The Himalayan aquatic ecosystem flourishes with a diversified fauna and flora. The Himalayan Rivers have an important place in Indian culture and tradition. They are the lifeline of majority of population in cities, towns and villages and are considered sacred. The mountain streams or rivers composed of a number of auxiliaries, which linked to one another and form the great morphological sequence of fluvial environment where each river system always conform to such a series of adjacent channels separated by landscape.

**Western Ramganga River** of Kumaun Himalaya is the subject matter of the present study considered as the border between Kumaun and Garhwal region of Uttarakhand, India.

**Kumaun region**-

Kumaun region is located in the central Himalayan zone in the Uttarakhand state of India. It is a picturesque place and summons tourists worldwide to its alluring opulence of natural beauty. This place offers a panoramic view of Himalayan Mountain. It is famous for its rich cultural heritage, unique handicraft, splendid cuisines and magnificent wild life. Adding to the beauty of this region mesmerizing rivers, their tributaries and streams drains through the area into the Ganga River via, the snowcapped mountains down to the plains of the Tarai.

Prime drainage systems of the region are characterized by two broad system of mighty Ganges Maha Kali and Western Ramganga. Among these three Maha Kali is snow fed and drain considerable snow melt from the glaciers in North-East and North-West of greater Himalaya whereas Western Ramganga is a spring fed river it receives number of springs and streams in the central and south central part of Kumaun in lesser Himalaya.
or Siwalik regions. Maha Kali and Western Ramganga includes important tributaries like Goriganga, Dhauli Ganga, Ramganga (East), Saryu, Ladhiya, Panar and Kosi etc.

Kosi major tributary of Ramganga West originates on the Southern slope of the Bhatkot-Kausani range (2,715m) dividing the Kali and the Western Ramganga systems. In addition, other streams from the Siwalik ranges having drainage from west to east join Western Ramganga River system in Tarai zone. Among the Siwalik streams, the Dabka, the Baur, the Bhakra, the Gaula and the Nandhaur are important. The extremely porous permeable nature of the Sarju, the Kosi and the Gaula river beds precludes surface drainage during dry weather, so that large number of them look like almost dry gulches. Khoh, Kolhu and Mandal are other important tributaries of the Western Ramganga River.

**Origin**

The Western Ramganga River originated in the Southern slopes of the lesser Himalaya, Dudhatoli (3,110 amsl) ranges in the District of Pauri Garhwal, Uttrakhand state of India. It is tributary of the holy Ganga River, originates from the high altitude zone of 800-900 m.

**Course of the River**

The Western Ramganga emanating from the Southern slopes of lesser Himalayan Dudhatoli mountain 3,110 m above sea level in Garhwal and after flowing in northeast direction it enters Almora through a gorge at G iarwar and after taking a South-Westerly course, it becomes a major river downstream. Ramganga goes through various places. It consolidates many places into one. The main location that it goes through are Gairsen, Taal, Chaukhutiya, Bhagoti, Masi, Bhikyasen etc., these places come under Kumaun region. The river enters Almora District and joins Binav and Gagas Rivers. The Kosi divides the Kali and Western Ramganga system and after joining the Suyal River in South of Almora leaves Kumaun to join Ramganga at Ramnagar of Nainital District. River expands from Gairsen to Kalagarh dam- Nainital plains. The river traverses near about 158 km
before it meets the reservoir and continuous to downstream for about 322 km before joining river Ganga at Kannauj of Uttar Pradesh. Bareilly and Badaun city of Uttar Pradesh is situated near its banks.

**Location-**

The present study was carried out in 45 km stretch of Western Ramganga River at three sampling sites namely Gairsen, Chaukhutiya and Masi at Almora District of Uttarakhand. The study area, is located between 29° 36’ N latitude and 79° 30’ E longitude in the Western part of Central Himalaya. Major parts of this area represents a temperate zone, climatically and monsoon pattern of rain fall with dry summer and chill winter. The altitudinal gradient has profound effect on the climate of the area, like occasional rainfall in summer and snowfall during winters. Water quality is influenced by natural and anthropogenic effects including local climate, geology and irrigation practices. A major part of it is under forest. It drains the Central part of the Almora District and Western part of Nainital District and Udham Singh Nagar Districts of Uttarakhand.

**Description of sampling sites-**

**Gairsen (S1)-**

Gairsen very beautiful town lies on the border of Garhwal and Kumaun region at an altitude 1650mt above sea level. Gairsen is just 16km far away from the Almora District. The name Gairsen is derived from Garhwali language Gair means a specific village and Sain means plain. Gairsen is also the site of the origin of the River Ramganga West, the Dudhatoli Mountain from where the river rises. Gairsen is being mooted as the future summer capital of Uttarakhand because it is situated in hilly areas and also with the close proximity of both the regions. In addition, this place emerging as a tourist spot and offer breathtaking views of the snowy summits of Himalaya with peaceful holiday.

**Chaukhutiya (S2)-**

Chaukhutiya is very charming town in Almora District of Uttarakhand. It located at the bank of Western Ramganga River at an
altitude 1090mt above sea level. This picturesque place Chaukhutiya derived its name from a Kumauni word “Chau (four) Khut (feet). These four feet indicates four ways, first is towards Ramnagar, second towards Karnprayag, third towards Ranikhet and fourth towards Almora. Its religious significance and historical past can be seen basking in its glory in nearby places. Chandikhet, Dhudalia, Ganai, Bhatkot, Jhalla, Haat, digaut, Baskenia, Jukanauli, Gangholi, Dwarahat etc., are nearby places of Chaukhutiya. A very popularly known Agneri temple, dedicated to Hindu Goddess Kali is located in the bank of Ramganga River. Ashtami fair is every year organized at this temple. Many people witness huge numbers of animals (buffalo’s and goats) sacrifice here in Navratris.

Masi (S3)-

A small village Masi located in the bank of Western Ramganga River at an altitude about 1060mt above sea level on the way to Chaukhutiya at Almora District of Uttarakhand. The Shiva temple of Masi during Somanath fair attracts large number of pilgrims every year. Nearby attractive places includes Bhumia temple, Jaurasi, Lakhanpur temple etc. Naithna Devi temple devoted to goddess Durga, is 4kms far away from here.

Climate-

Western Ramganga River is situated at the foothills of the Kumaun Himalayas. This place is known for its salubrious climate and is surely a place with great weather with moderate rainfall. It experiences five seasons such as winter, spring, summer, monsoon and autumn in a year. Here in winter average temperature ranging from 12°C to 17°C. Winter is cold and chilly due to the low temperature. Sometimes snowfall may also occur during that season. Spring extends from March to April, experiences pleasant with fresh air and the blossom flowers of mustard in the fields. In addition, lush green trees of red Rhododendrons envelope the valley. Summer starting from May to June and having a temperature range of 24°C to 29°C, has hot days, cooler evenings and nights. Monsoon is
comparatively longer extending from July to August sometimes till September and major portion of the annual rainfall. Autumn extends from October to November and is characterized by chill nights with clear sky.

**Population**

The catchment area is sparsely populated. As per the survey of census by Indian Government during 2011 the total population of this District is about 622,506. This place is popularly known as a hill station and tourist spot. In addition, alluring beauty of this place attracts a large number of tourists every year.

**Cultivation**

The river receives plant debris, eroded soils, and some domestic wastes mainly from the catchment area and from the surrounding villages. However, the quantum of domestic wastes is substantial. Significant number of live-stocks like cows, oxen, horses, buffaloes, goats, poultry etc. are domesticated in these villages. Leaf-litter and organic manure derived from these animals is used as fertilizer in the surroundings. Recent use of chemical fertilizers such as urea has also increased in the catchment.

Farming of vegetables and fruits is the main cultivation. Mangoes, pears, peaches, apricots, plums, walnuts are some of the common fruits grown here. The bumper crops of this area are wheat and rice. In addition, seasonal crops like maize, gram, barley, local pulses, and vegetables like potatoes, cabbages, beans, peas, tomatoes etc., are also cultivated in the terraced fields. Intermittent sparse patchy terraced cultivation is also practiced on fairly steep hill slopes whereas dry and wet cultivation are prevalent on the uplands and low-lying valleys respectively.

**Vegetation in the catchment**

The catchment of river Western Ramganga is immensely rich with various plant species having remarkable diversity. The major plant species found in the catchment includes Sal (*Shorea robusta*), Chir/Pine (*Pinus roxburghii*), faliyal Oak (*Qurecus gloca*), Banj Oak (*Qurecus*...
leucotriochophora), Rhododendrons and Deodara (Cedrus deodara) etc. Generally, climatic variation, altitude ranges associated with the alignment determine the altitudinal growth and variety of vegetation. Thus, this study might also be important from altitudinal variation perspective.

**National Park in River Basin**

**Jim Corbett National Park**

Jim Corbett national park is located on the bank of the Western Ramganga River. Initially, in 1954-1955 this park was named Ramganga Park in honor of this river. Later changed to the Corbett national park. The Jim Corbett Tiger Reserve has been described by many as one of the most prolific eco-systems of the Indian sub-continent. Situated within Corbett tiger reserve’s 750 square miles, offers a captivating array of landscape and vegetation that offers sanctuary to an abundance of wildlife.

The great diversity of wildlife found in this region. The Western Ramganga River that enriches the heart of the Jim Corbett tiger reserve is home to river otters, Gharials, crocodiles, “River Monster Cat-fish” the Goonch said to be the only catfish in the world with teeth that grows to over 200 lbs in weight as well as the mystical king of the Asian rivers the Golden Himalayan Mahseer.

**Ramganga Dam and hydroelectric project**

The Ramganga River crosses the dam at Kalagarh. Kalagarh a famous hydroelectric dam has been constructed in 1963-1970 responsible for the obstruction of continuous natural flow of water in downstream. This barrage provide water supply for the Hydroelectric Project and also important for the irrigation purpose of nearby places. This dam generates 198 MV energy and also provide water for irrigation of 57,500 hectare farm land.

**Economic importance of Western Ramganga river**

As other rivers of the world, Western Ramganga River plays a key role in the socio-economic development of the area. Western Ramganga is a
prime drainage systems of the Kumaun region. In addition, the enchanting beauty of this place attracts a large number of tourists every year. River water is used for various purposes like drinking, swimming, bathing, irrigation, fish production, educational purposes. Besides that, river also act as depository of unique biodiversity.

Various factors such as constructional work, development of croplands and landslide during monsoon in the catchment affects the hydrological regime of the river. It was hypothesized that the water quality of the river might be deteriorating considerably. The current study was therefore aimed to revealing the changes in water quality and its effect on aquatic fauna and flora. This study will also serve as baseline information for future studies which may reveal the chronological changes in water quality of the river.
Fig. 2.1. A picture of Western Ramganga River.