



# The History of a Short-lived Lake Gohna (Fallstruz Lake) (1894-1970) with the Introduction of Trout Fishes in Gohna

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**Abstract:** There was a lake named Gohna Tal, bigger than the lake of Nainital, in the district of Chamoli of Garhwal, in India, which existed from 1894 to 1970 (only for 76 yrs). 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 Alakhnanda River, due to a mountainous landslide. The author was among a few persons who, after the Britishers, had visited the lake, enjoyed its serene beauty and seeing the Himalayas from boating in it, and tasted the trout fishes from the lake. The vivid history of the lake from its formation and its two times bursting to the catastrophic losses and devastation caused to human lives and property, is discussed by the author, along with its long history with its photographs taken in the past by the author and from the websites taken by the Britishers at the time when it burst out for the first time.

**Keywords:** Birehi, Crookshank, Fallstruz-lake, Flood-management, Heim & Gansser, Osmaston, Percy-Wyndham, Pulford, Trout, Durmi Tal, Durmi village

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## Introduction

There existed a lake named Gohna Tal, bigger than the lake of Nainital, in the district of Chamoli (Garhwal), in India, from 1894 to 1970 (only for 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 it from different points and angles. 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 formation of a dam in 1893 and its conversion into a lake in 1894 is well described. In this event, the officers, engineers and geologists connected with are well described with respective roles. The danger of bursting of the dam at any time would cause great harm to the property and lives due to the 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 the geologists of that time and the scientific research undertaken for this catastrophe is described. The lake so formed was known in geological terms as a 'Fallstruz lake'. Later, again, the lake busted in 1970 and the catastrophe is recorded with the immense loss of property and live. How the place looks now after 10 years and is described through photographs, where once the lake existed. In the future the chance of a dam and lake forming is discussed.

### **Methodology or Material & Method**

In the Year 1968 the author had visited the village Durmi in Chamoli for the survey of medicinal plants, where a lake existed. The author carried his own personal camera, as he was fond of photography. While visiting different sites around the lake, he had photographed the lake as best as he could. At that time he did not know that these photographs were the only photographs in the world of the 18th century. In 1970, the author heard the news that Gohna Lake had washed away. So, he collected all the information published in newspapers; further, he wanted more information to know about the washed-away lake. At that time, no computer existed. He came to know about a report by Pulford, Crookshank and Holland (1894). It is a Narrative Report on the Gohna Lake and Flood, published by the Govt. of United Provinces, Allahabad. First, he visited all the institutes' libraries. Then he thought to visit the Govt. of U.P Library. He applied and got permission to see the report. He sat for three days in the library and copied the main portions required for an article. Then, he wrote an article. Shah (1971). Then it was thought to write a detailed article from its formation to its first time bursting, in detail. Again, the old photos were required to know how the lake of Gohna was created. The website was searched; on the website, it is difficult, as many other lakes were shown as Gohna. However, some photos were collected and sequenced to make the real story and an article was written for Earth Science India in 2014. But it was thought this information was to be spread among more people; then an article with more information was included, like the

introduction of trout fishes, as the author came to know that Gohna was made a trout fishery to spread in the whole Kumaon.

### Approaching the Gohna Lake

For reaching 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 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. **Fig. (1. Map of the area and Gohna tal.).**



Fig. 1: A. map showing the actual position of Gohna Lake along with Karnprayag and Chamoli

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 he departed to his village, which was on

a hill, the Durmi village. When reached the Forest Rest House, it was late in the night. Only the hard splashes of the lake waves, which were striking the banks of the lake, were heard, which were due to fast-blowing winds.

### **Deldhunga Hill**

The next morning, at about 6 o'clock, the author started for Pana village for the survey to cover the eastern side of the lake. On the way, we had to wade 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 was seen the hill of Maithana or Hariadeep (9000 ft.), with its prominent scars showing the landslide that had caused it. On the right flank of the lake was the Kitchmoli hill (about 7,000 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. **Fig. (2).**



**Figure 2:** 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)

### Kitchmoli Hill

The next day was fixed for visiting the right flank of the lake, known as Kitchmoli Hill. We started early in the morning. The path to Kitchmoli was very rough and rugged. From Kitchmoli Hill, the view of the lake was marvellous. The view was like the view one gets from the Dorothy Seat of the Nainital Lake. The FRH and the houses of Durmi village looked like white specks in between the green vegetation. **Fig. (3.)**



**Figure 3. 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: Author1968)**

After collecting the plants and taking photographs of the lake, we proceeded further and came to the base of the Kitchmoli Hill. From here, we could see the mighty Mt. Trisul and Kuari Pass, which Frank Smythe, the explorer of the 'Valley of Flowers,' had remarked as one of the finest viewpoints in the world. **Fig.(4.) & Fig. (5).**

After about three hours of reconnaissance, we returned to the FRH. On reaching there, we came to know that the sub-divisional forest officer of the division was also camping in the suite next to our suite.

### 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



**Figure 4: A view of the lake from Kitchmoli Hill, showing the FRH and other government buildings. At the mouth of the lake, the silt deposit lake. (Photo: Author 1968).**



**Figure 5: A view of the Gohna lake from the base of Kitchmoli hill showing in the back drop the famous Kuari pass on top and of the Mt. Trisul. (Photo: Athor, 1968)**

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 that we saw 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 short time. 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 the resting day. In the morning, the forest officer came to us to bid us goodbye as he was proceeding to some other place. The whole day, we changed our herbarium specimen and completed our field notes and the field book. In the evening, I was sitting in the bungalow compound when I saw a retired army sepoy who was standing on the edge of the compound and was 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, had brought a 0.22 rifle and loaded it with a high-velocity English cartridge and stepped 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 and told 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 came near the duck, it did not show any 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 the next day he would try to get some trout fish for him from the lake.

### The Trout in Gohna and its Introduction in Gohna and other places in Kumaon

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 at about 3.00 PM to FRH. After taking tea then, 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 from eight to twelve inches in size. 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 two trout for us. 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 very tasty.

### Trout Fishery in Gohna Lake

The trout are cold-water fish and native to countries like North America, Europe, and Northern Asia. The introduction of trout in India was initiated by the Duke of Bedford, England, and Mr. Frank Mitchell actually brought it into action by introducing the 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) has given the first official account from the official files 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, Garhwal, introduced trout in the year 1917-18. These flourished very well in the lake so much so that it became a fishing lake for the Britishers and others who so ever visited the Gohna Lake. Further, introduction of trout in Kashmir and to other parts of Himalayas in India is well discussed by Howell(1916). and Mitchell,(1918). Britishers use to visit Lake Gohna for trout fishing, boating and swimming. **Fig. (6).**

**Percy Wyndham I, C.S.:** It is worth mentioning here about Percy Wyndham, who introduced trout in Lake Gohna and in other lakes and rivers in Kumaon but also did developmental work in district Mirzapur, from where he had come. He was one of the most popular British administrators in the annals of Mirzapur and Kumaon. He initiated developmental work wherever he was posted. He joined as a Deputy Commissioner at Mirzapur and remained from the year 1901-1912. At Mirzapur, a waterfall was developed by him into a picnic spot, which became famous as a tourist centre and was named 'Wyndham Falls'. He developed a historical tourist place that was called by his name, 'Wyndhamganj. He was very famous among the public of Mirzapur and people



**Figure 6:** A British guy, Gordon Summers, visited the lake in the year 1946. He is posing with his catch of trout at Lake Gohna. Trout are the cold-water fish native to North America, Europe, and Northern Asia and were introduced in India by the British. The trout of Gohna Lake were rainbow-coloured with a striking and shining golden circled spotted row, which I cannot forget. Its taste was unforgettable, as it was very tasty. (Photo – by courtesy of Peter Summer, son of Mr Gordon Summers, who was born in Nainital and sent me this photograph from Midland Derbyshire, England)

liked him very much. He had spent most of his career hunting in Mirzapur district and had killed about 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 Kumaon Division and sent to Nainital for another 12 years. Fig.(7).



**Figure 7: Percy Wyndham, Commissioner of Kumaon, who introduced trout in the year 1917-1918 in the Gohna Lake and other lakes and rivers in Kumaon. ( From author's family album)**

In the year 1922, he came in 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, then 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).

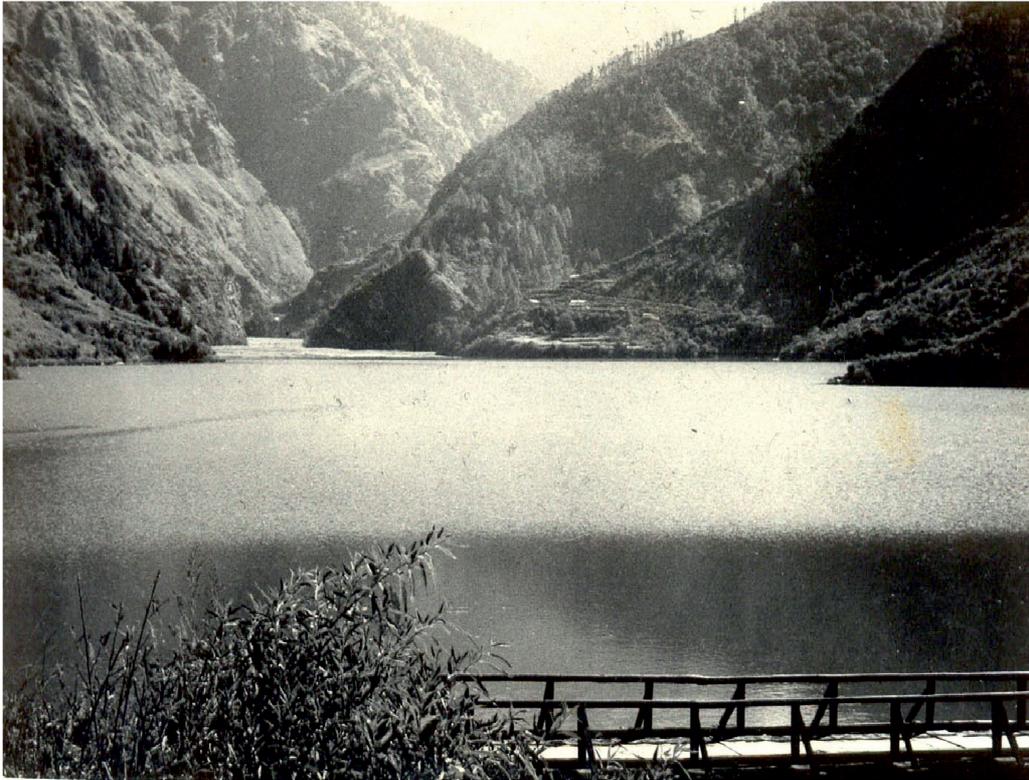


Figure 8: A view of the Gohna Lake from the entrance, a wooden bridge had existed over the outlet of the lake water, to reach Durmi village and the Forest Rest House. (Photo: Author, 1968)

### 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. (Fig. 8 & 9). We reached Birehi in the evening, and the night we spent at the Forest Log Cabin, which was also swept away with the lake water after two years.

In the British period, the Britishers used to come for a picnic at Gohna tal. A Gohna lake photograph taken by Gordon Summers, a Britisher living at Nainital, came here for trout fishing in the year 1946. Fig. (10).



Figure 9: Another view of the lake from the end of the wooden bridge, with the branches of a pine tree. (Photo: Author 1968)



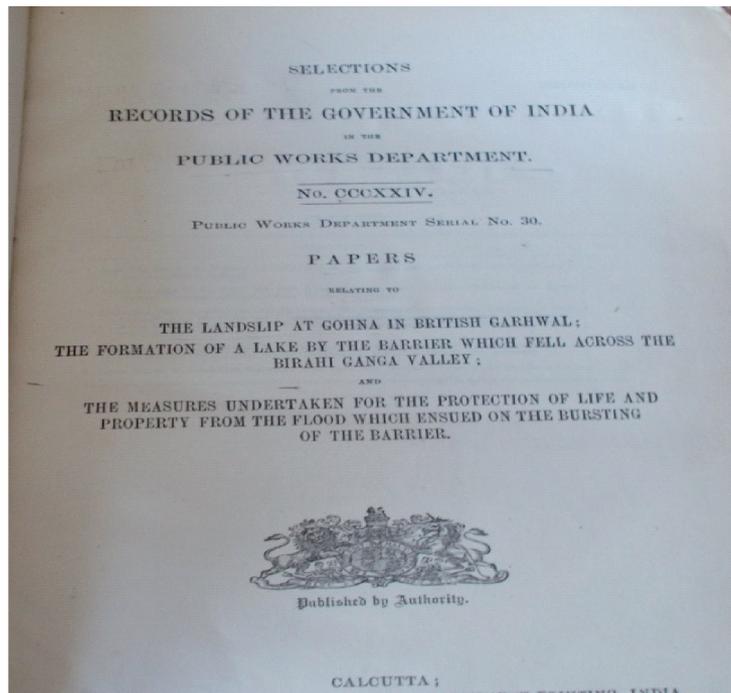
Fig. 10 : A Gohna lake photograph taken by Gordon Summers. A Britisher living at Nainital, in the year 1946. Here the FRH in front is quite clearly seen

### The Bursting of Gohna Lake in 1970

In the year 1970, just two years after the author's visit to the lake, when the author was in Lucknow, one fine morning, the author read the news that due to heavy rains, the lake had burst and completely washed away. The author could not believe that such a huge lake could vanish. Then the author started collecting material about the lake's history and its origin, etc., and published an article about his visit to the lake (Shah, 1971 & 2014). Side by side, the author was busy collecting the devastation caused by the bursting of the lake from the newspapers and, side by side, tracing the history of the lake.

### The past history of the formation of the lake in 1893

A report the author found in the Secretariat library of government U.P., which was entitled 'A Narrative Report on the Gohna Lake and Flood' by **R.R. Pulford, Crookshank**



**Figure 11: T.H. Holland Report on sale in website which includes papers relating to the landslip at Gohna in British Garhwal, the formation of a lake by the barrier which fell across the Birahi Ganga valley and the measures undertaken for the protection of life and property from the flood which ensued on the bursting is on sale in the website \$ 27.98. Published by Calcutta : Office of the Supt. of Govt. Printing 1896, Calcutta, 1896**

and T.H.Holland. in Nov. 1894). he noted the contents. Later on, the whole library was gutted in a fire along with all the books and reports. This report was well published in a number of journals in 1894 and 1896. Later, T.H.Holland from Calcutta published a report in which he had reported the complete story of the lake Gohna. **Fig.(11)**.

Before September 21, 1893, the Birehi used to flow freely in this open valley (as it is seen presently in **Figs 18 & 19**). On September 21, 1893, a portion of Hariadeep hill broke with a thunderous noise and an enormous dust cloud was formed, which was spreading slowly, and people witnessed that the right wing of Hariadeep (massive rock) had fallen, where existed the cowsheds and agricultural fields of Durmi villagers. (**Fig. 12**). The storm of dust lasted for 3 days, and even the sun was not visible. It is stated that this cloud of dust reached up to 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 until August 24, 1894, a vast dam of about 4 km. long and a maximum breadth of 0.7 km existed. 300 m high and about 150 m deep was formed.



**Figure 12:** On 23<sup>rd</sup> August 1894 the massive steep rocks and big stones came rolling down, from the Maithana or Haria Deep hill and which blocked the river Birehi to form a dam. (The Album in the website).

The river Birehi used to flow freely in Gohna or Durmi village, as the river is now flowing (see Figs.21 &22). All of a sudden, the Haria Deep hill, as shown in photos with scars (Figs. 10 & 22), had broken and fallen on the flowing Birehi River. This happened on 21<sup>st</sup> Sept.1893. The Patwari of the village Gohna, rushed to Chamoli at that time, the district HQ and met the Deputy Commissioner and stated that a mountain had fallen. The DC took it in lightly and ignored this missive as an exaggeration, thinking how a mountain could 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 fall, the river Birehi water could not flow and a dam was being formed naturally underway and day by day increasing. As a follow-up, an Army engineer, Lieut.-Colonel R. R. Pulford, Resident Engineer, Superintending Engineer of the Lucknow Circle, assisted by Mr. Joseph, Divisional Engineer of Kumaon, and by Mr. Wildeblood, Dietriot 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 there would be a huge flood in the valley of the Alakhnanda.



**Figure 21: 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)**



**Figure 22: Another view of the washed away lake of Gohna in 2006 from Durmi village, in the backdrop seen the Haria Deep hill, showing the scars of the 1893 rockfall prominently. (Photo by James Champion, grandson of Sir Harry George Champion (17 August 1891 – 20 June 1979) was a forest officer in British India who created a classification of the forest types of India and Burma. (<http://www.the-south-asian.com/April-June-2008/web-Gohna>)**

Subsequently, T.H. Holland, a geologist of the Geological Survey of India, Calcutta, arriving on 2<sup>nd</sup> March 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, which was published in the July 5<sup>th</sup>, 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 1909), (Pulford et al. (1894), (Anonymous, 1894). Later, T.H.Holland the Geologist, published a report on whole incidents of Gohna Lake, which is still now on sale. Fig. (11.)

There were sharp differences of opinion about what the consequences would actually be if the dam were to burst and what measures should be taken to save the property and lives from the floodwater that would come after the bursting of the so-formed huge dam. But Col. Pulford’s recommendations were paid heed to and another assistant engineer from the army, Lt Crookshank, was placed at Gohna Lake to keep a vigil on the lake and to warn when expecting anything untoward to take place through the telegraphic line, which started on 12th April, 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. The lakes day-to-day condition was being recorded through photographs by Crookshank and his photographer, Rahim Khan (Figs. 12, 13, 14, 15,16, 17, 18 & 19)



Figure 13: The big stones and rubble are also seen on the right bank of the river Birehi, which came down rolling with such a speed that it reached the right bank of the river and played an important role in blocking the river and forming a dam. (The album on the website)



Figure 14: The photograph of the lake taken on 23rd August, 1894 showing the eastern side with a massive lake-water, a day before the bursting of the lake. (The album on the website)



Figure 15: In 1894, Lt. Crookshank was in charge of sending day-to-day warning- reports by telegram to the authorities at Chamoli to inform about the bursting of the lake, the photograph was taken on 25th August 1894. and at midnight, the lake broke the barrier.  
(The album on the website)



Figure 16: On 25<sup>th</sup> midnight the lake busted and released water with great force. This photograph was taken on 26th August' 1894, on lower reaches when the flood water was still draining out with force. (The album on the website)



**Figure 17:** A photograph taken after the bursting of the lake Showing the receding marks of the lake on the Kitchmoli hill, on the right bank (North) of the lake. (The album on the website)



**Figure 18:** A photograph taken in Sept. 1894, when everything was normal and a new lake was born in which a Mrs Crookshen as lady is seen on a boat. near the east end of the lake (the album on the website)



**Figure 19:** A view of the lake in 1894, when lake water completely receded and a lake was formed. A good number of houses of Durmi village with fields are visible and the in the west Maithana or Haria Deep hill with prominent big white portion of rock fall are Seen. (From the website)

**The Management and Precaution 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 war footings. The precautionary measures as suggested by Eng. 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:

- (i) **Shifting of engineers & photographers to Durmi or Gohna village:** Lt. Crookshank, an Assistant Engineer from the army, along with Eng. T.H. Holland, Geologist, of the Indian Geological Survey, Calcutta, was sent to Durmi village to keep watch on 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 and a day-to-day report was sent to Chamoli and an alarm was sounded when it was about to overflow. Out of 50 photographs, only 7 were available on websites which have been used in the present article.
- (ii) **Laying of temporary telegraph line for sending quick messages:** A temporary telegraph line was also installed from village Durmi up to Chamoli under the

supervision of Lt. Crookshank for sending quick messages. It started on 12<sup>th</sup> April 1994 from the village of Gohna.

- (iii) **Information was given to the village people:** 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 commanding places if the flood comes at night to warn people along the valley that the catastrophe has begun. All the villages by the sides of Birehi, Alakhnanda and Ganga were evacuated.
- (iv) **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 reached.
- (v) **Masonry or signal pillars erection:** Signal pillars or masonry pillars at a distance of two miles of the size of 4 ft x 4 ft x 6 ft were erected above 200 ft above the high flood mark throughout the valley. Showing that below the pillars is a danger zone and to keep the people and cattle away as the telegraphic message reached from Gohna.
- (vi) **Suspension bridges were removed:** All suspension bridges below Gohna over the river Alakhnanda up to Lakshman Jhula over the Ganga, a bridge, were removed gradually and in their place, a temporary manila-rope bridge was installed. Lakshman Jhula is a famous suspension bridge across the river Ganges. It has been now closed since 2020. Lakshman Jhula was built by the East India Company (Wikipedia).
- (vii) **The danger limits were marked:** 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.

- (viii) **The pilgrim routes were diverted:** The pilgrim routes for holy shrines like Badrinath & Kedarnath fall on river sides and were diverted from danger zones, especially from Byasghat to Rudraprayag and Gopeshwar to Haat, etc.
- (ix) **Safety huts at higher points:** A number of huts were made at higher points for the safety of the officials.

Further, according to the Imperial Gazetteer, **Anonymous (1909)**, “In December, 1893, the area of the lake was about one square mile and its depth 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 the 22nd of August 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 of 25-26 August. 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 3,900 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.

### **The 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**).

### **A lake was formed and washed away after 76 years**

At Hardwar, the head works 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 till 20 July 1970, when another Alakhnanda flood was instrumental in draining the rest of the waters of the lake. Today the bed turned into a field with a stream flowing like a streak with sand, rubbles and stones and a grass very much favoured by village boys to play cricket and the tourists to fix their camps.

### **A new lake in place of a small river was formed and named the Gohna Lake**

When the people of Durmi village awoke on August 26, they saw the fallen level of the lake, and what they saw after that catastrophe was a lake about 3.2 km. long, 0.7 km. wide, and 120 meters deep, which stood with them for another 76 years from 1894 to 1970. This was known as Gohna Lake, which has been described earlier.

### **Visit of the two geologists of repute, Albert Heim and August Ganseer**

Albert Heim and August Ganseer, the Swedish geologist, visited the Birehi valley in the year 1937, exactly 46 years after the incident was in the valley, to work on the geology. They wrote two books, one as a travelogue in which they had given a beautiful account of the places they visited in Kumaon supported by nice photographs and also gave a botanical account of the region. Dr. E. Schmid of the University of Zurich had identified the plants and the plants are lodged in the herbarium of Zurich University. 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, 1939 b.*). In 1964, Gansser revised his book, *Geology of the Himalayas*, which summarised the geologic knowledge of the Himalaya drawn from the works published from 1851 through 1962. **Fig. (20).**

### **Fallstruz Lake**

According to **Heim (1939 a.)** 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 rock-fall 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 lived for a hundred years or more, but due to the pressure of bursting a blockage in the upper reaches, which had rushed with very high speed, pressure, and weight of water, it was wiped off.

### **The lake burst in 1970 and the loss of human lives and property**

In the year 1970, during the rainy season, there was a heavy rainfall in the upper reaches of Chamoli, i.e., about 24 inches in two days. All the tributaries of Alakhnanda were swollen, and there were a number of landslides causing blockages in these. There were two disastrous incidents that occurred simultaneously, one in July 2020 at

Belakuchi and the other at Gwaldom-Kuari Road at Jhingi Patan, on the river Birehi (Shah, 1971).

### **The Belakuchi disaster**

On July 20, due to very heavy rains all over the upper reaches of district Chamoli and all the tributaries of Alakhnanda, mainly Patalganga, a blockage was formed at Ringi village, and a lake was formed one mile ahead of Belakuchi. The blockage gave way at 7 p.m. on July 20th, resulting in a quick rise in the level of the river Alakhnanda. The water in Alakhnanda rose up to 15 meters above the river bed. 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 the vehicles but also a few bridges were swept away. It is recorded that 29 vehicles (17 tourist buses, 6 trucks, two military trucks, and 6 taxis) along with 600 passengers were all of a sudden washed away only at Belakuchi, which is known as the 'Belakuchi disaster.'

### **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 the first day it filled up the lake Gohna. On July 20, Shri N.D. Tewari, then the finance minister to the Govt. of India, flew over Gohna Lake in a helicopter and described the lake as looking like a vast ocean and only the tops of the surrounding hills were seen. 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 at village 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) and the past and recent flood caused in Alakhnanda are well covered by Rana, et al (2013).

### **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 6 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 19th July 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 T.H.Holland, in 1894, in Journal of Geological Survey of India ; Gen. R. Strachey (1894) in Geographical Journal; Glass ( 1896) in Journal of Society of Arts (London) and Guy Lubbock( 1894) in Geographical Journal., It is to add heret; Frizell (1906; Howell (1916) Barrows (1948) Gupta(1974) also discussed the catastrophe of lake Gohna.

### **Now, After Seventy-Six Years**

In place of a big lake, the bed has been filled with small or big boulders and mud. The area of the lake is now a pastoral expanse full of grass, crisscrossed with pretty small streams. The beautiful Birehi Ganga continues to flow in the valley, dominating the landscape. A suspension bridge had been erected across the river just opposite Durmi (Gohna) village. A natural, serene, and beautiful lake of 3.2 km. in length, 0.7 km. wide, and 120 meters deep, full of trout fish, with the facility of boating, which had remained with the people of Durmi village for 76 years, was lost forever to make a geographical history.

### **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 bank of the river for ages and they might 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.

### **Discussion & Conclusion**

The article gives a vivid description of Gohna Lake when it existed in the form of an author's travelogue in the year 1968 and in the year 1970, it was 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 by Osmaston, the District Forest Officer.Kumaon. Not only this, but this lake was used as a fishery for all the lakes and rivers of Kumaon. This article describes the lake and its surroundings with the rare photographs taken by the author. Apart from these, a complete history of the lake from its formation from a petty river in the year 1893 into to a dam existing for a year or so and the catastrophe known as the Gohna floods without a loss of a human life and a meagre public property harm and loss. The only loss to existing British governments due to well-conceived

precaution was in managing the catastrophe in the best way ever. A beautiful and serene lake was left, which existed up to 1970. Albert Heim and August Ganseer, the Swedish geologist, the famous geologist of the world visited the Birehi valley in the year 1937, exactly 46 years after the incident was in the valley, to work on the geology and it is important the correct facts should be known. No doubt, the details are given quoting the authorities who took part in this but the best one is given by Pulford et al. (1894), Walton (1910) 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 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 this Gohna Lake is also included.

The past and the present catastrophes in the Birehi valley were so important that they covered the news in all the important international journals, including *Nature*, the foremost journal. The year of the 1970 incident was so important that geologists ran to India and visited the valley to study the site of the Gohna Lake site and visited the Birehi valley to study. Though significant events of landslide damming have been recorded since the 19<sup>th</sup> century, the most notable being the breach of Gohna Lake in 1970, which had long-term impacts. The old photographs of the lake from the 17th century have been collected from Website and these have been captioned by the author, as he knew the incidents from the past Pulford et al. report. The 18th-century photographs taken in 1968 by the author and two of a British person, Mr Summers, taken in 1946 are the only available photographs of the lake and have become a history, as these are the only existing photographs of Gohna lake in its youth.

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