like those of Piccaninnie. If the water table has subsided, the hole will be dry. If the limestone has dissolved along a vertical joint, the ground tumbles in and exposes shafts such as the Chasm. All are called sinkholes, an unglamorous name for often glorious creations.

Receiving strong light only at midday, the algae so rich near the surface have all but vanished when Rodney Fox, one of our guides, reaches 18 meters deep in Piccaninnie Chasm (***left***). Swimming to the right, he joins photographer Anne Doubilet, David's wife and assistant, in a massive side chamber called the Cathedral (***overleaf***). Nine strobes here light the normally dark cavern. Drifting in this nearly sunless room, I recalled the words of veteran Australian cave diver Ian Lewis: "The best diving in the clearest cave is like taking a space walk. It's the nearest thing to flying." Another diver amended, "It *is* flying."

Hillary Hauser is the author of several books about skin diving. She now works for California's *Santa Barbara News-Press*. Eminent free-lance underwater photographer **David Doubilet** lives in New York City.

LIKE A GREAT BOOT, the Piccaninnie Ponds stand out as we fly over the marshland protected since 1972 as Piccaninnie Ponds Conservation Park (***above***). Divers enter on the rough road seen at top left and swim from the dock. The Chasm drops where the pond narrows into the long heel. The Cathedral lies at the base of the heel. Another shallow sinkhole forms the foot.

Some 70 sinkholes, many of them dry, surround Mount Gambier, a city of 20,000 people built around a volcanic crater lake.

LOOKS DECEIVE in the world of sinkholes. That is part of their fascination, and their great danger.

Rigging a lifeline is crucial as Anne Doubilet, guide John McCormick, and I (***below,*** left to right) gear up to probe the Pines. Spring Cave is its official name, but pine trees in the commercially farmed Tantanoola Forest Reserve inspire its more popular title. As we stand in this drinking-clean water topped with duckweed, our precautions seem hardly necessary. Yet the Pines is one of the most dangerous of the Mount Gambier sinkholes. A wide chamber opens beneath the limestone rim and plunges 20 meters (66 feet) at a 45-degree angle before sharply narrowing. Only diving lamps break the darkness. I swam close to John as we squeezed into a corridor near the bottom, careful not to kick up disorienting clouds of ground silt.

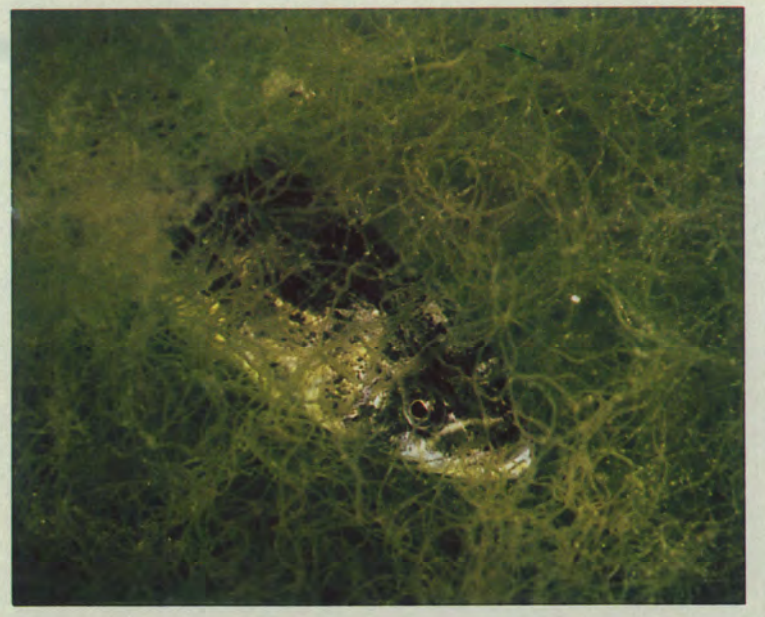
Eleven divers perished in the region's sinkholes between 1969 and 1974. Three died in a hole, now sealed, near the Pines. Two were lost in dark corners of Piccaninnie Chasm. The state government nearly banned all sinkhole diving. Instead, concerned divers formed the Cave Divers Association of Australia and were given authority to train divers in cave safety. No one lacking its certification can dive in the sinkholes. The rules sadden some older divers who don't want to retrain with the required modern equipment. "We were the original guides," says Phil Potter, who discovered Piccaninnie Chasm in 1962. "Now we can't get in." But the association's work has so far ended cave fatalities.

GENTLE BEAUTIES beckon in Ewens Ponds, a trio of shallow sinkholes west of Piccaninnie that require no cave-diving permits. The largest measures 30 meters (100 feet) wide and 10 meters deep. Mounted policeman Thomas Ewens is said to have tumbled into one while crossing the territory in the 1860s and recovered his dignity by christening the ponds in return.

Eight Mile Creek flows south to the sea through the ponds and forms connecting channels called races.

Each day roughly 52 million gallons of water—nearly three times the intake in Piccaninnie Ponds—stream into Ewens from the underlying aquifer. The aquifer fissures are scattered across the pond bottoms, so the water appears calm in spite of this massive influx. But as the water sweeps through the races, 36,000 gallons a minute accelerate into a current Rodney Fox strains to swim against (***right***).

The relentless flow sculptures neat hedgerows from stalks of *Lilaeopsis*, a relative of celery. As we let the current take us on a gentle flight through these green corridors that appear so carefully planted and manicured, David Doubilet thought of them as an underwater English garden. I imagined myself awash in a great salad bowl as I gathered clumps of watercress. Back on shore we laced our sandwiches with the tender greens.



TANGLED CLOUD of algae camouflages a congolli, or tupong (***top***), as the fish lies in wait at the bottom of the foot-shaped branch of Piccaninnie Ponds. One of its favorite foods, small Australian trout called galaxiids feed on algae and mosses that build into green underwater castles.

Along the shoreline of Piccaninnie, wisps of algae frost the red leaves of an aquatic *Ranunculus,* a member of the buttercup family (***above left***). The slightly saline aquifer that feeds Piccaninnie seems to inhibit the spread of *Ranunculus,* which adjusts its red pigment as needed to protect against the sunlight drenching these crystalline waters.

In the fresher water of Ewens Ponds, great bouquets of the water buttercups climb stalks of *Triglochin* (***above***). Found in fresh waters across Australia, *Triglochin* produces an edible, potato-like tuber still harvested by Aboriginals in the north.

The fantastic water clarity of the Mount Gambier sinkholes results from several factors. The holes are fed from aquifers holding rainwater that fell decades—even centuries—ago, and that has been filtered through miles of limestone. The high level of calcium that limestone adds causes the silty detritus from dead plants and animals to cling together and settle quickly to the bottom. Abundant bottom vegetation in the shallow sinkholes also helps bind the silt. And the rapid turnover of water prohibits stagnation.

CHAMPAGNE bubbles seem to rise from Ewens Ponds when oxygen streams from *Triglochin* leaves and other plants (***facing page***). Indeed, I felt like raising a toast to the unexpected sight of photosynthesis made visible.

In the presence of sunlight, green plants convert carbon dioxide and water into the oxygen that makes our life on earth possible. The oxygen from aquatic plants normally dissolves invisibly into the water. But if leaves have suffered surface cracks due to the grazing of snails or aquatic insects, the gas has another escape route. This oxygen bubbles to the surface in the same way that bubbles rise in soda water saturated with carbon dioxide.

The quantity of sunlight penetrating the clear waters of Ewens and Piccaninnie Ponds prompts such a high rate of photosynthesis that plants virtually saturate the water with oxygen. The relatively cool temperature of the sinkholes, 15°C (60°F), makes the water capable of absorbing a much greater volume of oxygen than warmer water.

Waving a dissolved-oxygen meter over a fissure admitting new water to Ewens Ponds, botanist Neil Hallam (***above***) discovers that the low-oxygen aquifer water quickly approaches saturation from oxygen production by the submerged plants. A professor at Monash University in the neighboring state of Victoria, Dr. Hallam has spent ten years studying Ewens and Piccaninnie Ponds. "The high level of oxygen shows that their waters are very clean and could support a diverse plant and animal population," he explained.

Yet animal life is not especially abundant or diverse in these shallow sinkholes. Though rich in oxygen, the water is low in the phosphorus and nitrogen needed to support phytoplankton, the single-cell floating algae that form the basis of most complex food chains.

With slower moving water and extensive marshland, Piccaninnie holds the most animal species and the largest, including aquatic tortoises, water birds, and short-finned eels that poke from crevasses in the Cathedral.

The Eight Mile Creek Swamp that once surrounded Ewens Ponds has been drained for farmland since before the Second World War. The pond water levels, now apparently stabilized, lie one and a half meters (five feet) below their original marks, and many of the plant species still found at Piccaninnie Ponds have vanished from Ewens.

TO CLOCK the rate of water exchange in the largest of Ewens Ponds, Dr. Hallam and Monash University graduate students release rhodamine, a water-tracing dye. They wedged a container holding only a small amount of the harmless dye into one of the many cracks emitting aquifer water. The dye billowed to this height in just ten minutes. In little more than six hours the pond was again clear, filled with more than seven million gallons of new water.

I marveled that in this relatively dry region, where annual rainfall averages 70 centimeters (28 inches), Ewens Ponds each year send more than 19 billion gallons of fresh water to the sea. Local farmers do not need to tap the ponds for irrigation because their wells draw from the same aquifer. One man does siphon Ewens water to raise trout.

Recreational use is the immediate dilemma. The popularity of Ewens, thrilling even for snorkelers, has taken a toll on the plant life. Dr. Hallam and the Cave Divers Association of Australia have recommended that Ewens Ponds be named a state park (a management plan is now being prepared) so the weekend crush of visitors can be regulated.

SINUOUS REACH lets the small Australian snake-necked tortoise (***above***) plunder algal fortresses that hide snails, crustaceans, and small fish in Piccaninnie Ponds.

In Ewens Ponds the once numerous spiny crayfish (***right***) still falls to thoughtless divers as an edible souvenir. Several of Australia's more than one hundred species of crayfish scavenge around the Mount Gambier sinkholes.

Animal life in the sinkholes has not been fully cataloged, and many known species have yet to be firmly identified. This underwater limestone kingdom does not easily give up its secrets. □