



The history of a short-lived Lake Gohna (1894–1970), with the introduction of Trout fish in India

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Abstract

There existed a lake named Gohna, larger than the lake of Nainital, in the district of Chamoli, Garhwal, India, which existed from 1894 to 1970 (only 76 years). In its heyday, it had spectacular dimensions, having nearly 4.2 km in length, 2.7 km in width, and 150 m in depth. It was formed in 1893 due to the blocking of the Birehi Ganga stream, a tributary of the Alaknanda river, by a mountainous landslide. At that time, a number of photographs were taken, out of which about 50–60 photographs were documented as a visual record. The author was among a few people who, after the Britishers, had visited the lake, enjoyed its serene beauty, and appreciated seeing the Himalayas from a boat and tasting the trout in the lake. The author took photographs; these are the historical photographs. The author discusses the rich history of the lake, from its formation to its two instances of bursting, and the catastrophic losses and devastation it has caused to human lives and property. The lake's long history is also explored, accompanied by photographs taken by the author in the past.

Keywords Birehi · Crookshank · Fallstruz-lake · Flood-management · Heim & Gansser · Percy-Wyndham · Pulford · Trout

1 Introduction

There existed a lake named Gohna, larger than the lake of Nainital, in the district of Chamoli (Garhwal), in India, from 1894 to 1970 (a period of only 76 years). In October 1968, the author had an opportunity to visit Gohna Lake for the survey of medicinal herbs. The author visited the surrounding hills around the lake and photographed them from different points and angles. In 1894, it is stated that approximately 50–60 photographs were documented as a visual record in the form of an album. Several photographs were taken during the formation of the dam or lake. After 1894, the author was the first to record the lake's photographs, which are accompanied by text, except for one by Mr. Summers. There was a boating facility and trout in the lake, so he enjoyed the boating and trout fishing. There were plenty of introduced trout in Gohna. These were introduced by Mr. Percy Wyndham I, C.S., the most popular and ablest British administrator of British India. The history of the

dam's formation in 1893 and its subsequent conversion into a lake in 1894 is well-documented. In this event, the officers, engineers, and geologists involved are well described in their respective roles. The danger of the dam bursting at any time would cause great harm to property and lives due to the resulting flood. The management taken by the government of that time is described, which later came out to be the world-class management of the dam's burst that was undertaken. The geology of the river Birehi was studied by geologists of that time, and the scientific research undertaken in response to this catastrophe is described. The lake so formed was known in geological terms as a 'Fallstruz lake'. Later, again, the lake burst in 1970, and the catastrophe is recorded with immense loss of property and life. How the place looks now, after 10 years, and is described through photographs, where the lake once existed. In the future, the chance of a dam and lake forming is discussed.

2 Approaching the Gohna Lake

To reach the Gohna Lake in the years 1960–1970, in those days, one had to go by bus from Karnprayag to reach the small village of Birehi, with only three or four houses and

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a forest log cabin, and from Birehi, Chamoli is only 7 miles away, and from Birehi, one had to travel on foot 16 km to reach lake Gohna or Durmi tal. On the way, the author met an old man, who was also proceeding to Durmi (Gohna) village. He was a talkative, intelligent, and well-informed person. On the way, he told us many interesting things but the author was interested to know about Gohna Lake. When I asked about the lake; the first information the author received from him is as follows: “Many years ago, there was a big landslide near the village of Durmi (Gohna) that dammed the flow of the Birehi River, and a vast lake bigger than Nainital lake was formed.” It was almost dark when the party crossed a wooden bridge. As the party was crossing the wooden bridge at that time, the old man told us that we were crossing over the outlet of the lake and came to the right bank of the lake. He was so kind; he took us up to the Forest Rest House (FRH) and then departed for his village, which was located on a hill, Durmi village. When I reached the Forest Rest House, it was late at night. Only the hard splashes of the lake waves, which were striking the banks of the lake, were heard, due to fast-blowing winds.

The first sight of the lake: The next day, when the author woke up and came out of the room at FRH, it was a fine, cool morning, and the rays of the rising sun were touching the tops of the hills surrounding the lake. A beautiful lake, a little bigger than Nainital, was in front of the author in an east–west direction. On the eastern side, there was the silted mouth of the lake, from where the Birehi River was entering, and towards the west, there was the outlet of the lake, which we had crossed in the night and was at the base of a high hill known as Hariadeep or Maithana, about 9000 ft. What was the cause of the formation of the lake and had scars left due to the broken portion of the hill in 1893?

Deldhunga Hill: The next morning, at approximately 6:00 a.m., the author set out for Pana village to conduct a survey of the eastern side of the lake. On the way, we had to wade across the river, as there was no bridge. After walking a short distance, we had to ascend the hill. In an hour, we reached a point where a massive stone was standing. That place was known as Deldhunga, meaning ‘a standing stone.’ At that point, we halted for a brief siesta and enjoyed the bird’s-eye view of the lake and the surrounding hills. In the west, the hill of Maithana or Hariadeep (9000 ft.) was visible, with its prominent scars indicating the landslide that had caused it. On the right flank of the lake was the Kitchmoli hill (about 7000 ft.), and on the left was a hill on which Durni (Gohna) village was situated. In between these two hills was the Gohna Lake, with its outlet towards the west and mouth towards the east of the Birehi valley at an altitude of 5405 ft. above sea level. At the mouth of the lake was a huge amount of silt, which the river Birehi had deposited (Figs. 1, 2).

Kitchmoli Hill: The next day was fixed for visiting the right flank of the lake, known as Kitchmoli Hill. We



Fig. 1 A view from Deldhunga from the east side of the lake and in front of the silt deposit of the lake is seen in the west; the base of Hariadeep Hill (8500 ft) and, on the left side, a few houses of the Durmi Hill (6000 ft.) and, on the right side of the lake, the Kitchmoli Hill (7000 ft). (Photo: Author, 1968)



Fig. 2 Another bird's-eye view from Del Dhunga Hill showing the lake and, in the backdrop, the Hariadeep Hill (8500 ft) with a prominent scar of rock fall and on the left of the lake is seen Durmi or Gohna village (6000 ft.), and on the right side is seen the steep Kitchmoli Hill (7000 ft). (Photo: Author, 1968)

started early in the morning. The path to Kitchmoli was very rough and rugged. From Kitchmoli Hill, the view of the lake was marvellous (Figs. 3, 4). The view was similar to the one from the Dorothy Seat of Nainital Lake. The FRH and the houses of Durmi village appeared as white specks amidst the green vegetation. After collecting the plants and taking photographs of the lake, we proceeded further and arrived at the base of Kitchmoli Hill. From here, we could see the mighty Mt. Trisul and Kuari Pass, which Frank Smythe, the explorer of the ‘Valley of





Fig. 3 A view of the lake from Kichmol Hill, showing the FRH and other government buildings. At the mouth of the lake, the silt deposit lake. (Photo: Author, 1968)



Fig. 4 A view of the Gohna lake from the base of Kichmol hill, showing in the backdrop the famous Kuari pass on top of Mt. Trisul. (Photo: Author, 1968)

Flowers,' had remarked as one of the finest viewpoints in the world.

After about three hours of reconnaissance, we returned to the FRH. Upon arriving, we discovered that the sub-divisional forest officer of the division was also staying in the suite next to ours.

Boating in Gohna Lake: In the evening, we received a message from the forest officer asking if we would like to go boating in the lake. We were looking for such an opportunity and were readily accepted. The boat was owned by the Forest Department, so the Chowkidar of the FRH was deputed to row the boat. It was a pleasant evening, and the sun was approaching the high hills. Soon, it had gone behind the hills, and its last rays were kissing the tops of the surrounding hills to bid goodbye. Our boat was moving slowly towards the centre of the lake. The view from the middle of the lake is unforgettable. The setting sun rays were kissing

the icy cliffs of Mount Trisul, standing against the backdrop of a light blue sky that was changing colour to a light green. Soon, the silvery rocks were glowing with a golden-red colour like a fire. This colourful sunset lasted only for a very brief moment. Thereafter, the colour changed to ash-grey. Now, we were at the mouth of the lake, from where the river Birehi entered and had deposited a large amount of silt. The Sub-Divisional Forest Officer had actually come to take the measurements of the silt deposited at the entrance of the river Birehi.

The Duck shooting: The next day was a resting day. In the morning, the forest officer came to bid us goodbye as he was proceeding to another location. Throughout the day, we changed our herbarium specimens and completed our field notes and field book. In the evening, I was sitting in the bungalow compound when I saw a retired army sepoy standing on the edge of the compound, curiously looking towards the lake. When the author asked him, what was the matter? In reply, he pointed out a wild duck swimming freely in the lake. The author asked him to keep an eye on the duck, and by this time, he had brought a .22 rifle and loaded it with a high-velocity English cartridge, stepping down to the field next to the compound boundary. The range of the duck from where we were standing was about 200 yards or so. The duck, for a moment, stopped and gave a chance to shoot. The author slowly raised his rifle, aimed steadily, and fired. The duck tried to make a jump to fly but fell into the water. The sepoy who was standing behind said that the shot was missed. The author knew that he had not missed the shot, and the bird must have been wounded, if not dead. First, the sepoy did not agree later; he followed the bird on a boat. As the boat approached the duck, it showed no sign of life. The sepoy struck hard two or three times with his boat oar and finally got hold of it. The sepoy was back with the duck and wanted to give it to the author. Considering the labour he had taken, the author gave him back the duck. The sepoy was very happy, and while thanking the author, he told him that he would try to catch some trout for him the next day from the lake.

Trout fishing in Gohna Lake: The next morning, we set out for a survey of Durmi village and the adjacent area. From this place, the author could not get a good view of the lake. After our work, we returned to FRH at about 3 p.m. After taking tea, I went for a light stroll towards the lake. There, he saw the sepoy was fishing. The author approached him and asked if he had any luck. In reply, he showed three trout, ranging in size from eight to twelve inches. He asked the author if he would like to try. The author agreed, but even after an hour's try, he could not catch any trout. In the evening, the sepoy brought us two trout. The trout is a spotted fish, and in the centre there was a striking and shining golden circled row, which the author cannot forget. Its taste was unforgettable, as it was delicious (Figs. 5, 6).





Fig. 5 A view of Gohna Lake from the entrance. A wooden bridge had existed over the outlet of the lake's water, allowing access to Durmi village and the Forest Rest House. (Photo: Author, 1968)



Fig. 6 Another view of the lake from the end of the wooden bridge with the branches of a pine tree. (Photo: Author, 1968)

The Retreat: Our work at Gohna was over, and the next day, we had to leave. Early in the morning, the coolies had arrived, and we were ready to march for Birehi to board a bus for our HQ at Ranikhet. While leaving, we crossed the wooden bridge, and the author had the last look at the lake; not only a last look at the lake, but also the author had also snapped a few photographs of the lake showing the wooden bridge and pine tree, and at that time, the author did not know that he was looking at the lake from the world's eyes as after two years it was to be washed away and vanished forever. We reached Birehi in the evening, and the night we spent at the Forest Log Cabin was also swept away by the lake water after two years.

3 Introduction of Trout fish in Gohna Lake

The trout are cold-water fish native to countries such as North America, Europe, and Northern Asia. The Duke of Bedford, in England, initiated the introduction of trout in India, and Mr. Frank Mitchell actually brought it into action by introducing trout in Hawan Nallah and Dal Lake, Kashmir, in 1903. Trout are not only the noblest sport but also provide food of the highest quality. Perhaps Khanduri (1944) provided the first official account from the official files regarding the introduction of trout and its fishery in Gohna Lake.

According to Khanduri (1944), Mr. Percy Wyndham, Commissioner of Kumaon (Shah, 2006), and A.E. Osmaston, Divisional Forest Officer of Garhwal, introduced trout in the year 1917–18. These flourished very well in the lake, to the extent that it became a popular fishing spot for the British and others who visited the Gohna Lake. Furthermore, the introduction of trout in Kashmir and other



Fig. 7 A British guy, Gordon Summers, visited the lake in 1946. (Photo courtesy: Peter Summer, son of Mr Gordon Summer, who was born in Nainital and sent me this photograph from Midland Derbyshire, England)





Fig. 8 A Gohna lake photograph taken by Gordon Summers, A Britisher living at Nainital, in the year 1946

parts of the Himalayas in India is well discussed by Howell (1916) and Mitchell (1918) (Figs. 7, 8).

3.1 Percy Wyndham I.C.S.

It is worth mentioning here that Percy Wyndham introduced trout to Lake Gohna and other lakes and rivers in Kumaon, and also conducted developmental work in the district of Mirzapur, from which he originated. He was one of the most popular British administrators in the annals of Mirzapur and Kumaon (Fig. 9). He initiated developmental work wherever he was posted. He joined as a Deputy Commissioner at Mirzapur and remained in this position from 1901 to 1912. At Mirzapur, a waterfall was developed by him into a picnic spot, which became famous as a tourist center and was named 'Wyndham Falls'. He developed a historical tourist place that was called by his name, 'Wyndhamganj'. He was very famous among the people of Mirzapur, and they liked him very much. He had spent most of his career hunting in the Mirzapur district and had killed approximately 500 tigers and leopards; hence, the people referred to him as 'Bagmaroo Wyndham' or 'Bagmaroo Sahib,' which means 'Wyndham, the killer of tigers' or 'Sahib, the killer of tigers.' In the year 1912, he was promoted to the Commissioner of the



Fig. 9 Percy Wyndham, Commissioner of Kumaon, introduced trout in the year 1917–1918 in the Gohna Lake, as well as in other lakes and rivers in Kumaon. (From the author's family album)

Kumaon Division and sent to Nainital for another 12 years. In 1922, he came into contact with Jim Corbett, and they became fast friends. Both were bachelors and above all, both were tiger hunters. When Sultana Daku was at large in the Bhabar region and at other places in the state, Mr. Wyndham made a special dacoity force of 300 policemen to capture him. Wyndham made Frederick Young the sole in charge of the force, who was the Superintendent of Police of Kumaon. Not only this: in one of the raids conducted to arrest Sultana Wyndham & Corbett, they also joined, but the raid failed. The next day, Wyndham and Corbett left, and Capt. Young was able to capture Sultana alone and alive (Shah, 2008).

4 The formation of Gohna Lake, 1894

In 1970, just two years after the author visited the lake, while the author was in Lucknow, one fine morning, the author read the news that due to heavy rains, the lake had burst and was completely washed away. The author could not believe that such a huge lake could vanish. Then, the author began collecting materials about the lake's history



and origin, and published an article about his visit to the lake (Shah, 1971, 2014). Side by side, the author was busy collecting information about the devastation caused by the lake's burst from newspapers, and simultaneously tracing the history of the lake. A report the author found in the Secretariat library of the government of U.P., entitled 'A narrative report on the Gohna lake and flood' by R.R. Pulford, Crookshank, and T.H. Holland (November 1894). He noted the contents. Later, the entire library was destroyed in a fire, along with all the books and reports. This report was well published in a number of journals in 1894 and 1896.

Before September 21, 1893, the Birehi used to flow freely in this open valley. On September 21, 1893, a portion of Hariadeep Hill broke with a thunderous noise, and an enormous dust cloud formed, spreading slowly. People witnessed that the right wing of Hariadeep (a massive rock) had fallen, where the cowsheds and agricultural fields of the Durmi villagers were located. The storm of dust lasted for three days, and even the sun was not visible. It is stated that this cloud of dust reached as far as Chamoli and Karnprayag. A thick layer of dust covered everything on the ground, and the portion of rock that fell from Hariadeep was estimated to be about 1000–1200 cm, which blocked the river course and formed the dam. Day by day, the water level began to increase, and by August 24, 1894, a vast dam approximately 4 km long, with a maximum breadth of 0.7 km, a height of 300 m, and a depth of about 150 m, was formed. The Patwari of the village Gohna rushed to Chamoli, the district headquarters, and met the Deputy Commissioner, stating that a mountain had fallen. The DC took it lightly and ignored this mis-sive as an exaggeration, thinking that a mountain could not fall. So no action was taken at that moment. However, the district executive engineer and the surveyor, who were touring the area, investigated the matter and made a detailed report. Due to the mountain's fall, the water of the River Birehi could not flow, and a dam was forming naturally, day by day, increasing in size. As a follow-up, an Army engineer, Lieutenant Colonel R. R. Pulford, Resident Engineer, Superintending Engineer of the Lucknow Circle, assisted by Mr. Joseph, Divisional Engineer of Kumaon, and by Mr. Wildeblood, District Engineer of Almora. They visited the place from Lucknow and opined that there was no immediate danger, but that sooner or later, the dammed waters would overflow the dam, and then a huge flood would occur in the Alakhnanda valley.

Subsequently, T.H. Holland, a geologist of the Geological Survey of India, Calcutta, arriving on March 2, 1894, undertook the survey of this site. The report of Mr. Holland was transmitted to the journal *Nature* by Sir. Edward Charles Buck, through the Under Secretary to the Government of India, was published in the July 5, 1894, issue of the journal. Sir. Edward Charles Buck was a British civil servant who served in the Indian Civil Service, serving as a director for

the Department of Agriculture. He came to be known as the "Grand Old Man" of Indian agriculture (Anonymous, 1894, 1909; Pulford & Holland, 1894).

There were sharp differences of opinion about what the consequences would be if the dam were to burst and what measures should be taken to save the property and lives from the floodwater that would follow the dam's collapse. However, Col. Pulford's recommendations were heeded, and another assistant engineer from the army, Lt. Crookshank, was placed at Gohna Lake to monitor the lake and warn of any unusual activity through the telegraphic line, which began on April 12, 1894. A skilled photographer was attached to Lieut. Crookshank, so as to secure a complete record of all changes up to and after the time of the overflow.

4.1 The management and precautions undertaken

The British authorities handed over the case to Engineer Pulford, and he was made the sole person in charge to deal with the matter on a war footing. The precautionary measures as suggested by Pulford and others were taken on a war footing and completed before the outburst of the dam and before the flood to come, and these were the following:

Shifting of engineers & photographers to Durmi or Gohna village: Lt. Crookshank, an Assistant Engineer from the army, along with Eng. T.H. Holland, a geologist with the Indian Geological Survey in Calcutta, was sent to Durmi village to monitor Gohna Lake. Photographs of the lake and its surrounding hills were being taken by a team consisting of Mr. Wildeblood, Griffith, Mr. Lubock, and Rahim Khan. It is stated that a number of photographs were taken, out of which about 50–60 photographs were documented as a visual record in the form of an album. A day-to-day report was also sent to Chamoli, and an alarm was sounded when it was about to overflow.

Laying of temporary telegraph line: A temporary telegraph line was also installed from the village Durmi up to Chamoli under the supervision of Lt. Crookshank for sending quick messages. It started on April 12, 1894, in the village of Gohna.

Information to villagers: The villagers who were living by the sides of the rivers Birehi, Alakhnanda, and Ganga were informed to move to a safe location with their movable property. Not only this, arrangements were made to light beacons in strategic places in case the flood came at night, to warn people along the valley that the catastrophe had begun. All the villages along the sides of the Birehi, Alakhnanda, and Ganga rivers were evacuated (Fig. 10).

Creation of Benchmarks: Masonry benchmarks were constructed at 10-foot intervals down the slope of the dam. These were numbered, and the PWD officer stationed at Gohna was required to send a telegraphic report every week to higher authorities about the level of the lake that had been





Fig. 10 A view of the lake after 1894, when lake water was full. A good number of houses in Durmi village with fields are visible, and in the west, Maithana or Haria Deep Hill, with a prominent, large white portion of rockfall, is visible (Photo: Wikipedia)

reached. Signal pillars or masonry pillars at a distance of two miles, of the size of 4 ft × 4 ft × 6 ft were erected above 200 ft above the high flood mark throughout the valley. It is shown below that the pillars are a danger zone, and it is advised to keep people and cattle away, as indicated in the telegraphic message from Gohna.

Removal of suspension bridges: All suspension bridges below Gohna, spanning the river Alakhnanda, up to Lakshman Jhula over the Ganga, were gradually removed, and in their place, a temporary manila-rope bridge was installed. The danger limits were marked by establishing observation posts to monitor the levels of the Alakhnanda and the Ganga and to mark the danger limits of the expected deluge from Chamoli all the way downstream up to Haridwar; pillars were erected at many places in the Alakhnanda and Ganga, and the inhabitants were directed to evacuate as soon as the water crossed these danger levels. Right from Chamoli, all the way downstream up to Haridwar, pillars were erected at many places in the Alakhnanda and Ganga valleys to mark the danger limits of the expected deluge. The inhabitants were directed to evacuate as soon as the water crossed these danger levels. The danger limits were marked by establishing observation posts to monitor the levels of the Alakhnanda and the Ganga rivers.

Diversion of pilgrim routes: The pilgrim routes to holy shrines like Badrinath & Kedarnath run along riverbanks and were diverted from danger zones, especially from Byasghat to Rudraprayag and Gopeshwar to Haat, among others. A number of huts were made at higher points for the safety of the officials. Further, according to the Imperial Gazetteer, Anonymous (1909), and Walton (1910) “In December, 1893, the area of the lake was about one square mile and its depth



Fig. 11 In 1894, Lt. Crookshank was responsible for sending day-to-day warning reports by telegram to the authorities in Chamoli, informing them of the impending lakeburst. The photograph was taken on August 25, 1894, and at midnight, the lake broke through the barrier. (Photo: Wikipedia)

450 feet. By July, 1894, the lake had become a large sheet of water, nearly 4 miles long and half a mile broad, and the level of the water had risen nearly 170 feet, while percolation was freely taking place and a month later the water was rising about 4 feet a day.”

Lt. Crookshank warned on August 22, 1894, that the dam was likely to burst in a couple of days. In the event, he was absolutely right, as the dam burst with a bang at about midnight on August 25–26 (Fig. 11). About 10,000 million cubic feet of water poured down the hillside, and Srinagar was completely washed away. The Gazetteer again stated, “It was found next day that the level of the lake had fallen 390 feet, leaving a stretch of water 3900 yards long with an average breadth of 400 yards. The depth near the dam was 300 feet, and the bed had already silted up about 85 feet. Immediately below the dam, the flood rose 280 feet, but its height rapidly decreased as the channels of the rivers that carried it off widened. At Rudraprayag, 51 miles away, the rise was 140 feet; at Beasghat, 99 miles, 88 feet; and at Hardwar, 149 miles, only 11 or 12 feet.

Damage caused: The total damage caused to public property was valued at more than Rs. 95,000, but no lives were lost except those of Fakir’s family of five persons who insisted on remaining just below the dam (Khanduri, 1944). At Hardwar, the headworks of the Ganges Canal were slightly damaged, but beyond this point the flood had no appreciable effect.” Even after the bursting of the dam, there was still a large lake formed here, about two miles long and half a mile wide, and covering 400 acres. This lake lasted until July 20, 1970, when another Alakhnanda flood was instrumental in draining the remaining waters of the lake. Today, the bed turned into a field with a stream flowing like

a streak, filled with sand, rubble, and stones, and a grass that was very much favored by village boys for playing cricket and tourists for setting up their camps.

5 Visit of Albert Heim and August Ganseer

Albert Heim and August Ganseer, the Swedish geologist, visited the Birehi valley in 1937, exactly 46 years after the incident occurred in the valley, to study the geology (Fig. 12). They wrote two books, one a travelogue in which they provided a beautiful account of the places they visited in Kumaon, supported by nice photographs, and also offered a botanical account of the region. Dr. E. Schmid of the University of Zurich had identified the plants, which are lodged in the herbarium of the University of Zurich. The other book is solely on the subject of geology, in which they have described the area of the Birehi River as being formed from the limestone mass, not from a slippery argillaceous bed, but from a dry rock wall across the stratification (Heim & Ganseer, 1939b). In 1964, Gansseer revised his book, "Geology of the Himalayas," which summarized the geological

knowledge of the Himalayas drawn from works published between 1851 and 1962.

Fallstruz Lake: According to Heim (1939a), there are 20 types of mountain slides, and the lake in a river so formed was called a 'Fallstruz' (falls truz), which means rock-fall, and the lake so formed is often called 'fallstruz lake.' If a rockfall or landslide is on a river, it blocks the passage of water, and a lake is formed. Gohna Lake was the best example of 'Fallstruz Lake.' It is stated that 'Fallstruz' lakes live only for a hundred years or so. Gohna lake must have existed for a hundred years or more, but due to the pressure of bursting a blockage in the upper reaches, which had rushed with great speed, pressure, and weight of water, it was wiped out.

6 The Lake Burst of 1970

In 1970, during the rainy season, there was heavy rainfall in the upper reaches of Chamoli, amounting to approximately 24 inches in two days. All the tributaries of the Alakhnanda were swollen, and numerous landslides caused blockages in them. Two disastrous incidents occurred simultaneously, one at Belakuchi and the other at the Gwaldom-Kuari Road in Jhingi Patan, near the river Birehi (Shah, 1971).

6.1 The Belakuchi disaster

On July 20, due to very heavy rains throughout the upper reaches of District Chamoli and all the tributaries of Alakhnanda, mainly Patalganga, a blockage formed at Ringi village, creating a lake one mile ahead of Belakuchi. The blockage gave way at 7 p.m. on July 20, resulting in a quick rise in the level of the river Alakhnanda. The water in the Alakhnanda rose up to 15 m above the riverbed. The abrupt and abnormal rise of water engulfed and washed away a large number of vehicles that were trapped on the road near Belakuchi. Not only were the vehicles swept away, but a few bridges were also swept away. It is recorded that 29 vehicles (17 tourist buses, 6 trucks, 2 military trucks, and 6 taxis), along with 600 passengers, were suddenly washed away at Belakuchi, known as the 'Belakuchi disaster.'

6.2 The Gohna disaster (based on newspapers)

On July 19, on the Gwaldom-Kuari road at Jhingi Patan, a mountain fell, which blocked the flow of the river Birehi in the upper reaches of the valley due to a cloudburst. When this blockage burst, a huge amount of water was released, and the flow was so fast and heavy that on the first day, it filled up Lake Gohna. On July 20, Shri N.D. Tewari, then the Finance Minister of the Government of India, flew over Gohna Lake in a helicopter and described the lake as looking like a vast ocean, with only the tops of the surrounding



216. Two "New Indians" have had a refreshing swim in Lake Gona. October 19, 1936.

Fig. 12 This photograph is actually of Prof. Albert Heim and Dr. August Gansseer when they visited the Birehi valley for geological works. They enjoyed swimming in Lake Gohna. They called themselves as the 'Indian'. Do you know why? Because they are taking their food in a thali with rice and eating it by hand, as the Indians do. This photograph was published in their book Heim & Ganseer (1939a, Plate 216). They had to adopt Indian food as a part of Indian culture, as they were in India in remote places for eight months



hills visible. Possibly, Mr. Tewari and the people of village Durmi (Gohna) were the only people to see the last sight of Lake Gohna. That night, the flow of water from the blockage also burst out of Lake Gohna. A school and a dispensary in the village of Durmi (Gohna) were washed away. And Birehi was the worst-hit place, where all the bazaar houses, bridges, log cabins, etc., were completely washed away (Shah, 1971).

6.3 The loss of the 1970 catastrophe

The final Report of the disaster, as collected and compiled from the newspapers, stated that about 1000 men and women lost their lives; about 1000 heads of cattle had been swept away; 10 suspension bridges and six motor bridges were also swept away; 210 houses were ravaged; and 25 vehicles were washed away. The total loss was estimated at about 10 crore rupees, including the Belakuchi disaster on July 19, 1970 (Shah, 1971). Not only this, when the catastrophe was over, the persons who took part actively in this mission published the Pulford reports with certain changes in different journals, such as Holland (1894) in *Journal of Geological Survey of India*; Strachey (1894) in *Geographical Journal*; Glass (1896), in *Journal of Society of Arts*, London and Guy Lubbock (1894) in *Geographical Journal*. It may be noted here that Frizell (1906), Howell (1916), Barrows (1948), and Gupta (1974) also discussed the catastrophe of Lake Gohna.

6.4 Now, after seventy-six years

In place of a big lake, the bed has been filled with small or big boulders and mud (Figs. 13, 14). The area around the lake is now a pastoral expanse of lush grass, crisscrossed by small, picturesque streams. The beautiful Birehi Ganga continues to flow in the valley, dominating the landscape. A suspension bridge had been erected across the river just



Fig. 13 A view in the year 1980, after 10 years of bursting of the lake. The Gohna Lake has changed into a narrow stream. (Photo: PAHAR)



Fig. 14 Another view of the washed-away lake of Gohna in 2006 from Durmi village, with the Haria Deep hill in the backdrop, showing the scars of the 1893 rockfall prominently. (Photo by James Champion, grandson of Sir Harry George Champion (August 17, 1891–June 20, 1979) was a forest officer in British India who created a classification of the forest types of India and Burm. Photo by Champion 2006

opposite Durmi (Gohna) village. A natural, serene, and beautiful lake of 3.2 km in length, 0.7 km wide, and 120 m deep, full of trout fish, with the facility of boating, which had been in use by the people of Durmi village for 76 years, was lost forever, making a significant mark in geographical history.

6.5 Etymology of the river ‘Birehi’

The name of the river is Birehi; ‘Birehi’ means ‘separator’, that is, ‘which separates and causes sorrow. The people have been living on the banks of the river for ages and may have seen the floods many times. These floods have taken many lives of the people (their own), and the people have been separated from the loving ones, so the river was named Birehi.

7 Discussion and conclusion

The article provides a vivid description of Gohna Lake as it existed in the form of an author’s travelogue in 1968, and by 1970, it had been washed away. There was a boating and fishing facility for trout in the lake. The trout were introduced in it by the Commissioner Kumaon and the District Forest Officer. Not only this, but this lake was used as a fishery for all the lakes and rivers of Kumaon, Khanduri (1944). This article provides a vivid description of the lake and its surroundings, accompanied by rare photographs taken by the author. Apart from these, a complete history of the lake from its formation as a small river in 1893 to its transformation into a dam, which existed for a year or so,



and the catastrophe known as the Gohna floods, without a loss of human life and with minimal harm to public property. The only loss to existing British governments due to well-conceived precaution was in managing the catastrophe in the best way possible. A beautiful and serene lake was left, which existed up to 1970.

The entire occurrence is of remarkable geological interest, and it is essential that the correct facts are known. No doubt, the details are provided, quoting the authorities who participated in this, but the most comprehensive account is given by Pulford and Holland (1894) and Khanduri. (1944).

On the other hand, the 1970 Gohna breach caused immense loss of property and lives. No management was done by the state government of that time, which was the cause of the loss, while the management done during the colonial period has been taken as a world record for the best management, Costa and Schuster (1991), who had documented and compiled the historical landslide dams from all over the world from countries like China, Australia, Chile, India, Japan, Canada, and North America, etc. The data in each dam or the lake consist of the location, date, triggering mechanism, kind, size, failure time and mechanism, breach dimensions, subsequent controls, materials, and references for 463 historical landslide dams and associated natural reservoirs that have been recorded throughout the world and in this Gohna Lake is also included.

The past and present catastrophes in the Birehi Valley were so significant that they garnered coverage in all the major international journals, including Nature, the foremost scientific journal. The 1970 incident was so significant that geologists rushed to India and visited the Gohna Lake site and the Birehi Valley to study the area. Though significant events of landslide damming have been recorded since the nineteenth century, the most notable being the breach of Gohna Lake in 1970, which had long-term impacts.

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Declarations

Conflict of interest The authors declare that there is no conflict of interest.

References

Anonymous. (1894). Land slip at Gohna Garwal. *Nature*, 50(1288), 231–234.

- Anonymous. (1909). *The imperial gazetteer of India. Descriptive new edition* (Vol. 12, pp. 305–306). The Clarendon Press.
- Barrows, H. K. (1948). *Floods—their hydrology and control*. McGraw-Hill.
- Costa, J. E. & Schuster, R. L. (1991). Documented historical landslide dams from around the world. *U.S. Geological Survey Open-File Report*, 91–23.
- Frizell, J. P. (1906). *Water-power* (3rd ed.). Wiley.
- Glass, J. H. (1896). The great landslip at Gohna, in Garhwal, and the measures adopted to prevent severe loss of life. *Journal of the Society of Arts*, 44, 431–446.
- Gupta, A. C. (1974). Lakes of sorrow. *Journal of the Institution of Engineers*, 55, 6–11.
- Heim, A., & Gansser, A. (1939a). *The throne of the gods*. Macmillan and Co., Ltd.
- Heim, A. & Gansser, A. (1939b). Central Himalaya, Geological Observations of the Swiss Expedition 1936. Reprint. (1975) Delhi: Hindustan Publishing Corporation (India). <https://archive.org/details/CentralHimalayanGeology>
- Holland, T. H. (1894). Report on the Gohna landslip. *Garwhal, Records of the Geological Survey of India*, 27, 55–64.
- Howell, G. C. L. (1916). The making of trout in Himalayan water. *JBNS*, 24(2), 1–28.
- Khanduri, J. K. (1944). Gohna lake and Trout fishery. *Indian Forester*, 70(Feb), 48–59.
- Lubbock, G. (1894). The Gohna lake. *Geographical Journal*, 4, Article 457.
- Pulford, C., & Holland, T. H. (1894). *A narrative report on the Gohna lake and flood, november 1938*. Government of United Provinces.
- Mitchell, F. J. (1918). How trials were introduced in Kashmir. *Journal of the Bombay Natural History Society*, 26(1), 176–179.
- Shah, N.C. (1971). Gohanalake-the lake that vanished. *Pioneer Magazine* Section, I & II: 8.
- Shah, N. C. (2006). Percy Wyndham: A meritorious British administrator of bygone days. *Family in British India Society (FIBIS)*, 16, 46–48.
- Shah, N. C. (2008). The police officer and the dacoit: Freddy Young and Sultana, the 'Robin Hood of British India. *Family in British India Society (FIBIS)*, 19, 43–52.
- Shah, N. C. (2014). A historical fallstruz lake, Gohna, Dist. Chamoli (Uttarakhand), India (1893–1970). *Earth Science India- Popular Issue*, VII(III), 1–14.
- Strachey, R. G. (1894). The landslip at Gohna, in British Garhwal. Based on landslide hazard management and control-Pulford report. *The Geographical Journal*, 4(2), 162–168.
- Walton, H. G. (1910). *British garwal gazetteer, vol XXXVI* (pp. 161–166). Supdt. Govt. Press.

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