Ishikari-gawa

Map of River

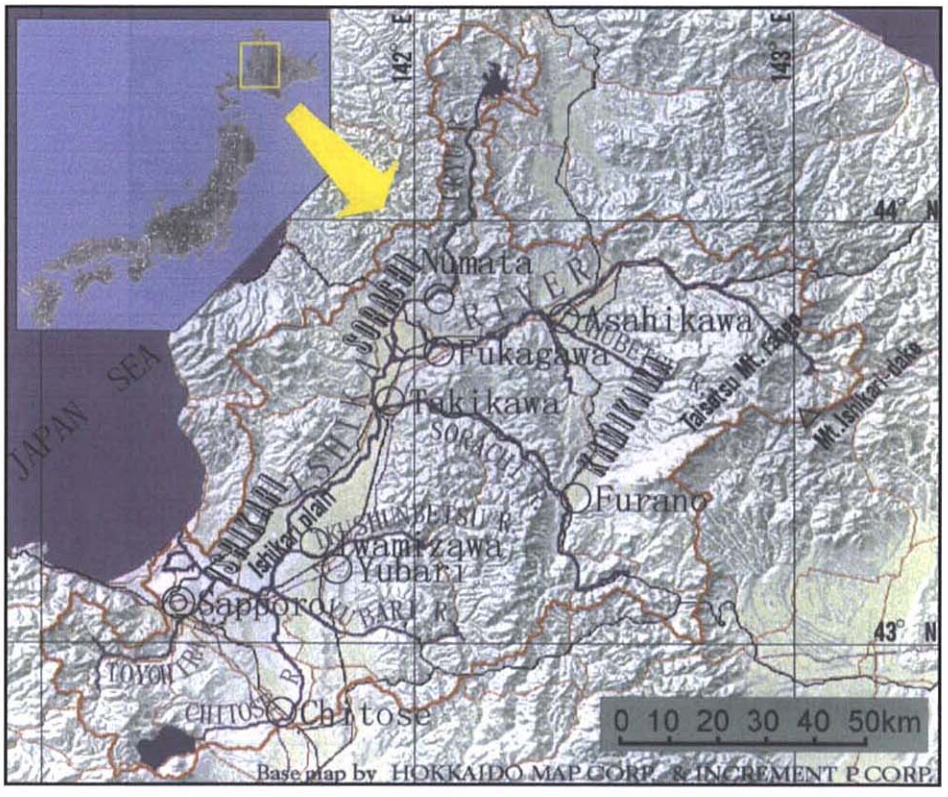
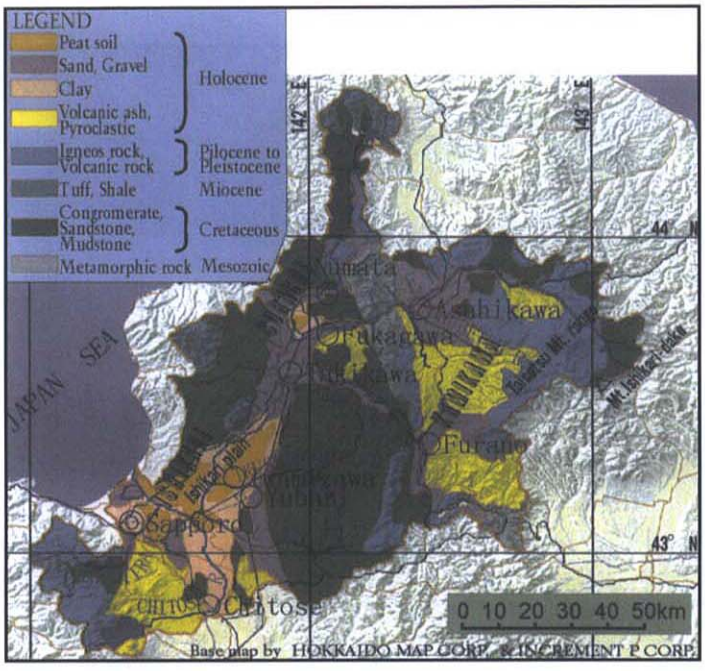


Table of Basic Data

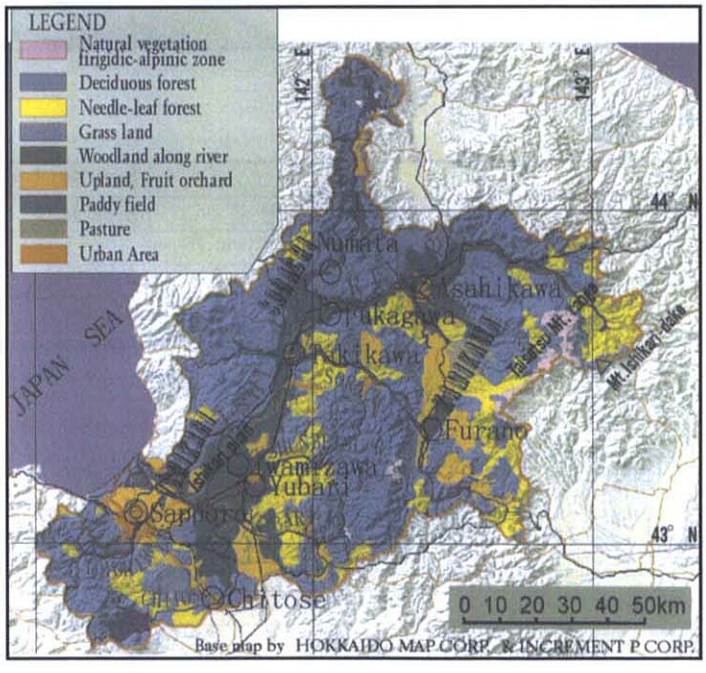
Name: Ishikari River		**Serial No.:** Japan-6
Location: Hokkaido, Japan	N 42° 40′ 30″ ~ 44° 28′ 30″	E 140° 59′ 55″ ~ 143° 10′ 50″
Area: 14,330 km^2	**Length of main stream:** 268 km	
Origin: Mt. Ishikari-dake (1,967 m)	**Highest point:** Mt. Asahi-dake (2,290 m)	
Outlet: Japan Sea	**Lowest point:** River mouth (0 m)	
Main geological features: Holocene (Gravel sand, Clay, Volcanic ash, Pyroclastic), Pliocene to Pleistocene (Igneous rock), Cretaceous (Conglomerate, Sandstone, Mudstone), Mesozoic (Metamorphic rock)		
Main tributaries: Toyohira River (898 km^2), Chitose River (1,244 km^2), Yubari River (1,463 km^2), Sorachi River (2,622 km^2), Uryu River (1,713 km^2), Chubetsu River (1,063 km^2)		
Main lakes: Lake Shikotsu, Lake Shumarinai		
Main reservoirs: Katsurazawa Reservoir (81.8x10^6 m^3, 1957), Kanayama Reservoir (130x10^6 m^3, 1967), Hoheikyo Reservoir (37.1x10^6 m^3, 1973), Taisetsu Reservoir (54.7x10^6 m^3, 1975), Izarigawa Reservoir (14.1x10^6 m^3, 1980), Jozankei Reservoir (78.6x10^6 m^3, 1990)		
Mean annual precipitation: 1,300 mm (1951~1980) (basin average)		
Mean annual runoff: 484.8 m^3/s at Ishikari-ohashi (12,697 km^2) (1960~1981)		
Population: 3,008,500 (1994)	**Main cities:** Sapporo, Asahikawa	
Land use: Forest (68.2%), Rice paddy (12.0%), Other agriculture (4.7%), Urban (2.3%) (1980)		

2. Geographical Information

2.1 Geological Map



2.2 Land Use Map



1. General Description

The Ishikari, 268 km long and draining an area of 14,330 km^2, is the largest river in Hokkaido. Originating from Mt. Ishikari-dake (1,967m above sea level) of the Taisetsu mountain range, the river first flows north-west through the narrow valley into the Kamikawa basin before turning south-west. Next it flows through a valley between Asahikawa and Fukagawa, and then into the Ishikari plain where it is joined by many tributaries. Near Ebetsu City the flow changes from south-west to north-west and finally to the Ishikari Bay of Japan sea.

The Ishikari River basin covers the central and western area of Hokkaido, and drains about 20 percent of the island. It flows through 48 municipalities with a total population of 3,008,500 (1994 census), about 52 percent of Hokkaido's total. Sapporo City, the thriving capital of Hokkaido and its center of government, economy, and culture, is located on the lower reaches of the river. Asahikawa, the second largest city in Hokkaido, is located in the upstream region.

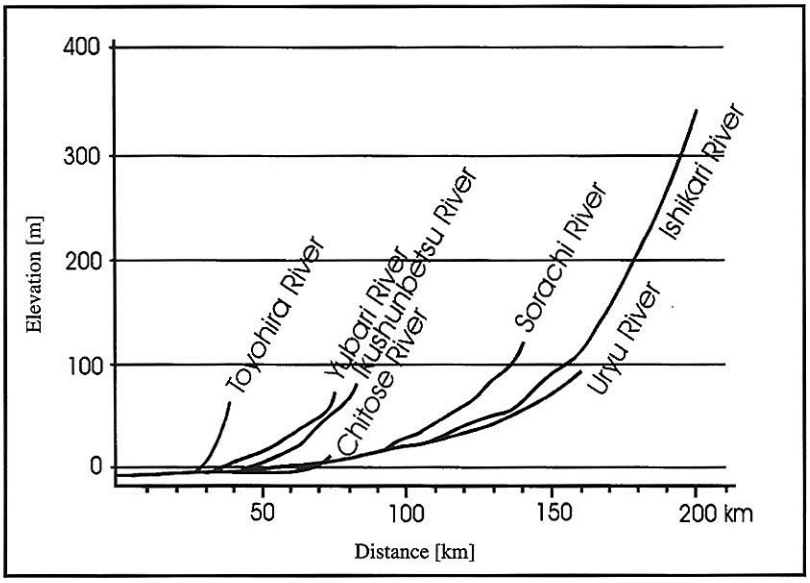
Kamikawa basin on the upper reaches of the river and the Ishikari plain around the central and lower regions are the most productive agricultural areas in Hokkaido. The Ishikari River is also an important breeding water for salmon. The tributary Chitose River is a principal breeding water where salmon hatcheries have been operating for many years.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km^2]	Highest peak [m] Lowest point [m]	Cities population (1994)	Land use [%] (1980)
1	**Ishikari** (Main river)	268 6,070	Mt. Asahidake 2,290 River mouth 0	Asahikawa City, etc. 762,900	A, O (4.7) F (68.2)
2	**Toyohira** (Tributary)	73 900	Mt. Yoichi 1,488 Sapporo 0	Sapporo City 1,753,200	L (12.8) P (12.0)
3	**Chitose** (Tributary)	108 1,240	Mt. Eniwa 1,320 Ebetsu 0	Chitose City, etc. 202,800	U (2.3)
4	**Yubari** (Tributary)	136 1,460	Mt. Yubari 1,668 Ebetsu 0	Yubari City, etc. 63,100	
5	**Ikushunbetsu** (Tributary)	56 330	Mt. Ikushunbetsu 1,063 Kita 0	Iwamizawa City, etc. 99,600	
6	**Sorachi** (Tributary)	173 2,620	Mt. Kamihorokamettoku 1,920 Sunagawa, 18	Furano City, etc. 104,300	
7	**Uryu** (Tributary)	177 1,710	Mt. Shokanbetsu 1,491 Uryu 27.5	Numata Town, etc. 22,600	

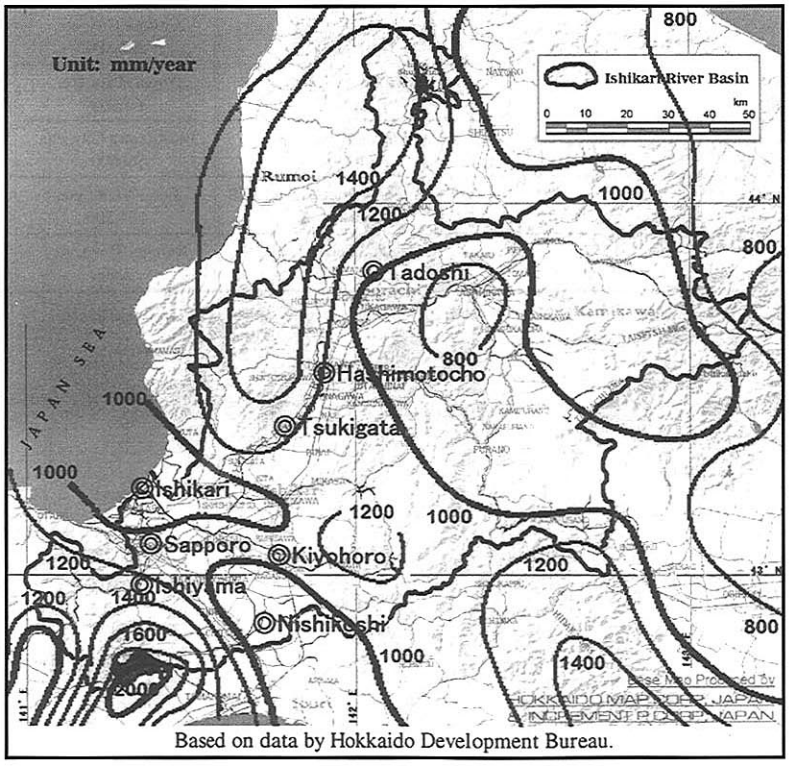
F: Forest L: Lake, River and Marsh P: Paddy field U: Urban O: Orchard A: Other Agricultural field (vegetable, grass)

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Observation Stations



Based on data by Hokkaido Development Bureau.

3.2 List of Meteorological Observation Stations

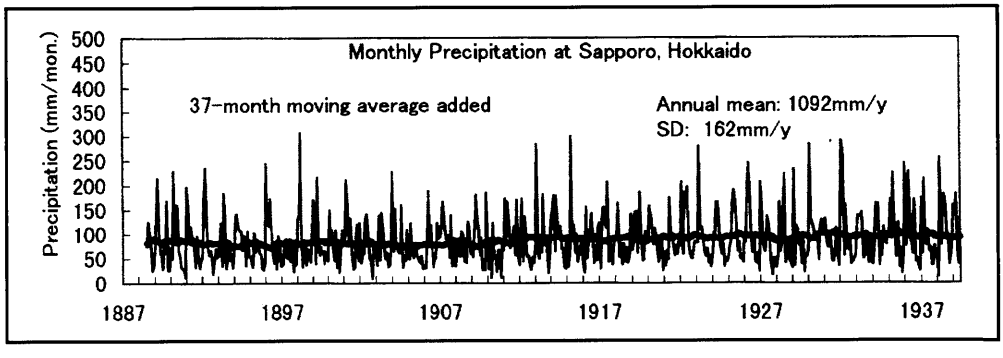
No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation [mm]	Observation items[1)]
1-04-05*	Hashimotocho	26.96	N 43° 33' 20" E 141° 53' 13"	1959~present	1,141(1959~1995)	P(TB)
1-04-11*	Tadoshi	60.49	N 43° 48' 21" E 142° 01' 00"	1955~present	1,376(1955~1995)	P(TB)
1-05-01*	Tsukigata	12.30	N 43° 19' 45" E 141° 41' 50"	1954~present	1,343(1954~1995)	P(TB)
1-05-05*	Ishikari	5.20	N 43° 14' 54" E 141° 20' 55"	1953~present	1,023(1953~1995)	P(TB)
1-05-17*	Kiyohoro	14.64	N 43° 05' 02" E 141° 41' 09"	1962~present	982(1962~1995)	P(TB)
1-05-24*	Nishikoshi	10.45	N 42° 50' 36" E 141° 40' 24"	1957~present	988(1957~1995)	P(TB)
1-05-41*	Ishiyama	109.91	N 42° 57' 41" E 141° 19' 37"	1956~present	1,185(1956~1995)	P(TB)
47412**	Sapporo	17.00	N 43° 03' 05" E 141° 19' 09"	1889~present	1,092(1889~1990)	P(TB),T,S

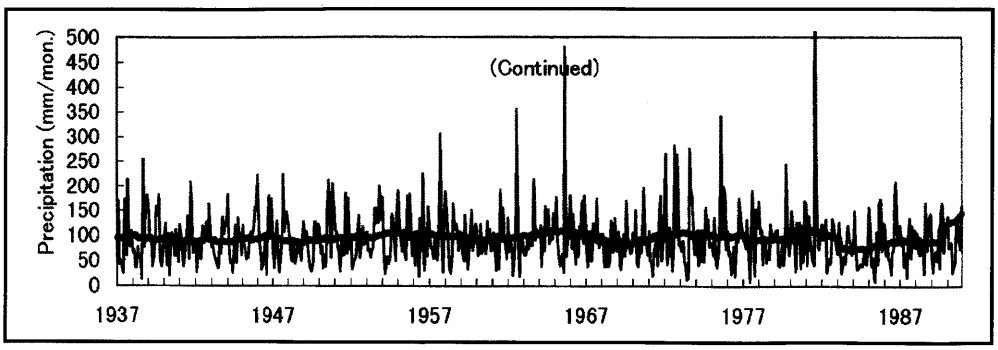
*: Serial number used by Hokkaido Development Bureau, Hokkaido Development Agency.
**: Meteorological Observatory, Japan Meteorological Agency (This number is used by the World Meteorological Organization)
1)P: Precipitation; T: Temperature; TB: Tipping bucket with recording chart; S: Solar radiation & Duration of sunshine

3.3 Monthly Climate Data

Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [C]	Sapporo	-4.6	-4.0	-0.1	6.4	12.0	16.1	20.2	21.7	17.2	10.8	4.3	-1.4	8.2	1961~1990
Precipitation [mm]	Sapporo	107.6	94.1	81.8	62.3	54.8	66.4	68.7	142.0	137.7	115.6	98.5	100.1	1,129.6	1961~1990
Solar radiation [MJ/m^2/d]	Sapporo	5.9	8.7	12.3	15.0	17.6	18.5	17.2	15.3	12.7	9.4	5.8	4.8	11.9	1961~1990
Duration of sunshine [hr]	Sapporo	99.3	111.8	158.6	183.4	202.0	192.1	179.1	168.9	167.3	156.0	100.3	85.8	1.804.6	1961~1990

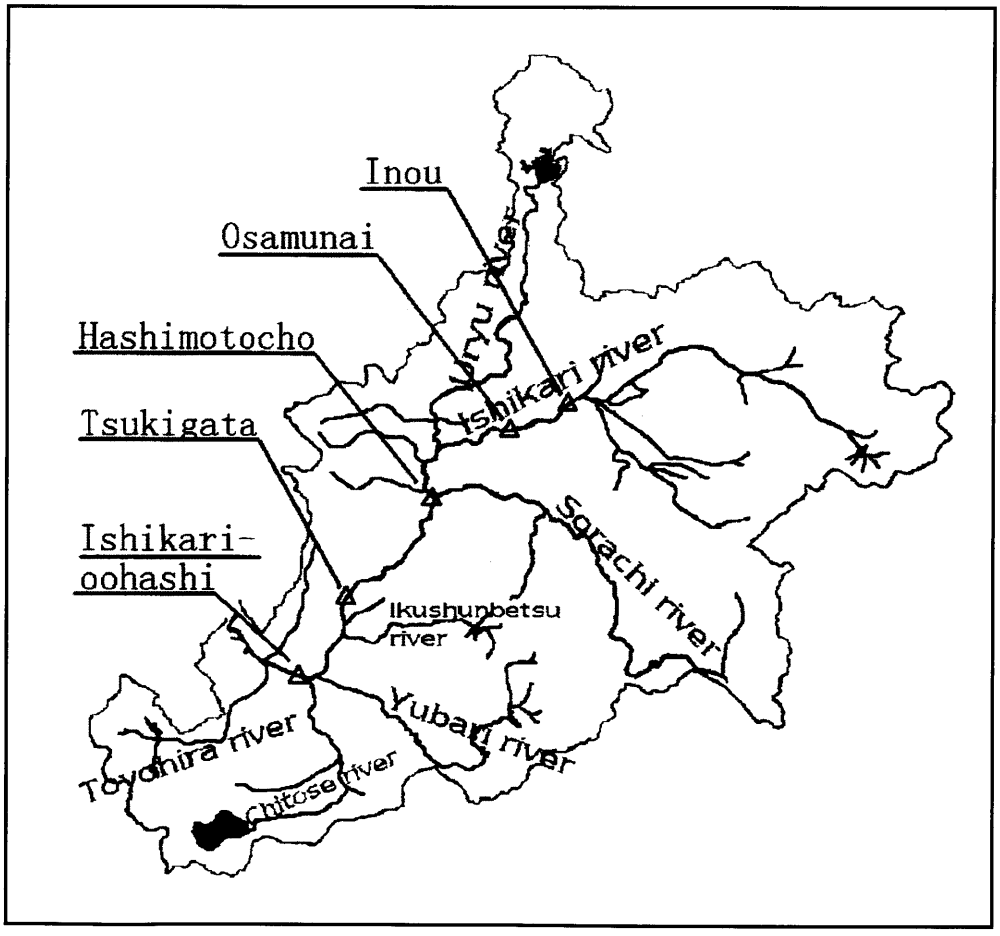
3.4 Long-term Variation of Monthly Precipitation





4. Hydrological Information

4.1 Map of Streamflow Observation Stations



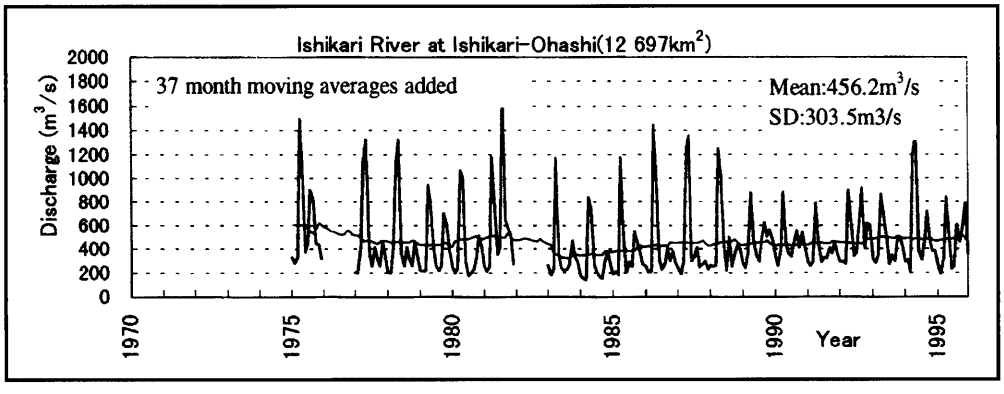
4.2 List of Hydrological Observation Stations (five main stations)

No.*	Station	Location	Catchment area (A) [km^2]	Observation period	Observation items [1] (frequency)
1-03-10	Inou	N 43° 45′ 38″ E 142° 16′ 44″	3,378.6	1899~present	H(h), WQ
1-04-01	Osamunai	N 43° 42′ 56″ E 142° 08′ 12″	3,558	1956~present	H(h)
1-04-06	Hashimotocho	N 43° 33′ 30″ E 141° 53′ 30″	5,711	1899~present	H(h)
1-05-01	Tsukigata	N 43° 19′ 48″ E 141° 41′ 36″	9,306	1901~present	H(h), WQ, SD
1-05-03	Ishikari-Ohashi	N 43° 07′ 11″ E 141° 32′ 44″	12,697	1932~present	H(h)

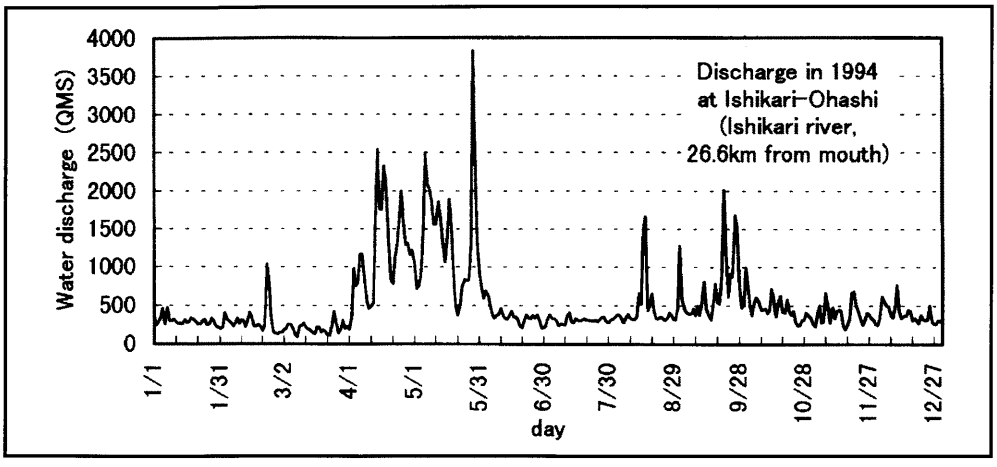
No.*	$\overline{Q}$ [2] [m^3/s]	Q max [3] [m^3/s]	$\overline{Q}$ max [4] [m^3/s]	$\overline{Q}$ min [5] [m^3/s]	$\overline{Q}$ / A [m^3/s/100km^2]	Q max / A [m^3/s/100km^2]	Period of statistics
1-03-10	93.38	4 025.32	1443.95	36.07	3.985	119.14	1951~1995
1-04-01	107.50	4 505.16	1533.05	33.67	4.12	126.62	1958~1995
1-04-06	141.12	5 730.26	2108.60	46.31	3.99	100.34	1961~1995
1-05-01	215.37	8 833.57	3180.88	63.05	3.74	121.75	1970~1995
1-05-03	314.79	11 329.96	3472.65	76.80	3.69	89.23	1962~1995

*: Serial number used by Hokkaido Development Bureau
1) H: Water Level; WQ: Water quality; SD: Snow depth
h: hourly
2) Mean annual discharge
3) Maximum discharge
4) Mean Annual maximum discharge
5) Mean Annual minimum discharge

4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features

The Ishikari River, unlike rivers in Honshu which flow from steep mountains through narrow plains into the sea, is characterised by meandering through the Ishikari Plain. Due to the meandering, the alluvial soil along the river has eroded during flooding, leading to changes in the river course. The meandering is especially severe in the areas below Fukagawa City as shown in the front map. After 1910, many of the river meanders were straightened to allow smooth flow. The Ishikarai, in its original course was the second longest river in Japan. In a period of about 100 years, the length of main stream has been shortened by about 75 km thereby making it the third longest in Japan.

Cut-off works in the river have been adopted for directing a smooth flow, preventing flood overflow, and for decreasing the ground water level of low damp ground. The middle and lower reaches of the river were divided into three parts, and cut-off works were executed from the lower to the middle parts. The work on the first and the largest cut-off in the downstream section began in 1918 and was completed in 1931. This shortened the river by 14.5 km. The next cut-off works changed 33.4 km of meandering river courses into 11.3 km of wide, straight channels.

Of the 24 areas designated for cut-off work, 16 were begun and 10 completed before 1945. The remaining eight were not even started by 1945 despite the plans. Along with the cut-off projects of main stream, larger tributaries such as the Yubari River (1922-1936), the Toyohira River (1932-1941) and the Ikushunbetsu River (1941-1961) were also straightened. The cut-offs succeeded in preventing floods in the plains, and the new channels were effective in lowering the ground water table.

The flood prevention projects outlined above had dramatic economic effects on farming in the low Ishikari plain, making more land available for sustained agriculture.

Effect of cut-off works and channel straightening (frequency of flooding)

Period	1899-1931 (33 years)			1932-1969 (35 years)			1970-1989 (20 years)		
Type of flood	Snowmelt	Low pressure / typhoon	Total	Snowmelt	Low pressure / typhoon	Total	Snowmelt	Low pressure / typhoon	Total
Number	18	6	24	10	7	17	1	2	3
Frequency per year	0.55	0.18	0.73	0.29	0.20	0.49	0.05	0.10	0.15

by Michio Hirano, 1992. Hokkaido Development Bureau

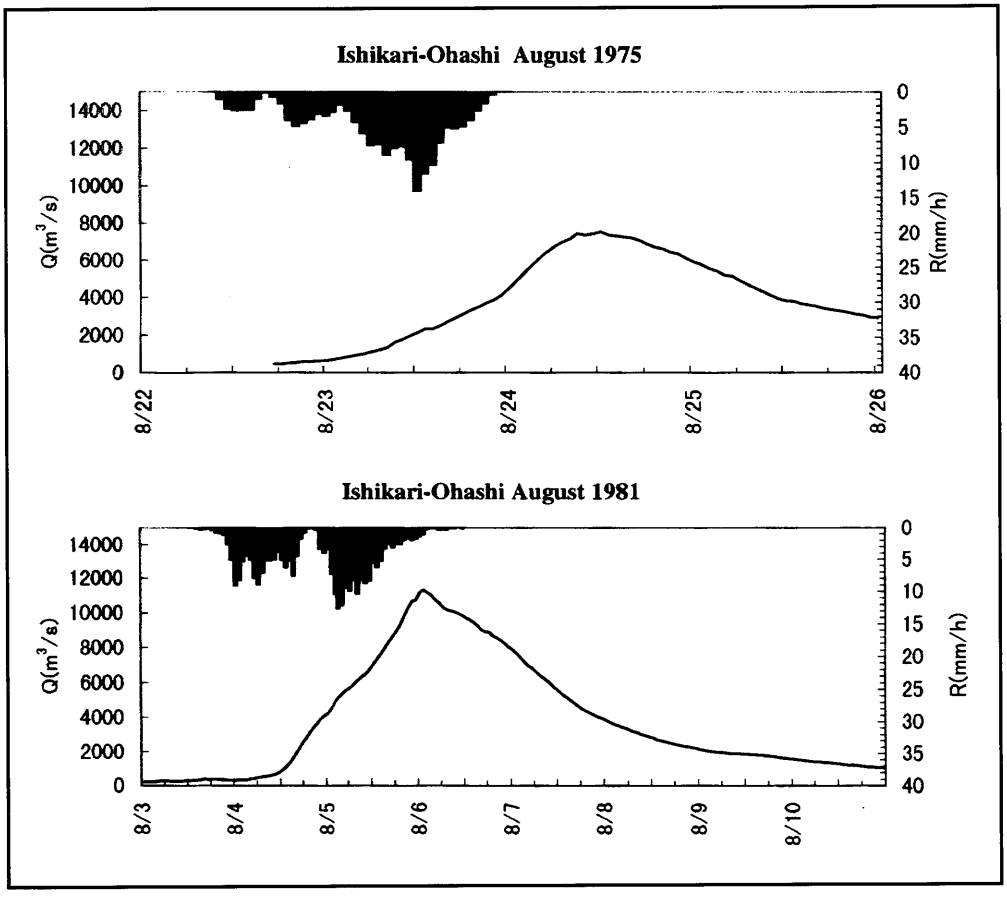
4.6 Annual Maximum and Minimum Discharges

At Ishikari-Ohashi [12,697 km²]

Year	Maximum [1]		Minimum [2]		Year	Maximum [1]		Minimum [2]	
	Date	[m³/s]	Month	[m³/s]		Date	[m³/s]	Month	[m³/s]
1975	8.24	7,533	11	128	**1985**	4.25	3,068	3	59
1976	4.16	1,988	7	96	**1986**	4.24	2,584	3	108
1977	4.17	3,871	3	70	**1987**	4.23	3,955	3	112
1978	5.02	2,958	10	110	**1988**	8.27	5,759	2	107
1979	10.20	3,139	7	58	**1989**	9.04	2,569	2	84
1980	4.07	2,668	7	59	**1990**	4.24	3,401	2	151
1981	8.06	11,330	3	38	**1991**	9.07	2,315	2	113
1982	12.01	2,526	7	91	**1992**	9.26	4,482	3	99
1983	4.16	2,306	7	122	**1993**	11.22	1,633	8	51
1984	4.29	1,673	7	112	**1994**	5.28	4,163	3	69

1), 2) Instantaneous observation by recording chart

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

5.1 General Description

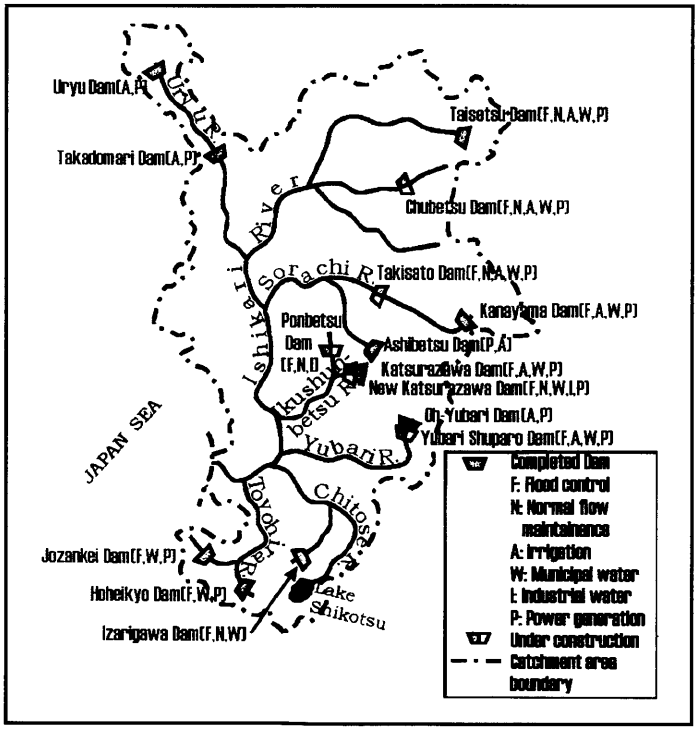
Before the Meiji era(1868-1912), the extensive plains along the Ishikari River were entirely covered with moors, and the water level in the river was too high to utilize the land. Only Ainu, the indigenous people of Hokkaido who had a natural style of living settled in places along the river. In 1868, the Government of Japan established a special unit named "Hokkaido Kaitakushi" empowered to start development of Hokkaido, but the wet marshy land which gets flooded every year made their task unenviable.

The first river improvement works were aimed at converting the moors into habitable land. Cut-off works and drainage works were implemented in the lower plains along the Ishikari River for about half a century. These works have changed vast marsh areas into arable land and made people settle. The second river improvement works were aimed at improving water utilization in the Ishikari River basin.

After the World War, the Government established the Hokkaidō Development Agency, following the enactment of the Hokkaido Development Law in 1950. A number of reservoirs have then been built in Hokkaido. In the Ishikari River System, the Katsurazawa dam on the Ikushunbetsu River was the first multi-purpose dam constructed by the Hokkaido Development Bureau, the local office of the Agency, under the River Integrated Development Program. The dam started in 1951 and completed in 1957, provides flood control, drinking water, irrigation water and power generation. With water demand rising as a result of development and improvement of living standards, other multi-purpose dams were built at reaches and tributaries in the Ishikari River as shown in the map below under this program.

At present a great deal of surface water is utilized for irrigation, municipal and industrial needs, power generation etc. The abstractions from the Ishikari River System in 1994 have been 530m^3/s for irrigation, 910 m^3/s for power generation, 30 m^3/s for industry, 17 m^3/s for city water and 6 m^3/s for other purposes. As the Ishikari plain is one of the great rice growing regions of Hokkaido, large amount of water is utilized for irrigation.

5.2 Map of Water Resource Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam (reservoir)	Catchment area [km^2]	Gross capacity [10^6m^3]	Effective capacity[10^6m^3]	Purpose [1)]	Year of completion
Ikushunbetsu	**Katsurazawa**	298.7	92.7	81.8	F,P,W,A	1957
Ashibetsu	**Ashibetsu**	147.5	1.6	0.2	P	1957
Sorachi	**Kanayama**	470.0	150.5	130.4	F,P,W,A	1967
Toyohira	**Hoheikyo**	159.0	47.1	37.1	F,P,W	1973
Ishikari	**Taisetsu**	291.6	66.0	54.7	F,P,W,N,A	1975
Izari	**Izarigawa**	113.3	15.3	14.1	F,W,N	1980
Otarunai	**Jozankei**	104.0	82.3	78.6	F,P,W	1990

1) A: Irrigation; F: Flood control, N: Maintenance of normal river flows, P: Power generation, W: Municipal water supply

5.4 Major Floods and Droughts

Major Floods at Ishikari-Ohashi [12,697 km^2]

Date	Peak discharge [m^3/s]	Rainfall [mm] Duration	Meteorological cause, (Districts affected)	Dead & missing	Major damages
1898 9.6 - 9.8	5,400 (presumption)	158 9.6 ~ 9.8	Low pressure (Kamikawa)	112	Houses inundated: 18,600 Area inundated: 1,500 km^2
1904 7.9 - 7.11	4,234	177 7.9 ~ 7.11	Low pressure (Ishikari, Sorachi)	NA	Houses inundated: NA Area inundated: 1,300 km^2
1922 8.23 - 8.25	NA	105 (Asahikawa) 8.23 ~ 8.25	Typhoon (Sorachi, Kamikawa)	NA	Houses inundated: 16,000 Area inundated: NA
1932 9.4 - 9.10	3,199	117 9.4 ~ 9.6	Low pressure (Sorachi, Ishikari)	9	Houses inundated: 18,100 Area inundated: 1,400 km^2
1947 8.14 - 8.16	NA	56 8.14 ~ 8.16	Low pressure (Kamikawa)	7	Houses inundated: 4,303 Area inundated: 214 km^2
1961 7.24 - 7.26	4,410	151 7.24 ~ 7.26	Low pressure (Sorachi, Ishikari)	11	Houses inundated: 23,300 Area inundated: 523 km^2
1962 8.2 - 8.6	4,568	203 (Sapporo) 8.1 ~ 8.3	Typhoon (Ishikari, Sorachi)	7	Houses inundated: 41,200 Area inundated: 661 km^2
1975 8.22 - 8.24	7,533	175 (Sapporo) 8.22~8.24	Typhoon (Ishikari, Sorachi, Kamikawa)	9	Houses inundated: 20,600 Area inundated: 292 km^2
1981 8.3 - 8.5	11,330	294 (Sapporo) 8.3~8.5	Typhoon (Ishikari, Sorachi)	2	Houses inundated: 22,500 Area inundated: 614 km^2
1981 8.21 - 8.23	4,332	229 (Sapporo) 8.21~8.23	Typhoon (Ishikari, Sorachi)	1	Houses inundated: 12,200 Area inundated: 57 km^2

NA: data not available

5.5 Groundwater and River Water Quality

River Water Quality [1] at Ishikari-Ohashi [2] in 1995

Date	Jan 19	Feb 15	Mar 3	Apr 28	May 17	Jun 14	Jul 19	Aug 23	Sep 20	Oct 18	Nov 15	Dec 13
pH	7.0	7.2	7.4	7.2	7.08	7.56	7.48	7.38	7.47	7.27	7.27	7.38
BOD [mg/l]	0.6	1.0	0.9	0.5	2.0	1.8	2.1	0.9	0.8	1.8	1.2	0.8
COD_{Mn} [mg/l]	3.7	3.6	3.7	6.2	5.8	5.5	7.9	6.2	3.3	6.8	7.2	3.9
SS [mg/l]	3	12	11	151	53	15	11	50	12	46	126	10
Coliform group [3] [MPN/100ml]	1.7×10^3	7.9×10^3	1.1×10^3	2.2×10^3	2.4×10^4	4.9×10^2	3.3×10^3	2.4×10^4	4.9×10^3	4.9×10^4	7.9×10^3	4.9×10^3
Discharge [4] [m^3/s]	160.37	125.33	64.93	1534.1	378.22	175.83	175.31	761.31	261.35	562.84	1,087.7	276.87

1) Observed once a month on a dry day normally several days after rainfall.
2) Located near Sapporo City, 27 km upstream from the river mouth.
3) Measurement method: BGLB (brilliant green lactose bile) culture MPN (most probable number) method.
4) Discharge on the water quality observation date.

6. Socio-cultural Characteristics

The Ishikari River basin is a newly developed area. Developments came mainly after the beginning of this century. Socio-cultural characteristics of the area therefore is seen as different from general Japanese traditions. Cold and snowy climate and rich natural environment also characterise the human life in this region.

Sapporo Snow Festival, for example, is a unique winter event which was originally programmed among people living in the city who wanted to enjoy and play outdoor activities in the snowy season rather than to endure the long and dark days as it was the common way of winter life previously. The festival has nowadays became a world famous event which attracts many tourists from abroad. The same style of snow structural functions have prevailed in many other cities in cold region of Japan.

Unlike narrow and steep rivers seen in other islands of Japan, the vast and flat area of the Ishikari Plain provides comfortable fields for sky sports such as flying light planes, gliding and sky-diving. The nature friendly environment of the river also provides the citizens with recreational amenities when they enjoy raft races, fishing, running and many physical activities. In winter the river front is also used for cross country skiing.

The Chitose River, one of the tributaries of the Ishikari River, is rich in anadromous fishery habitats. The Salmon Park, located at Chitose City, provides facilities for education, cultural activities, sightseeing and recreation. The center housing displays an integration of urban life in Hokkaido, history and social resources of the river. The Salmon Park centers around an Indian Water Wheel, which is a means of fishing used originally by native Americans. It has become a symbol of Chitose River, invigorating industry and tourism.

7. References, Databooks and Bibliography (In Japanese)

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