Monitoring Dataset on Waterbirds in the Qinghai Lake Basin (2019)

Zhang, N. N.[1,2,3]   Sun, J. Q.[4]   Wang, X. Y.[1,2,3]   Qi, D. S.[2,3,5]   Chen, K. L.[1,2,3*]
Yang, S. D.[4]   Wei, Q. C.[4]

1. College of Geography, Qinghai Normal University, Xining 810008, China;
2. Key Laboratory of Physical Geography and Environmental Process of Qinghai Province, Qinghai Normal University, Xining 810008, China;
3. Key Laboratory of Surface Process and Ecological Conservation of the Qinghai-Tibet Plateau, Ministry of Education, Xining 810008, China;
4. Qinghaihu National Natural Reserve, Forestry Administration of Qinghai Province, Xining 810007, China;
5. College of Life Sciences, Qinghai Normal University, Xining 810008, China

Abstract: The Qinghai Lake Basin is an important natural geographical area in the northeastern part of the Qinghai–Tibet Plateau and a crucial component of Qinghai Province's "Two Shields and Three Zones" ecological security pattern. The basin boasts rich biodiversity, serving as the gene pool for species on the Qinghai–Tibet Plateau and a typical area of the plateau's ecosystem. In 2019, waterbird monitoring was conducted at 27 sites and 33 points within the basin. This dataset included recording information such as habitat types at the waterbird sites, unified disturbance types, and the distribution of migratory waterbirds in different seasons. The dataset includes: (1) the time frequency of water birds monitoring, and an overview of the sampling sites (including the GIS data); (2) the composition and spatiotemporal distribution of various water bird species; (3) the dynamic changes in water bird population numbers; (4) the diverse distribution of water bird migrations in different seasons; (5) number of four major breeding water bird clusters during 2015-2019. The dataset is archived in .xlsx and .shp formats, and consists of 8 data files with data size of 60.9 KB (Compressed into one file with 51.6 KB).

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2024.04.01.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2024.04.01.V1.

1 Introduction

Biodiversity monitoring aims to provide information on the spatial and temporal changes in biodiversity, thereby assessing the effectiveness of ecological protection[1]. As top-level consumers in wetland ecosystems, birds cannot exist independently of lower trophic level organisms and the inorganic environment[2]. As a unique group of higher organisms existing in wetlands, waterbirds are important indicators for assessing changes in wetland quality[3, 4]. Waterbird monitoring, through predetermined spatial and temporal plans, records specific information on waterbird species, numbers, behavior, and habitats[5, 6].

   The Qinghai Lake Basin, located on the eastern edge of the Qinghai–Tibet Plateau, is an enclosed and independent basin that connects the eastern, western, and southern regions of Qinghai Province. It plays a crucial role in preventing eastward invasion by western deserts, and is an important part of the ecological security barrier of the Qinghai–Tibet Plateau[7, 8]. The Qinghai Lake National Nature Reserve is located at the intersection of the Central Asian and East Asian migratory routes for waterbirds, and boasts the largest wetland area in the country[9]. The dataset utilized in this study was derived from years of waterbird monitoring data collected by the Qinghai Lake Nature Reserve Administration Bureau[10]. The monitoring period spanned the period from March 2019 to February 2020, with a total of nine monitoring sessions. Through these monitoring efforts, data on the number, dynamics, distribution, and structure of waterbird populations were collected and compiled into the QinghaiLakeWaterfowl2019[11].

2 Metadata of the Dataset

The metadata of the Monitoring dataset on waterbirds in Qinghai Lake Basin (2019)[11] is summarized in Table 1. It includes the dataset full name, short name, authors, year of the dataset, data format, data size, data files, data publisher, and data sharing policy, etc.

3 Methods

In the waterbird monitoring work, the original sites and points were renumbered and renamed, and place-names were standardized according to administrative divisions. Ten habitat types were uniformly determined, and the methods for recording disturbance types and intensities were standardized. Based on the unique characteristics of waterbird distribution in Qinghai Lake, the area around the lake was divided into 27 waterbird monitoring sites, comprising a total of 33 monitoring points (Figure 1). Among these sites, the Shadao area included three monitoring points: Reed Lake, Sun Lake, and Crescent Lake. The Ganzihe Wetland comprised four monitoring points: Xiao Dalian, Cao Dalian, Orchid Lake, and the Ganzihe Estuary. The Buha Estuary area had two monitoring points: Buha Estuary and Buha River Bay. Based on the spatiotemporal distribution characteristics of waterbirds in Qinghai Lake (the habitat utilization), the habitats at the monitoring points were categorized into five types: migratory stopover sites, non-colonial breeding sites, wintering sites, foraging sites, and colonial breeding nesting sites. According to habitat types, they were divided into ten types: estuarine wetlands, swamp meadows, agricultural land, sub-lakes, freshwater lakes, river wetlands, lakeside salt marshes, river manzanita, peninsulas, and islands. According to the functional zoning of the reserve, they were divided into five types: core area, buffer area, experimental area, outside the reserve, and the junction of the experimental area and the reserve. Based on disturbance types and intensities,

they were classified into four types and three intensity levels: grazing, tourism, bird-watching photography, no disturbance, and weak, medium, and strong disturbance, respectively. The administrative divisions of the waterbird monitoring points were specified down to the township level.

Table 1   Metadata summary of the monitoring dataset on waterbirds in Qinghai Lake Basin (2019)

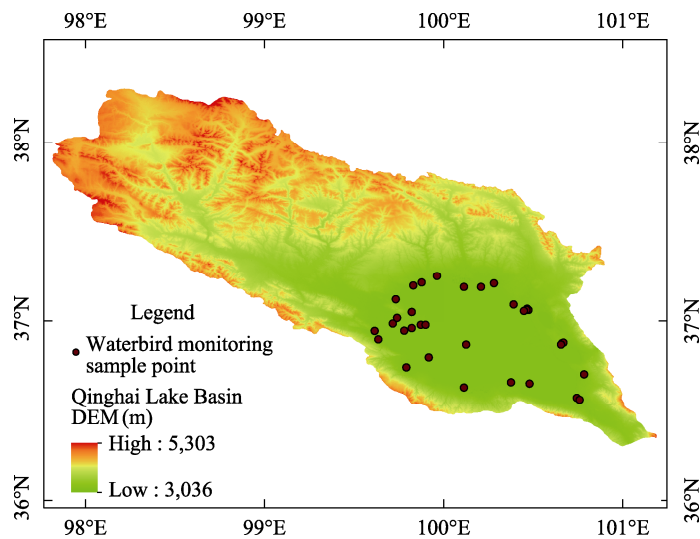| Item	Description
Dataset full name	Monitoring dataset on waterbirds in Qinghai Lake Basin (2019)
Dataset short name	QinghaiLakeWaterfowl2019
Authors	Zhang, N. N., Qinghai Normal University, zhangnana2021@yeah.net; Sun, J. Q., Qinghai Lake National Nature Reserve Administration, sunjq@163.com; Wang, X. Y., Qinghai Normal University, 245003744@qq.com; Qi, D. S., Qinghai Normal University, 2964694441@qq.com; Chen, K. L., Qinghai Normal University, ckl7813@163.com; Yang, S. D., Qinghai Lake National Nature Reserve Administration, 2402236852@qq.com Wei, Q. C., Qinghai Lake National Nature Reserve Administration, 350568066@qq.com
Geographical region	Qinghai Lake Basin
Year	March 2019 to February 2020
Data format	.shp, .xlsx
Data size	60.9 KB (51.6 KB after compression)
Data files	Overview of monitoring sites, composition of various waterbird species, spatiotemporal distribution, dynamic changes in waterbird populations, and diversity distribution of waterbirds in different periods. The dataset consists of 8 files
Foundations	Ministry of Science and Technology of P. R. China (2019ZQKK0405); National Natural Science Foundation of China (41661023); Qinghai Province (2020-ZJ-Y06)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) *Data* are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use *Data* subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute *Data* subject to written permission from the GCdataPR Editorial Office and the issuance of a *Data* redistribution license; and (4) If *Data* are used to compile new datasets, the 'ten per cent principal' should be followed such that *Data* records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[12]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

Figure 1   Map of waterbird monitoring sample points in the Qinghai Lake Basin in 2019

4 Data Results and Validation

4.1 Dataset Composition

This dataset, through waterbird monitoring, captures information on population numbers, dynamics, distribution, and structure. The dataset is archived in .shp and.xlsx formats, consisting of two data files, with a total data size of 60.9 KB (compressed into 1 file, 51.6 KB).

4.2 Data Results

In 2019, monitoring recorded 61 species of birds across six orders and 14 families (Table 2). Of these, three were species from one family in the order Ciconiiformes, one species from one family in the order Pelecaniformes, eight species from three families in the order Storks, three species from two families in the order Ornithales, 19 species from one family in the order Anseriformes, and 27 species from six families in the order Plovers.

Table 2   Composition of waterbird species observed in Qinghai Lake Basin in 2019

Order	Family	Species
Ciconiiformes	Pediatrics	3
Pelecaniformes	Phalacrocoracidae	1
Storks	Ciconiidae	1
	Ardeidae	6
	Threskiornithidae	1
Ornithales	Gruidae	2
	Rallidae	1
Anseriformes	Anatidae	19
Plovers	Charadriidae	6
	Recurvirostridae	2
	Scolopacidae	13
	Laridae	2
	Glareolidae	1
	Sternidae	3
Total 6 Orders	14 Families	61 Species

   The   waterbird monitoring in 2019 indicated that the Heima River Wetland, Daotang River Wetland, Erhai Lake, Quanwan Wetland, and Jiangxi Gully habitats experienced significant disturbances, primarily from tourism, bird-watching photography, and transportation. Important waterbird habitats such as Daotang River Wetland, Ha Da Beach, and Jiangxi Gully had not yet been included in the protected area. In 2019, the number of waterbirds in Qinghai Lake was 196,000, a decrease of nearly 55,000 compared to 2018. Over the past five years, the variation of waterbird population in Qinghai Lake is shown in Table 3.

Table 3   Dynamics in waterbird populations in the Qinghai Lake Basin from 2015 to 2019

Year	March	April	May	June	July	September	October	December	February (following year)
	Spring migration period			Summer breeding period		Autumn migration period		Wintering period	
2019	17,277	31,351	34,475	23,348	37,751	84,076	143,499	4,622	165
2018	16,695	20,203	46,332	45,001	23,961	31,514	57,792	8,582	1,178
2017	38,157	24,289	26,731	51,781	38,638	42,931	100,969	6,232	6,731
2016	25,350	41,673	27,107	35,751	18,196	55,176	43,832	3,245	21,177
2015	23,666	65,375	48,859	50,019	35,413	26,383	110,496	2,945	1,438

As listed at the Table 4, during the spring migration period of 2019, a total of 16 key waterbird habitats were identified, including Ganzihe Wetland, Ha Da Beach, Cormorant Island, Naren Wetland, Erhai Lake, Paerqiong Wetland, Egg Island, Quanwan Wetland, Jiangxi Gully, Daotang River Wetland, Heima River Wetland, Nuraogeta Estuary, Quanji Estuary, Qieji Estuary, Naishiji Wetland, and Erlangjian. These habitats encompassed nine types of environments: freshwater lakes, river manzanita, herbaceous swamp, lakeshore peninsulas, estuarine wetlands, agricultural land, freshwater river, sub-lakes, and lakeshore wetlands.

Table 4   Spring migration of waterbirds in the Qinghai Lake Basin in 2019

Number	Location	Number of individuals	Number of species	Habitat type
1	Ganzihe Wetland	1,388	30	Freshwater lake
2	Ha Da Beach	3,922	18	River manzanita
3	Naren Wetland	1,860	29	Herbaceous swamp
4	Cormorant Island	1,670	2	Lakeshore peninsula
5	Egg Island	2,981	7	Lakeshore peninsula
6	Erhai Lake	2,169	18	Freshwater lake
7	Paerqiong Wetland	1,192	23	Estuarine wetlands
8	Quanwan Wetland	6,756	9	Estuarine wetlands
9	Jiangxi Gully	1,060	4	Agricultural land
10	Daotang River Wetland	1,591	18	Freshwater river
11	Heima River Wetland	1,255	12	Herbaceous swamp
12	Nuraogeta Estuary	1,081	16	Estuarine wetlands
13	Quanji Estuary	1,000	15	Herbaceous swamp
14	Qieji Estuary	2,114	3	Estuarine wetlands
15	Naishiji Wetland	1,722	4	Sub-lake
16	Erlangjian	1,705	8	Lakeshore wetlands

As listed at the Table 5, during the summer breeding period, a total of 13 major waterbird habitats were identified, including Cormorant Island, Egg Island, Buha Estuary, Ha Da Beach, Quanwan Wetland, Heima River Wetland, Shaliuhe Estuary, Naren Wetland, Haergai River Estuary, Sankuai Shi, Haixin Mountain, Qieji Estuary, and Paerqiong Wetland. These habitats included five different habitat types: lakeshore peninsula, estuarine wetlands, herbaceous swamp, river manzanita, and islands in the lake.

Table 5   Summer breeding of waterbirds in the Qinghai Lake Basin in 2019

Number	Location	Number of individuals	Number of species	Habitat type
1	Cormorant Island	3,966	12	Lakeshore peninsula
2	Egg Island	2,837	13	Lakeshore peninsula
3	Buha Estuary	3,137	14	Estuarine wetlands
4	Ha Da Beach	2,836	23	River manzanita
5	Quanwan Wetland	12,587	14	Herbaceous swamp
6	Heima River Wetland	1,964	9	Herbaceous swamp
7	Qieji Estuary	2,694	8	Estuarine wetlands
8	Shaliu Estuary	2,486	15	Estuarine wetlands
9	Naren Wetland	4,153	24	Herbaceous swamp
10	Haergai River Estuary	2,081	8	Estuarine wetlands
11	San Kuai Shi	14,800	3	Island in the Lake
12	Haixin Mountain	1,389	4	Island in the Lake
13	Paerqiong Wetland	2,390	10	Estuarine wetlands

As listed at the Table 6, during the fall migration period, a total of 17 major waterbird habitats were identified. These habitats included Egg Island, Cormorant Island, Paerqiong Wetland, Qieji Estuary, Ha Da Beach, Quanwan Wetland, Heima River Wetland, Daotang River Wetland, Erhai Lake, Jiangxi Gully, Naishiji Wetland, Naren Wetland, Garila Wetland, Xiannv Wan Wetland, Wuha Alanchu Estuary, Ganzihe Estuary, and Shaliuhe Estuary. They included eight habitat types: herbaceous swamp, lakeshore peninsula, freshwater river, estuarine wetlands, river manzanita, freshwater lake, agricultural land, and sub-lake.

Table 6   Fall migration of waterbirds in the Qinghai Lake Basin in 2019

Number	Location	Number of individuals	Number of species	Habitat type
1	Egg Island	5,518	111	Lakeshore peninsula
2	Cormorant Island	2,806	8	Lakeshore peninsula
3	Shaliuhe Estuary	1,411	10	Estuarine wetlands
4	Paerqiong Wetland	1,478	13	Estuarine wetlands
5	Qieji Estuary	16,847	16	Estuarine wetlands
6	Ha Da Beach	6,512	17	River manzanita
7	Quanwan Wetland	30,708	16	Herbaceous swamp
8	Heima River Wetland	3,712	7	Herbaceous swamp
9	Daotang River Wetland	3,073	14	Freshwater river
10	Erhai Lake	22,226	17	Freshwater lake
11	Jiangxi Gully	2,994	7	Agricultural land
12	Naishiji Wetland	42,086	13	Sub-lake
13	Naren Wetland	7,329	20	Herbaceous swamp
14	Garila Wetland	2,897	10	Herbaceous swamp
15	Xiannv Wan Wetland	1,756	12	Herbaceous swamp
16	Wuha Alanchu Estuary	1,681	13	Estuarine wetlands
17	Ganzihe Estuary	1,491	21	Herbaceous swamp

From Table 7, it can be seen that the key wintering habitats for waterbirds included Jiangxi Gully, Egg Island, Qieji Estuary, Ganzihe Wetland, Quanwan Wetland, Garila Wetland, Xiaobo Lake, Cormorant Island, Naren Wetland, Xiannv Wan Wetland, Buha Estuary, and Haergai River Estuary, making up a total of 12 locations. During the wintering period, these 12 major waterbird habitats included five types of environments: agricultural land, lakeshore peninsula, estuarine wetlands, swamp meadow, and herbaceous swamp.

Table 7   Wintering staying of waterbirds in the Qinghai Lake Basin in 2019

Number	Location	Number of Individuals	Number of Species	Habitat Type
1	Jiangxi Gully	540	1	Agricultural land
2	Egg Island	110	3	Lakeshore peninsula
3	Qieji Estuary	273	2	Estuarine wetlands
4	Ganzihe Wetland	233	3	Estuarine wetlands
5	Quanwan Wetland	247	4	Swamp meadow
6	Garila Wetland	9	1	Swamp meadow
7	Xiaobo Lake	20	1	Swamp meadow
8	Cormorant Island	3,020	5	Lakeshore peninsula
9	Naren Wetland	133	5	Herbaceous swamp
10	Xiannv Wan Wetland	116	2	Herbaceous swamp
11	Buha Estuary	59	2	Lakeshore peninsula
12	Haergai River Estuary	5	1	Estuarine wetlands

5 Discussion and Conclusion

To address the issue of declining waterbird populations, team members strengthened patrol and monitoring efforts to understand real-time changes and the distribution of waterbirds. Additionally, they actively launched wetland protection and restoration projects, implementing ecological restoration within protected areas to help maintain the overall population stability of waterbirds in the Qinghai Lake Basin. In response to the impact of ecological environmental changes on waterbird habitats, efforts are being made to restore and rehabilitate these habitats to provide suitable breeding environments for waterbirds. The composition of wintering waterbirds in the Qinghai Lake Basin has changed, prompting enhanced monitoring and protective measures for wintering areas to ensure waterbird populations remain stable. During specific periods, patrol enforcement is intensified to reduce disturbances to waterbird habitats, creating a safe and tranquil living environment. For waterbird habitats not included within protected areas, the team is collaborating with local governments to jointly establish protected zones or implement joint defense and management measures.

Author Contributions
Zhang, N. N. and Chen, K. L. were responsible for the overall design of the dataset development. Sun, J. Q., Qi, D. S., Wang, X. Y., Yang, S. D., and Wei, Q. C. collected and processed all the data. Zhang, N. N. wrote the data paper and other related documents.

Conflicts of Interest
The authors declare no conflicts of interest.

References

[1]   Zhi, Y. J., Yin, J. F., Liu, W., *et al*. Monitoring of wintering waterbirds in Poyang lake Nanjishan national nature reserve [J]. *Journal of Ecology*, 2020, 39(7): 2400–2407.

[2]   Qiang, W., Lü, X. G. Application of birds in wetland ecosystem monitoring and evaluation [J]. *Wetland Science*, 2007, 3(1): 274–281.

[3]   Wu, T. P., Zhao, Z. J., Luo, L., *et al*. Preliminary study on waterbird diversity in Dashanbao black-necked crane national nature reserve, Yunnan in winter [J]. *Wetland Science*, 2019, 17(3): 304–310.

[4]   Zhang, S. X., Dong, Y. X., Xia, F. Significance of waterbird monitoring in lake ecosystems [J]. *Journal of Lake Sciences*, 2011, 23(2): 155–162.

[5]   Delany, S. Guidelines for participants in the international water-bird census (IWC) [J]. *Wetlands International*, 2005, 10(4): 104–110.

[6]   Li, X. M., Cheng, R. M., Xiao, W. F., *et al*. Water bird monitoring: history and current status and recommendations for future development in China [J]. *Wetland Science*, 2020, 18(6): 633–645.

[7]   Zhang, L. L., Gao, L. M., Chen, K. L. Characteristics of radiation balance and surface albedo changes in Wayan mountain wetland, Qinghai Lake Basin [J]. *Journal of Glaciology and Geocryology*, 2018, 40(6): 1216–1222.

[8]   Gao, L. M., Zhang, L. L., Chen, K. L. Microclimate characteristics of wetlands in the Qinghai Lake Basin [J]. *Arid Zone Research*, 2019, 36(1): 186–192.

[9]   Caidan, Z. M. Legal research on the protection of wetland ecosystems in Qinghai Lake [D]. Lanzhou: Lanzhou University, 2016.

[10]   Hou, Y. S., He, Y. B., Xing, Z., *et al*. Diversity and distribution of waterbirds in Qinghai Lake national nature reserve [J]. *Acta Theriologica Sinica*, 2009, 34(1):184–187.

[11]   Zhang, N. N., Sun, J. Q, Wang, X. Y., *et al*. Monitoring dataset on waterbirds in Qinghai Lake Basin (2019) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2024. https://doi.org/10.3974/geodb. 2024.04.01.V1. https://cstr.escience.org.cn/CSTR:20146.11.2024.04.01.V1.

[12]   GCdataPR Editorial Office. GCdataPR data sharing policy [OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).