

Birds Korea small grant report: Improving the conservation status of the Scaly-sided Merganser along the Imjin River, Republic of Korea



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Moore, N., Baek S-K, Lee S-Y & Jang R. 2026. Improving the conservation status of the Scaly-sided Merganser along the Imjin River, Republic of Korea. EAAFP Small Grant report (August 2026)

Executive Summary

- Based on highest day-counts alone, the Yeoncheon Imjin River Flyway Network Site (FNS) is internationally important for Scaly-sided Merganser as defined by the Ramsar Convention, with a 5-year geometric mean of 53 individuals during northward migration and 106 individuals during southward migration.
- Highest day-counts made during a migration period in the Yeoncheon Imjin River FNS do not represent the total numbers of Scaly-sided Mergansers present during the whole migration period because of asymmetrical migration or migratory “turnover”.
- Along the Imjin River, frequent counts of Scaly-sided Merganser reveal more than one peak in number each migration season; changes in the ratio of adult males to total numbers through the migration season; and changes in numbers between count sites.
- In the absence of marked birds or local tracking studies, we are not aware of any robust method to measure migratory turnover of Scaly-sided Mergansers through the Imjin River or anywhere in the species’ range.
- To estimate the possible range of turnover through the Yeoncheon Imjin River FNS we added together any increase in number in subsequent day-counts; and added together any increase each day-count at 12 Count Sites. Similar to highest day-counts, these approaches are illustrative rather than precise.
- Factoring in turnover in this way, we estimate a 4-year geometric mean of Scaly-sided Merganser in the Yeoncheon Imjin River FNS of 59-102 individuals (1-2% of the population) during northward migration; and a 3-year geometric mean of 162-275 (3.6%-6%) during southward migration.
- As turnover is shown by many migratory species, we call upon the Science Team and modelling specialists to help develop standardized methods to estimate or represent turnover for this and for other threatened migratory species for use in Flyway Network Sites.
- While awareness of the importance of the Imjin River in Yeoncheon to biodiversity has increased greatly this decade, thanks to the efforts of many, and the designation of the Yeoncheon Imjin River Biosphere Reserve and the Yeoncheon Imjin River FNS, many serious challenges remain, with many of the most important river stretches for Scaly-sided Mergansers increasingly disturbed by human activities.
- Recognizing the need to separate out the obligations of the EAAFP and of national government partners, we therefore also call upon the EAAFP, as part of future Resource Planning, to develop a mechanism to support key stakeholders and managers of Flyway Network Sites in their efforts to secure funding from their central governments and from donor organisations for essential work. This mechanism could be as simple as an open letter confirming the need for such work and thereby the need for additional funding.



Figure 1. Scaly-sided Merganser *Mergus squamatus*, Yeoncheon Imjin River FNS © Kim Eojin

Background to this Report

The Scaly-sided Merganser *Mergus squamatus* is a strikingly beautiful, easily disturbed migratory waterbird that is assessed by BirdLife International on behalf of the IUCN as globally Endangered (BirdLife International 2026). Effectively restricted for most of the year to rivers in eastern and northeast Asia, with some individuals also using marine waters during migration or post-breeding, the monotypic population of this species in the wild has been estimated at between 3,600–4,800 individuals (Solovyeva et al. 2014) and 2,000–3,500 mature individuals (BirdLife International 2025). The 1% of population threshold used by the Ramsar Convention is set at 45 individuals (Wetlands International 2026).

This century has seen a substantial increase in research and conservation effort in the riverine forests of far eastern Russia and northeastern China, where the species is known to breed, and in eastern China where coordinated surveys have found a large proportion of the global population wintering (Zhao & Pao 1998; Zeng *et al.* 2015; Solovyeva *et al.* 2017; Xu *et al.* 2021). There has, however, been rather less research or conservation action on the Korean Peninsula, where the species was long considered to be a rare migrant or winter visitor (Moores 2022, Moores et al. 2023b). In spite of this perception, the Scaly-sided Merganser is assessed as Nationally Threatened (Class 1, equivalent to Endangered) and has been designated as National Natural Monument, Number 448 (MOEK 2022) in the Republic of Korea (ROK or South Korea).

Birds Korea is an active South Korean NGO member of the Scaly-sided Merganser Task Force. To improve understanding of the Scaly-sided Merganser's status in the ROK, we conducted mid-winter (January-mid-February) surveys focused on Scaly-sided Merganser along several major rivers in 2012 and again in 2014. Both surveys found between 140 and 149 Scaly-sided Mergansers, with the latter survey supported by a small grant from the EAAFP (Moores & Kim 2014). These surveys, together with research supported by an additional EAAFP small grant in 2022, helped to revise the national mid-winter estimate up to “probably c. 200 individuals (perhaps up to a maximum of 250)” in the ROK, i.e., c. 5–6% of the population; with probably most of the important river stretches for wintering Scaly-sided Mergansers now identified. Importantly, this information has also been made wholly accessible to researchers and decision-makers through open-access publications (e.g., Moores & Kim 2014; Moores 2022; Moores et al. 2023b).

Supported by the Hanns Seidel Foundation (Korea office), Birds Korea also conducted a mid-winter survey of several rivers in the DPRK, including stretches of the Chongchon River in 2019, together with DPRK officials and Scaly-sided Merganser Task Force members from the Russian Federation and PR China (Moores 2019). That research, in combination with other surveys and a review of DPRK ornithological literature, suggests that Scaly-sided Merganser is predominantly a migrant through the DPRK, with no confirmed breeding records and with few if any confirmed records of over-wintering (Moores et al. 2023b).

To date, survey effort and count data are insufficient to estimate the trend in the population of birds overwintering in the ROK. Establishing such a trend without much greater research effort at a minimum of all five of the most important known rivers in the ROK (see Moores et al. 2023b) is likely to be complicated by the ongoing degradation of many stretches of river that either support or used to support the species, set within the context of improved accessibility to previously inaccessible river stretches, combined with a rapidly warming climate that makes more river stretches available to the species in mid-winter than even two decades ago. This now includes in some recent winters a few stretches of the Imjin River in Yeoncheon County in the inner border region of Korea (centred at approximately 38.07°, 127.01°), in one of the coldest parts of lowland ROK in mid-winter,

The importance of the ROK and the DPRK to the Scaly-sided Merganser during migration is even less well understood (Moores et al. 2023b). Data from a small number of birds with geolocating loggers confirmed that a substantial, though still unknown, number of Scaly-sided Merganser pass through the

Korean Peninsula during southward and northward migration (Solovyeva et al. 2012). This led BirdLife International (2025) to comment that, “the main migration routes appear to pass through the Korean Peninsula”. Based on flight speeds estimated from these geolocators, it would take 36–40 hours for Scaly-sided Mergansers to migrate directly and non-stop between the catchment of the River Kievka (where most of the geolocating loggers were fitted) and wintering areas in eastern China. However, the birds with geolocators took a mean of 29.6 ± 8.1 days to move between breeding and wintering areas on southward migration; and 4-8 days on northward migration (Solovyeva et al. 2012; Moores et al. 2023b). Evidently, all tracked birds had stopovers. As noted by Sheehy et al. (2011), although stopover habitats are used by many species as refuelling stations during migration and can be critical for survival and successful reproduction, they are rarely incorporated in year-round population models and conservation strategies. In a similar way, although breeding and staging areas in the DPRK were identified as an important information gap in Solovyeva et al. (2017), staging areas in the ROK were not.

In order to be able to conduct research that can be used to identify staging / stopover sites, it is first important to understand the migration phenology of the target species. Based on Solovyeva et al. (2012), during southward migration, the bulk of tracked Scaly-sided Mergansers (all females caught at the nest) departed their breeding areas between October 26th and November 16th. On northward migration, the date of departure from the wintering range of five of these tracked birds in two years ranged from March 9th to April 7th (Solovyeva et al. 2012; Moores et al. 2023b). These dates coincide well with high counts of the species that were made along the Chongchon River in the early 2000s by Duckworth & Kim (2005), which is only 200-250km to the north-north west of the Imjin River in Yeoncheon. These dates also coincide well with our peak counts along the Imjin River made this decade (see below).

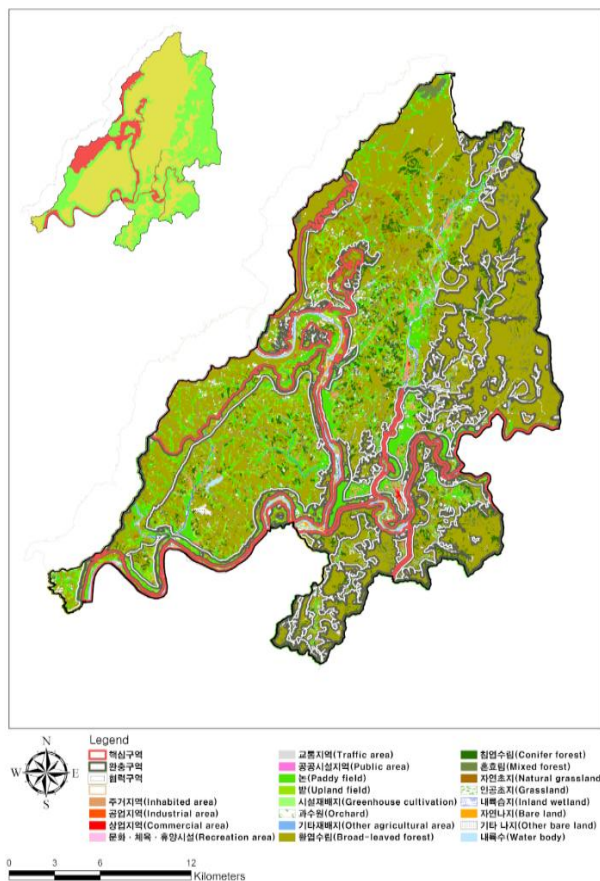
To begin to assess whether there is any turnover or not (i.e., if birds arrive and depart asymmetrically rather than all arriving and departing together) without large numbers of marked birds that can easily be detected in field conditions, it is important to conduct a high frequency of counts throughout the two main periods of migration. Although daily counts along whole river systems would be optimal, this is likely to be impractical for most researchers, NGOs and local counters with limited funding.

As set out by Solovyeva et al. (2012) in Moores et al (2023b), the estimated time needed to fly direct from the Imjin River to Russian breeding grounds during northward migration is approximately 14-18 hours; and the start and end of migration flight could only be identified in those five individuals with dataloggers which migrated from fresh water to marine waters or from marine waters to freshwater, presumably resting on the sea for most of a day (or more) before flying inland to the breeding area. Those five females took a mean of 4.4 days (range 3-8) to complete their northward migration. This means that if they stopped over on route during northward migration, they likely did so for 1-3 days. During northward migration, although daily counts would be optimal, conducting counts once every 3-4 days seems to be a practical compromise of research and logistical needs. Based on the data from birds with geolocators, southward migration, and staging therein, is likely to be rather more prolonged.

Since late 2021, Birds Korea and the local chapter of Birds Korea Yeoncheon have received a series of contracts from Yeoncheon County to help improve understanding of the status and conservation needs of biodiversity and to help raise awareness of that biodiversity in the Yeoncheon Imjin River Biosphere Reserve in Yeoncheon County, Gyeonggi Province. This has provided us with an unprecedented opportunity to improve understanding of the Scaly-sided Merganser’s migration strategy in central Korea. As part of this work, in addition to conducting surveys of key species in all months of the year, we have now conducted c.180 days of survey looking for Scaly-sided Merganser in the Biosphere Reserve. This includes survey of the Chatancheon (where no Scaly-sided Mergansers have been recorded); along the Hantan (where only one Scaly-sided Merganser has been found in total since 2021, on March 14th 2023); along the Imjin River between Mapo (38.01°, 127.00°) and Horogoru (37.98°, 126.85°) with 1-10 individuals counted during migration and in winter; and most especially the 21 km stretch of the Imjin River between the Pilsung Bridge (38.11°, 126.96°) in the Civilian Controlled Zone

and the Dongi Bridge (38.01°,127.01°), with a total of 156 days of counts, conducted every 3-5 days through one or both migration periods each year (2021-2026)

In addition to frequent counting of Scaly-sided Mergansers (and other threatened species), as an NGO dedicated to the conservation of birds and their habitats, we have also submitted multiple proposals in annual reports that aim to support Yeoncheon County in efforts to conserve this species and additional biodiversity along the County's three rivers as part of existing commitments to the global Sustainable Development Goals and to the National Biodiversity Strategy and Action Plan (Moore 2021, Moore et al. 2022, Moore et al. 2023a, Moore et al. 2024, Moore et al. 2025). We also helped to co-author, together with Dr Yoo Miyeon of Yeoncheon County, the Information Sheet for the Yeoncheon Imjin River FNS, the first Flyway Network Site in Korea to support an internationally important concentration of Scaly-sided Merganser (designated in 2024); and at the request of Yeoncheon County, in 2025, we identified clusters of sites which meet Ramsar convention criteria for the identification of internationally important wetlands for waterbirds to assist the County in its preparations to nominate a potential Ramsar site (Moore et al. 2025).



The Imjin River Biosphere Reserve, designated in 2019. The Core Area, including the Imjin River in Yeoncheon County, is outlined in red.



The Yeoncheon Imjin River Flyway Network Site, EAAF 156, designated on October 11th 2024. The site contains the most important 21km of the Imjin River for Scaly-sided Merganser in 2021-2026; rice-fields, semi-natural wetlands and river stretches in the Civilian Controlled Zone next to the DMZ used by internationally important concentrations of Red-crowned *Grus japonensis* and White-naped Cranes *Antigone vipio*; habitats used by internationally important concentrations of Eastern Taiga Bean Goose *Anser (fabalis) middendorffii* and Greater White-fronted Goose *Anser albifrons*; and a proposed restoration site on the Hantan River

Figure 2. The Imjin River Biosphere Reserve and the Yeoncheon Imjin River Flyway Network Site.



Figure 3. Visit by Birds Korea to the EAAFP office in Incheon, August 16th 2023, to discuss the proposed Yeoncheon Imjin River Flyway Network Site with its focus on Scaly-sided Mergansers. From left to right, Dr Nial Moores (National Director of Birds Korea), Baek Seung-Kwang (Birds Korea Hantan-Imjin Representative), Lee Su-Young (Birds Korea Yeoncheon), Dr Yoo Miyeon (Yeoncheon Imjin River Biosphere Reserve Manager, Yeoncheon County Office), Jeniffer George (Chief Executive, EAAFP) and EAAFP intern.

In mid-2025, we received an EAAFP Small Grant of 5,000 USD for “Improving the conservation status of the Scaly-sided Merganser along the Imjin River, Republic of Korea”. This small grant was subdivided under three headings: (1) essential support for a high frequency of counts of Scaly-sided Merganser, with almost all counts being made by Birds Korea Hantan-Imjin Representative Baek Seung-Kwang, during both the southward migration period in 2025 and the northward migration period in 2026 (with the main aim of confirming a five-year geometric mean of 1% or more of the population of Scaly-sided Merganser in both migration periods); (2) two designs for sign-boards that can be used to raise awareness of the Scaly-sided Merganser (both through the design process and also following placement by Yeoncheon County); and (3) the production of this small grant report.

This report’s primary aim is to make our count data more easily accessible. Counts are therefore presented migration season by migration season starting in late 2021, with clearer organization of count effort from 2023 to mid-2026 as our understanding of the species’ migration strategy improved. In this report, some of these count data have been modified from our Korean-language annual reports to the County and our English-language paper in *Wildfowl* published in 2023 (Moores 2021; Moores et al. 2022; Moores et al. 2023a; Moores et al. 2023b; Moores et al. 2024; Moores et al. 2025).

Most of our counts of Scaly-sided Merganser in Yeoncheon County from 2021-2026 have been made by Birds Korea Imjin-Hantan Representative Baek Seung-Kwang, with multiple counts most seasons also made by Birds Korea Yeoncheon members Lee Su-Young and Jang Ryang (especially in 2022) and Dr Nial Moores. All counts were therefore conducted by one or more experienced observers using high-quality optics (binoculars, cameras with long lenses or tripod-mounted telescopes), moving by car between points that overlook the river. From 2021, all counts included the number of adult males;

where possible, the more challenging identification of second calendar year males and females; and an assessment of whether or not birds were in pairs. From 2023, all counts were sub-divided strictly into 12 Count Sites based on our observations of the species, and its strong tendency, at least in daylight hours, to remain within discrete stretches of river unless flushed.

In support of KRA 3.1 of the EAAFP Strategic Plan (EAAFP 2018), and to help with the interpretation of these count data and of turnover, this report also includes clear information on how we developed what we consider to be reasonable, evidence-based lower and perhaps upper estimates of Scaly-sided Mergansers that likely staged in the Yeoncheon Imjin River FNS during both migration periods. The two main methods we used were the addition of differences in peaks and troughs of the total numbers recorded each count (the cumulated total of any increase between day-counts); and the addition of any increase in numbers between each count site each count (the cumulated total of the increase between counts each count and count site). If there are better methods available to estimate turnover, we welcome advice to that effect. If there are not, we would like to use this report to call upon the EAAFP Science Team and modelling specialists to develop and share guidelines that can be used consistently in Flyway Network Sites along the Flyway.

Our methods and estimates are provided in this small grant report fully in the understanding that in the absence of a large number of marked birds, no method of counting numbers through a migration season can be precise. In our counts in the Yeoncheon Imjin River FNS, some birds are very likely missed between and perhaps even during counts; some birds perhaps remain in the same area for one or two weeks (or longer) while others perhaps stop over much more briefly; at least some birds move between count sites when flushed; and our research in early 2026 also suggests that some birds appear to move between count sites after dark for overnight roosting, as has been proven in Common Merganser *Mergus merganser* at one site in Scotland (Marquiss & Duncan 1994).

Commentary on weather before and during some of our peak counts is also included in this report, with weather data from the adjacent county of Cheorwon taken from an open access database maintained by the Korean Meteorological Administration (data.kma.go.kr) (this database does not currently present data for Yeoncheon). This commentary is included because weather is one of the variables influencing the length of stopover in many migratory species (e.g., Ballard et al. 2026) and our research in Yeoncheon County, in eastern DPRK and on Baengnyeong Island (Incheon, ROK) suggests that this is likely the case in Scaly-sided Merganser too. If an attempt is made at modelling of migratory turnover in Scaly-sided Mergansers through the Korean Peninsula, we would recommend it to incorporate local and especially regional weather patterns, including those variables that might stimulate departure (such as length of day, clement or inclement conditions, strongly falling or rising temperatures and wind direction).

At their simplest, the count data we present below confirm the Ramsar-defined international importance of the Yeoncheon Imjin River FNS for Scaly-sided Merganser during migration. With the support of the 2025-2026 small grant, based on highest day counts alone we are able to confirm a 5-year geometric mean of 1% or more of population of Scaly-sided Merganser in the Yeoncheon Imjin River FNS during both northward and southward migration.

The last page of this small grant report also communicates in brief some of the proposals made by Birds Korea to Yeoncheon County to improve conservation opportunities for Scaly-sided Merganser and additional biodiversity in the Yeoncheon Imjin River FNS (in support of EAAFP 2018, KRA 1.5); and includes an image of a signboard, with the design of this signboard in-part supported by this small grant, as part of raising awareness (Objective 2, “Enhance communication, education, participation and awareness (CEPA) of the values of migratory waterbirds and their habitats”: EAAFP 2018). A second design has also been commissioned, but will not be completed until November 2026. Use of the small grant fund to pay for this design even after completion of the project was approved by the EAAFP office by email on August 4th 2026.

2021

Before 2021, Birds Korea had only conducted occasional mid-winter surveys along parts of the Imjin and Hantan rivers in Yeoncheon County, finding a maximum of 1-4 individual Scaly-sided Merganser in unfrozen patches of otherwise largely frozen rivers; none were reported in Yeoncheon County during the national winter census conducted under the auspices of the Ministry of Environment (now the Ministry of Climate, Energy and Environment) between 1999 and 2021 (MOEK 1999-2021); and there were no observations of the species on eBird or in other reports during that period that we have been able to access.

In late 2021, Birds Korea received our first contract from Yeoncheon County to conduct research on birds and additional biodiversity within the Yeoncheon Imjin River Biosphere Reserve. During our first survey period in early to mid-November, a cold front passed through, with 22 mm of rain on the 7th, winds swinging to the WNW (potential head-winds for Scaly-sided Mergansers on active southward migration). Temperatures dropped to below freezing overnight from the 11th for the first time that season (data.kma.go.kr). We found several groups of Scaly-sided Merganser distributed along 45km of the Imjin River (from Pilsung Bridge to Horogoru), and a single flock of 57 Scaly-sided Mergansers on November 11th, on a stretch of undisturbed, impounded river above the Gunnam Dam (subsequently known as Count Site 6: Figure 4). On November 12th, we counted 144-150 individual Scaly-sided Mergansers between the Pilsung and Dongi bridges, a 21km stretch of the Imjin River (Moores 2021). To the best of our knowledge, this remains the highest day-count of Scaly-sided Merganser along a single river on the Korean Peninsula.

Differences in counts made between mid-November and early December 2021 along the same and additional stretches of the Imjin River in Yeoncheon County conducted as part of our biodiversity monitoring confirmed that the vast majority of these Scaly-sided Mergansers were staging as part of their southward migration, rather than over-wintering there.

In addition, our surveys found differences in numbers, sex ratios and individual plumage details of birds between counts that suggested a possible turnover of birds. If it is assumed that birds did not move between preferred river stretches, and that observed differences were instead the result of immigration and emigration then – based on summing of these differences – at least 198 Scaly-sided Mergansers, or approximately 4% of the world population, staged along this 21km stretch of the Imjin River between November 7th and 12th. Although no individually marked birds were seen, our counts suggested that some birds likely stopped over for only one to two days (or less) while others appeared to remain for longer.

2022

In 2022, an EAAFP Small Grant was used by Birds Korea to supplement research on Scaly-sided Mergansers that were funded primarily by Yeoncheon County and the Hanns Seidel Foundation (HSF Korea office). Research included survey of 16 rivers nationwide in winter, covering a total of 324.9 km of river with an additional ~50km of frozen river viewed from a moving car; survey of the Nam River during the northward migration period and of the Namhan and Nam Rivers in November; production of an awareness-raising pamphlet on the species and co-ordination with HSF Korea Office of a small workshop on the Scaly-sided Merganser held in Suncheon on November 21st (Moores 2022, Moores et al. 2023b). This workshop appears to have been the inspiration behind the launch 1-2 years later of a new network of birdwatchers sharing their observations of Scaly-sided Merganser through Naturing, a Korean-language online database.

During the northward migration period, our research aimed to confirm whether or not the same key stretches of the Imjin River were favoured by Scaly-sided Mergansers as during southward migration, and to establish whether we were double-counting birds. Counts were made on 21 dates between March 4th and April 14th along all or only parts of the key 21 km of the Imjin River, with several additional counts further downstream especially at Baekhak (37.99°, 126.91°) and Horogoru which found between 1-4 Scaly-sided Mergansers.

Our counts found Scaly-sided Merganser on only 1-5 dates along several stretches, while the same 4-5km stretch between the Imjin Bridge (38.05°, 127.02°) and Dong-i Bridge (subsequently divided up as Count Site 10 and Count Site 11: Figure 4) consistently supported the species. We therefore conducted simultaneous counts with one team each at Count Sites 10 and 11 in the morning and again in the afternoon on March 7th and 21st. Although Scaly-sided Mergansers flew upstream when flushed from Count Site 11 most or all apparently did not reach as far as Count Site 10, and individuals started to return to Count Site 11 within 20-30 minutes. In addition, a single team counted the same two sites twice (once in the morning and once in the afternoon) on three dates (March 12th, 15th and 21st) and found no consistent pattern between the two sites (Table 1). This suggested that birds were not moving between the two sites, at least on these dates.

Table 1. Counts of Scaly-sided Merganser (including the number of adult males) at two adjacent count sites along the Imjin River in the morning and again in the afternoon in March 2022

Date	Count Site 10, AM	Count Site 11, AM	Count Site 10, PM	Count Site 11, PM
12th	20 (8 ad. males)	21 (9 ad. males)	27 (11 ad. males)	4 (1 ad. male)
15th	18 (8 ad. males)	4 (2 ad. males)	17 (8 ad. males)	21 (8 ad. males)
21st	12 (6 ad. males)	11 (4 ad. males)	14 (5 ad. males)	10 (4 ad. males)

The highest day-count of Scaly-sided Merganser along the key 21km was at least 56 individuals on March 12th at the start of four days of light-moderate NNE winds across the region; and the highest day-count of adult males was on March 16th, coincident with the start of a period of westerly winds. Most birds appeared to be in pairs between March 11th and 29th. Subsequently, numbers fell more or less steadily, with the exception of an influx between March 29th and April 2nd, coinciding with NE winds, which largely comprised unpaired and second calendar-year birds. All birds from April 4th onwards were either adult females or in their second calendar-year and were unpaired. The last observation of Scaly-sided Merganser was on April 12th (Moores et al. 2022; data.kma.go.kr).

During the southward migration period in 2022, ten dates of survey were conducted between late October and mid-December, with a peak day-count of 96 on November 9th (Moores et al. 2022).

This initial survey effort confirmed that the migration of Scaly-sided Mergansers through the Yeoncheon Imjin River Biosphere Reserve was not symmetrical, i.e. birds did not arrive, build up in number to a single peak and then all depart together. Rather, both migration periods comprised more than one peak (of total numbers or of adult males), indicating both a turnover of birds through the site and differential migration – with adult males departing during northward migration ahead of most immature birds.

In November, single day-counts of the Imjin, and the Namhan and Nam Rivers (the two most important known rivers for over-wintering Scaly-sided Mergansers in the ROK: Moores 2023b) found a combined total of 215 Scaly-sided Merganser. These two rivers are approximately 100km and 300km to the south

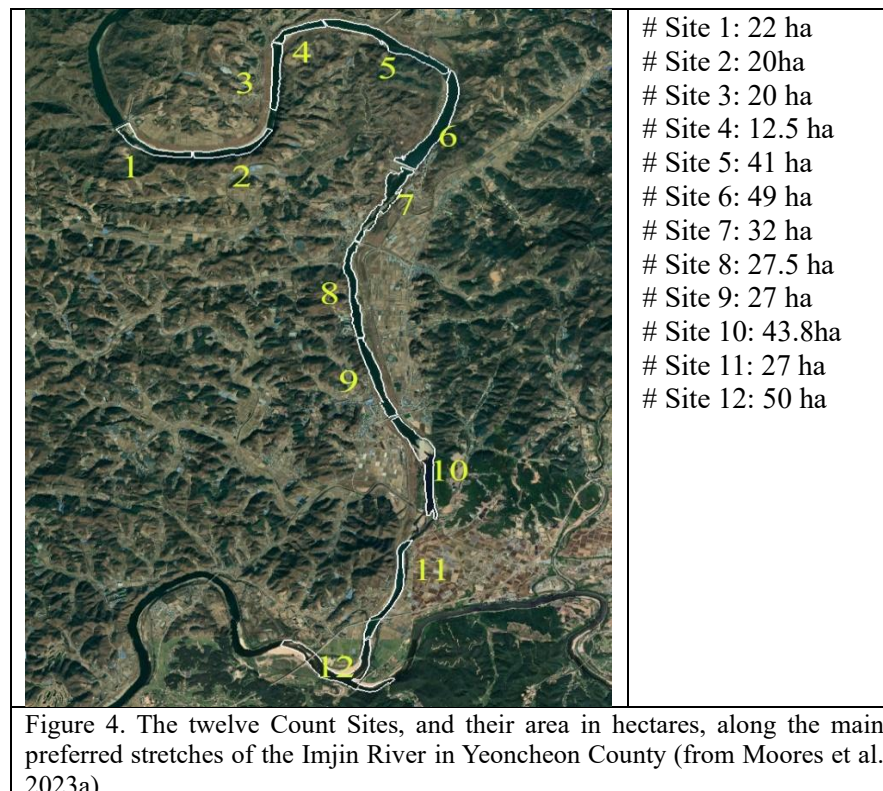
and southeast of the Imjin River. This combined total was higher than any previous national mid-winter count of the species along the same and additional rivers, and suggests that the species likely peaks in abundance in the ROK in November, when staging and over-wintering birds overlap in timing. Of these three rivers, only the Imjin River supported many more Scaly-sided Mergansers in November than in mid-winter (Moore 2022). This led Moore et al. (2023b) to suggest that, similar to other species which appear to migrate across the narrow “waist” of central Korea (e.g., Duckworth 2006; Xi et al. 2021; Birds Korea archives), Scaly-sided Merganser might also choose to migrate between Russian breeding grounds and Chinese wintering grounds through a relatively narrow corridor, largely between 37° and 40°N.

2023

In 2023, our research along the Imjin River aimed to refine further our understanding of turnover, both to help reduce further information gaps on the species’ migration strategy and also to support Yeoncheon County in efforts to designate a Flyway Network Site, as called for in Action 32 of the Scaly-sided Merganser Single Species Action Plan (Solovyeva et al. 2017) and in KRA 1.1 (EAAFP 2018).

Based on our observations combined with obvious landmarks, including the presence or absence of riffles greatly favoured by the species for foraging (Moore et al. 2023), we sub-divided the 21km stretch of the Imjin River into 12 more or less contiguous count sites to facilitate the organization and interpretation of count data (Figure 4).

We also committed to aiming for counts every 3-4 days through the whole of both migration periods at all 12 count sites - or at Count Sites 6-12 only in certain periods to minimize disturbance to large numbers of easily-disturbed Red-crowned *Grus japonensis* and White-naped Cranes *Antigone vipio* that are often present in and adjacent to the river along these river stretches.



During the northward migration period, we made 17 counts, with 10 complete counts between March 10th and April 6th, and found a peak day-count of 56 on March 17th (Table 2), made during a two-day period of southwesterlies. We also observed birds which were apparently actively on migration (rather than flying to avoid disturbance), including a male watched departing the Hantan River at 08:10 on March 14th; a pair watched flying strongly upstream, initially low over the water then gaining height, between Count Sites 5 and 4 at 11:15 on March 15th; and a group of females which flew in from about 200m above the river from the south, dropping down to join a larger group of twelve birds, located between Count Sites 8 and 9 at 11:15 on March 17th.

Our estimate of turnover based on differences in number between day-counts and between the 12 count sites each count suggests that the total number of Scaly-sided Merganser that we were able to observe during the northward migration period was between 63 and 141 individuals.

Table 2. Counts of Scaly-sided Mergansers during northward migration in 2023 with counts by Count Sites, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites

Date	Count Area #												Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
10/3	0	0	0	0	0	0	0	3	0	5	10	0	18	18	18
13/3	2	0	0	0	0	0	0	13	20	7	0	0	42	42	60
15/3	4	4	0	2	0	0	6	2	0	17	13	0	48	48	97
17/3	4	0	0	0	0	0	6	15	0	18	13	0	56	56	111
20/3	0	4	0	0	0	0	4	5	2	13	3	4	35	56	121
23/3	0	2	0	0	0	0	0	4	2	13	12	0	33	56	130
27/3	0	0	0	0	0	0	0	3	2	1	1	0	7	56	130
30/3	0	0	0	0	0	0	0	2	0	4	7	0	13	63	139
3/4	0	0	0	0	0	0	0	0	0	2	2	0	4	63	139
6/4	0	0	0	0	0	0	0	0	0	0	4	0	4	63	141

During the southward migration period in 2023, we made 22 counts between October 21st and December 23rd (Table 3). The highest day count was 91, on November 14th, with numbers building rapidly soon after minima temperature fell below zero from November 7th onward. A second much smaller peak was recorded towards the end of the migration period during the count of December 11th, coincident with heavy rain (c. 20mm) and several days of north-easterly winds. The late peak count in mid-December confirmed that southward migration through the Imjin River continues into December.

It seems plausible that these late migrants might be birds that intend to over-winter in the ROK rather than continuing on to PR China. This is because all of the birds with geolocators tracked by Solovyeva et al. (2012) reached their wintering area between October 28th and November 28th; and although the difference was small, in 2022, the number of birds in mid-winter recorded on the Nam River in southernmost ROK was higher than the number of birds recorded there in mid-November, when the river was likely to be supporting both migrants and birds which were intending to over-winter there (Moore et al. 2023b).

Table 3. Counts of Scaly-sided Mergansers during southward migration in 2023 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites.

Date	Count Area #											Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11 & 12			
21/10	0	0	0	0	0	0	2	2	0	4	3	11	11	11
24/10	0	2	0	0	0	0	0	2	0	5	0	9	11	14
27/10	1	0	0	0	0	0	0	0	0	17	0	18	20	27
30/10	0	0	0	0	0	0	0	4	0	10	5	19	21	36
2/11	0	0	0	0	0	0	5	5	0	20	0	30	32	52
5/11	2	3	3	0	0	8	0	0	5	13	0	34	36	73
8/11	0	0	5	0	0	0	2	9	4	32	18	70	72	123
11/11	5	0	2	3	1	0	8	3	5	40	20	87	89	149
14/11	0	0	3	0	0	0	8	6	0	41	33	91	93	167
17/11	0	2	4	0	0	0	0	14	0	22	33	75	93	178
20/11	0	0	4	0	0	12	6	0	8	10	25	65	93	204
23/11	0	0	0	0	6	0	3	4	17	12	16	58	93	225
26/11	0	0	0	0	0	2	3	2	13	8	10	38	93	227
29/11	0	0	0	0	0	0	4	5	0	13	9	31	93	236
2/12	-	-	-	-	-	-	-	0	2	6	3	11	93	238
5/12	-	-	-	-	-	-	-	2	0	10	5	17	99	246
8/12	-	-	-	-	-	-	-	0	0	3	3	6	99	246
11/12	-	-	-	-	-	-	-	0	0	19	4	23	116	263
14/12	-	-	-	-	-	-	-	0	0	2	9	11	116	268
17/12	-	-	-	-	-	-	-	0	0	8	3	11	116	274
20/12	-	-	-	-	-	-	-	0	0	1	4	5	116	275
23/12	-	-	-	-	-	-	-	0	0	0	0	0	116	275

Note: dashes indicate that no count was made at this count site on that date

Our count effort revealed a fairly steady increase of Scaly-sided Mergansers into mid-November followed by a steady decline in number, with the exception of some smaller peaks toward the very end of the migration period (Figure 5).

The ratio of adult males to females and immatures, however, reveals that males initially outnumbered females and immatures; then comprised approximately half of the total into early November, before falling to approximately a third or less of the total from November 17th through to mid-December.

This differential migration and the obvious change in the ratio of males to females and immature birds, even while the total number of birds during a day-count does not change as much, helps to confirm “hidden” turnover. Our estimate of turnover suggests that perhaps between 116 and 275 Scaly-sided Merganser staged on the key stretches of the Imjin River during southward migration in 2023.

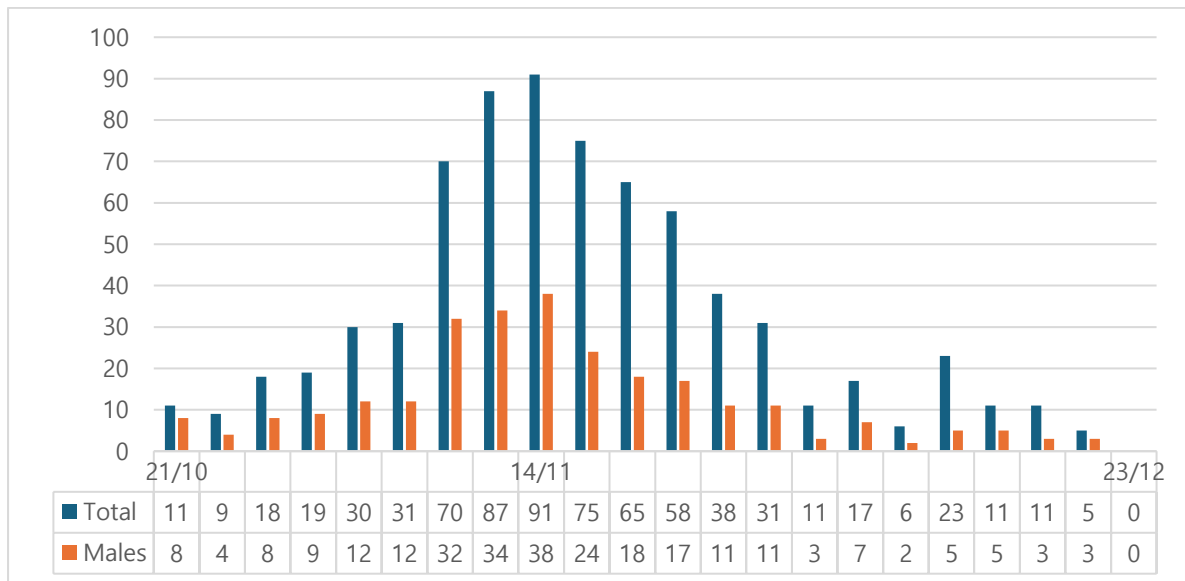


Figure 5. Total number and number of adult male Scaly-sided Merganser along the main preferred river stretches of the Imjin River between October 21st and December 23rd 2023 (from Moores et al. 2023a)

2024

Through the 2023 / 2024 winter and the main migration periods in 2024, count effort was continued as part of biodiversity monitoring under contract to Yeoncheon County.

In 2024, counts were conducted twice in January, finding 7-9 over-wintering individuals during a partial thaw.

In February, nine day-counts found between 13 (on 14th) and zero (on 20th) individuals, latter absence of birds coinciding with a cold spell when most of the river surface was frozen. The first obvious build-up in numbers took place in March.

Sixteen day-counts were made between February 26th when zero Scaly-sided Mergansers were observed, and April 14th. Results are presented in Tables 4 and Figure 6.

The highest day-count was on March 21st, when winds were southwesterly. This was 3-7 days later in March 2024 than in March 2023.

As in 2023, adult males made up about half of all Scaly-sided Mergansers until the highest day-count on March 21st. Subsequently, the ratio of adult males to females and immature female-type birds fell rapidly, with no adult males recorded after April 8th. In addition, the vast majority of adult males appeared to be paired. The decrease from 47 total individuals, including 21 pairs (=42 individuals) on March 21st to 29 with only 9 pairs on March 25th again indicates turnover.

Table 4. Counts of Scaly-sided Mergansers during northward migration in 2024 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites.

Date	Count Area #												Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
26/2	-	-	-	-	-	-	0	0	0	7	0	0	7	7	7
29/2	-	-	-	-	-	-	0	0	3	4	2	0	9	9	12
3/3	-	-	-	-	-	-	0	0	0	4	6	0	10	10	16
8/3	0	0	0	0	0	0	0	0	0	9	12	0	21	21	27
12/3	-	-	-	-	-	-	0	0	2	19	10	0	31	31	39
15/3	0	0	0	0	0	0	0	0	8	13	9	0	30	31	45
18/3	0	0	0	0	0	0	0	0	0	22	6	0	28	31	54
21/3	0	0	0	0	0	0	0	0	2	31	14	0	47	50	71
25/3	3	2	0	0	0	0	-	2	0	11	11	0	29	50	73
27/3	-	-	-	-	0	0	0	0	2	11	12	0	25	50	76
30/3	0	0	0	0	0	0	1	0	2	0	8	0	11	50	77
2/4	-	-	-	-	-	-	-	0	4	4	0	0	8	50	83
5/4	-	-	-	-	-	-	0	0	2	8	2	0	12	54	89
8/4	-	-	-	-	-	-	0	0	0	9	0	0	9	54	90
11/4	-	-	-	-	-	-	0	0	0	7	0	0	7	54	90
14/4	-	-	-	-	-	-	0	0	0	0	0	0	0	54	90

Note: dashes indicate that no count was made at this count site on that date

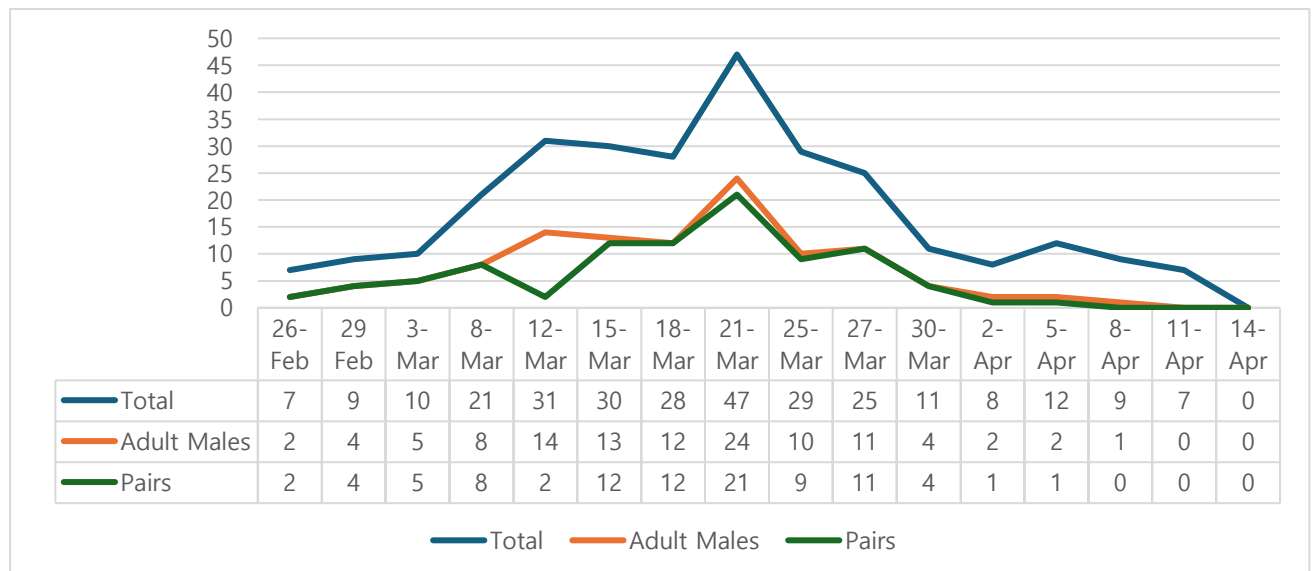


Figure 6. Numbers of Scaly-sided Merganser, Northward Migration 2024.

During southward migration in 2024, sixteen day-counts were made between October 22nd and December 7th (Table 6, Figure 7), with two of the three peaks in total number perhaps weakly influenced by local weather conditions (Table 5). Adult males represented approximately half of all birds initially, falling to less than a quarter of the total by the first main peak on November 11th.

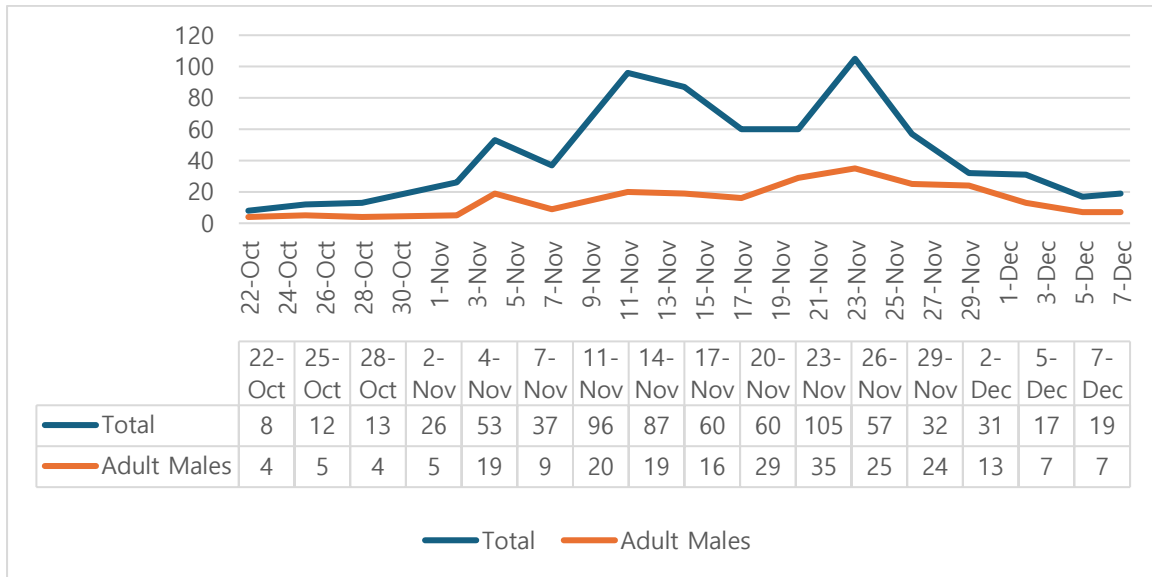


Figure 7. Number of Scaly-sided Merganser by day count, southward migration 2024

The first peak of 96 on November 11th followed several days of light winds between N and WNW, with minima near to freezing. The milder conditions that followed coincided with two counts of 60 individuals on November 17th and 20th (with either some movement of birds between count sites, or some emigration and immigration). The rapid increase in number recorded on November 23rd followed a period of overnight temperatures below freezing and coincided with the first NNE winds for ten days. This was followed by another period of subzero temperatures overnight.

Table 5. Daily weather conditions, Cheorwon, November 2024. From data.kma.go.kr

Date	Maximum Temperature	Minimum Temperature	Wind Direction	Maximum Wind Speed m/s	Precipitation
7	14.1	-3.4	NNW	1.9	
8	16.8	-3.3	WNW	2.2	
9	19.0	-0.6	N	1.5	
10	19.7	3.6	N	1.7	
11	20.8	3.1	N	1.8	
12	18.3	4.2	NW	2.6	
13	19.5	1.4	W	2.1	
14	16.8	8.5	SW	2.1	0.9
15	21.6	10.5	NNE	2.3	0.1
16	21.1	11.1	SSW	3.2	7.5
17	14.0	-2.1	N	3.1	
18	6.3	-5.6	NNW	2.6	
19	9.6	-5.5	WNW	2.0	
20	8.9	-2.9	SSW	2.3	0.7
21	11.7	1.0	SW	2.8	
22	9.2	-2.2	WNW	2.5	
23	11.6	-4.5	NNE	2.7	
24	11.8	-4.0	NNW	2.1	
25	14.4	-3.5	ESE	3.5	17.3
26	10.9	1.0	SW	6.3	3.3
27	1.1	-3.5	SSW	4.5	0.7

Table 6. Counts of Scaly-sided Mergansers during southward migration in 2024 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites.

Date	Count Area #												Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
22/10	-	-	-	-	-	-	0	0	4	4	0	0	8	8	8
25/10	-	-	-	-	-	-	0	0	8	4	0	0	12	12	12
28/10	-	-	-	-	-	0	0	0	5	6	2	0	13	13	16
2/11	-	-	-	-	-	0	0	0	8	10	8	0	26	26	29
4/11	0	0	4	5	3	9	1	0	3	24	4	0	53	53	65
7/11	-	-	-	-	-	7	0	8	0	16	6	0	37	53	75
11/11	-	-	-	-	-	26	0	0	12	54	4	0	96	112	144
14/11	-	-	-	-	-	6	2	2	13	42	0	0	87	112	149
17/11	-	-	-	-	-	0	2	0	13	40	5	0	60	112	154
20/11	-	-	-	-	-	0	0	2	0	44	14	0	60	112	169
23/11	-	-	-	-	-	0	7	2	11	64	21	0	105	157	214
26/11	-	-	-	-	-	0	4	2	6	15	30	0	57	157	223
29/11	-	-	-	-	-	0	0	0	2	14	16	0	32	157	223
2/12	-	-	-	-	-	0	4	0	5	8	14	0	31	157	230
5/12	0	0	0	0	0	0	2	0	0	10	5	0	17	157	232
7/12	0	0	0	0	0	0	3	2	2	6	6	0	19	159	237

Note: dashes indicate that no count was made at this count site on that date

2025

In 2025, because of other survey commitments we were only able to conduct five counts during northward migration (Table 7). The peak count during this period was 41 on March 11th, including 17 adult males only eight of which appeared to be paired-up.

Table 7. Counts of Scaly-sided Mergansers during northward migration in 2025 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites.

Date	Count Area #												Count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
1/3	-	-	-	-	-	0	0	0	0	20	2	0	22	22	22
4/3	-	-	-	-	-	0	0	0	0	3	3	0	6	22	23
8/3	-	-	-	-	-	-	0	0	0	15	7	0	22	38	39
11/3	-	-	-	-	-	0	0	0	2	15	24	0	41	57	58
16/3	-	-	-	-	-	0	0	0	0	18	14	0	32	57	61

Note: dashes indicate that no count was made at this count site on that date

With the support of the EAAFP small grant (confirmed in June 2025), we were able to conduct 19 day-counts between October 20th and December 28th. These counts reveal six peaks, with the highest of these being 100 on November 3rd and 90 on November 18th (Table 8, Figure 8).

Table 8. Counts of Scaly-sided Mergansers during southward migration in 2025 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites

Date	Count Area #												Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
20/10	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
27/10	0	0	0	0	0	0	2	0	18	15	8	0	43	43	44
30/10	0	0	0	3	0	5	2	0	14	0	1	0	25	43	52
3/11	0	0	0	0	0	22	2	8	7	30	31	1	100	118	138
7/11	0	0	0	0	0	10	6	0	12	20	10	0	58	118	147
11/11	0	0	0	7	8	2	6	4	8	15	24	1	75	135	181
15/11	0	0	0	0	0	0	8	2	6	24	6	2	48	135	193
18/11	0	0	0	0	0	8	11	0	12	52	7	0	90	177	236
21/11	0	0	0	0	0	8	7	0	12	20	6	9	62	177	245
24/11	0	0	0	0	0	4	7	0	12	9	5	6	43	177	245
27/11	-	-	-	-	-	0	3	0	5	7	6	0	21	177	246
30/11	0	0	0	0	0	0	0	0	7	0	5	0	12	177	248
3/12	0	0	0	0	0	0	0	0	0	0	16	0	16	181	259
7/12	-	-	-	-	-	0	0	0	0	0	0	0	0	181	259
10/12	0	0	0	0	2	2	0	0	0	6	0	5	15	181	275
13/12	0	0	0	0	0	0	0	0	0	0	0	0	0	181	275
16/12	0	0	0	0	0	3	0	0	0	0	5	0	8	189	283
23/12	0	0	0	0	0	0	4	5	12	8	5	6	40	230	318
28/12	-	-	-	-	-	0	0	0	0	0	6	0	6	230	319

Note: dashes indicate that no count was made at this count site on that date

As in 2024, there was strong evidence of birds continuing to pass through the Imjin River in December, with 40 recorded on December 23rd – a fifth of the total number estimated to over-winter in the ROK. These birds were counted during the passage of a cold front which dropped the season's first heavy snow (Table 9).

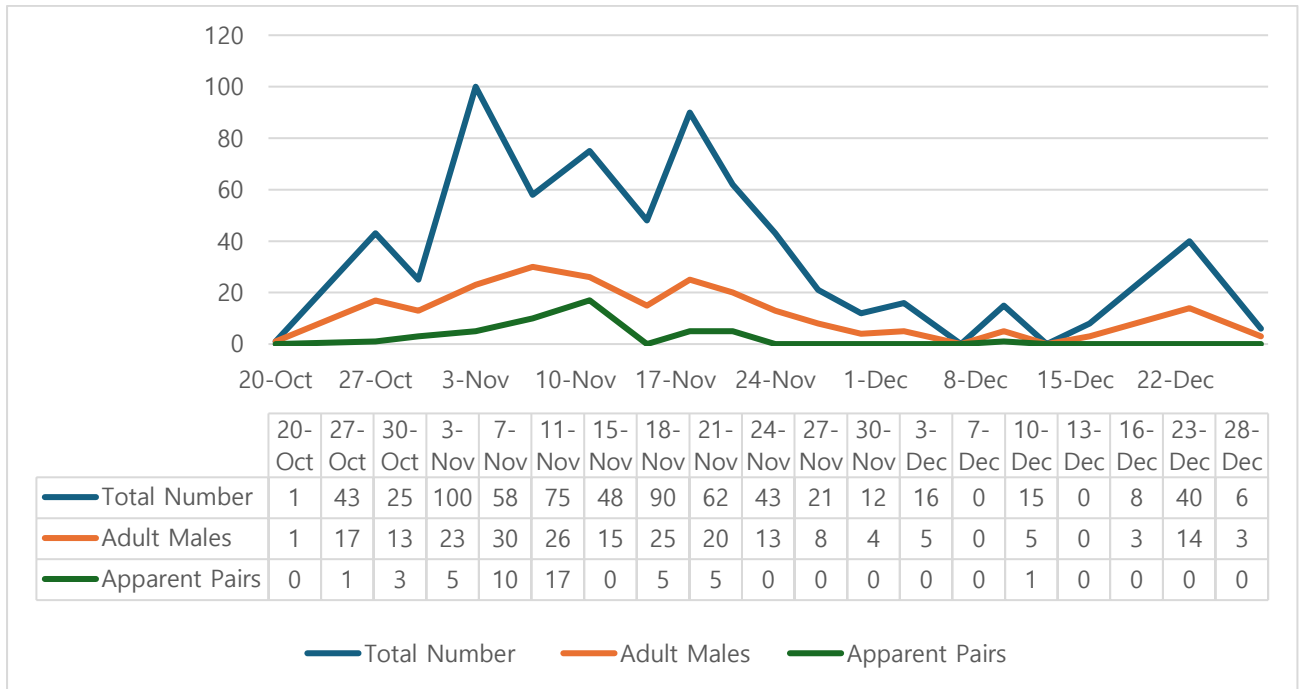


Figure 8. Number of Scaly-sided Merganser by day-count recorded during southward migration, 2025.

Table 9. Daily weather conditions, Cheorwon (November 1-8 and December 20-24) and Dongducheon (November 17-21), on selected dates near to peak counts in November and December 2025. From data.kma.go.kr

Date	Maximum Temperature	Minimum Temperature	Wind Direction	Maximum Wind Speed m/s	Precipitation
1/11	16.4	7.8	SW	3.8	0.6
2/11	9.6	-1.1	WNW	4.4	0.3
3/11	12.9	-3.1	SW	1.8	
4/11	14.8	-1.0	SW	2.5	
5/11	17.1	-0.1	NW	1.8	
6/11	17.4	0.8	NNW	1.6	
7/11	19.6	2.7	NNW	4.1	
8/11	15.4	8.7	NNW	3.1	
17/11	8.6	-2.0	WNW	5.2	
18/11	6.6	-5.0	WNW	3.8	
19/11	7.5	-5.0	WSW	2.9	
20/11	14.6	-2.0	WSW	6.3	
21/11	12.1	-3	W	5.5	
20/12	9.0	-0.2	S	2.8	1.0
21/12	0.3	-7.9	WNW	3.8	
22/12	3.5	-10.6	N	1.4	
23/12	0.3	-7.1	NW	2.2	10.5: snow

In January, we made seven day-counts, finding between zero and four individuals. In February, we counted four on the 3rd and two on the 9th.

By February 12th, northward migration had started. Numbers built up to a peak day-count of 53 on March 15th, and trailed off in late April, with the last two individuals seen on April 20th – the latest records of this species during northward migration in the ROK that we are aware of (Figure 9, Table 10).

Unlike in previous springs, adult males comprised only a third or so of the total numbers counted until mid-March until their peak of 33 on March 15th – the highest day-count to date of adult male Scaly-sided Merganser along this stretch of river during northward migration.

With funding support from the EAAFP small grant, we also tried to observe Scaly-sided Merganser on four late afternoons and nights in March 2026 (March 9th, 25th, 26th and 27th), from near to the new centre constructed at Dongi-Ri immediately adjacent to the river in Count Site 11. This was in order to advise Yeoncheon County on their proposal to use flood-lights to illuminate the river and geologically interesting columnar joints in this area.

We are aware of guidance published by EAAFP (2025) that states: “Light pollution transcends geographical boundaries and poses a significant environmental challenge impacting all living beings.” However, a literature search revealed that very little research appears to have been conducted to date on any species of merganser at night. A paper published by Marquiss & Duncan (1994) did include an important observation on Common Merganser (a species also found along the Imjin River at Dongi-Ri) from the Dee River catchment in Scotland: “All birds left the roost before sunrise and returned from 50 minutes prior to, until 10 minutes after sunset” suggesting that at least Common Merganser can have preferred roosting areas separate from their foraging areas. A study using radar in the Netherlands also found that the vast majority of mergansers fed during the day and roosted at night (Dirksen et al. 2007). My own opportunistic observations of Scaly-sided Mergansers at one site on the Nakdong River in the 2000s suggest that at least some Scaly-sided Merganser might also share similar behaviour, apparently commuting between a secure, undisturbed roost site used at night and areas used for foraging during the day.

We therefore used a high-quality thermal monocular (Hikmicro Condor 2 CH 35L) to observe Scaly-sided Merganser on four late afternoons and nights in March 2026 (March 9th, 25th, 26th and 27th), from near to the new centre at Dongi-Ri. The timing of each date of survey allowed birds to be detected and identified to species through typical optics before sunset; and potentially to follow movements of birds at dusk and after dark if they remained out on open water.

Between six and 12 Scaly-sided Merganser were present on each date of survey. On each date, an hour after dark, we could not detect any Scaly-sided Merganser, either because they had all left the site or because their thermal signatures were not possible to make out against the noisy background of rocks and flowing water. On each date, at least 5-8 individuals were seen swimming upstream (potentially toward Count Site 10) at or within 30 minutes of sunset; while others were seen to fly downstream (or initiate migration?). It therefore seems reasonable to suggest that, like Common Merganser in one study area in Scotland, Scaly-sided Merganser might also have preferred night-time roost sites on the Imjin River, in addition to preferred foraging areas used during the day.

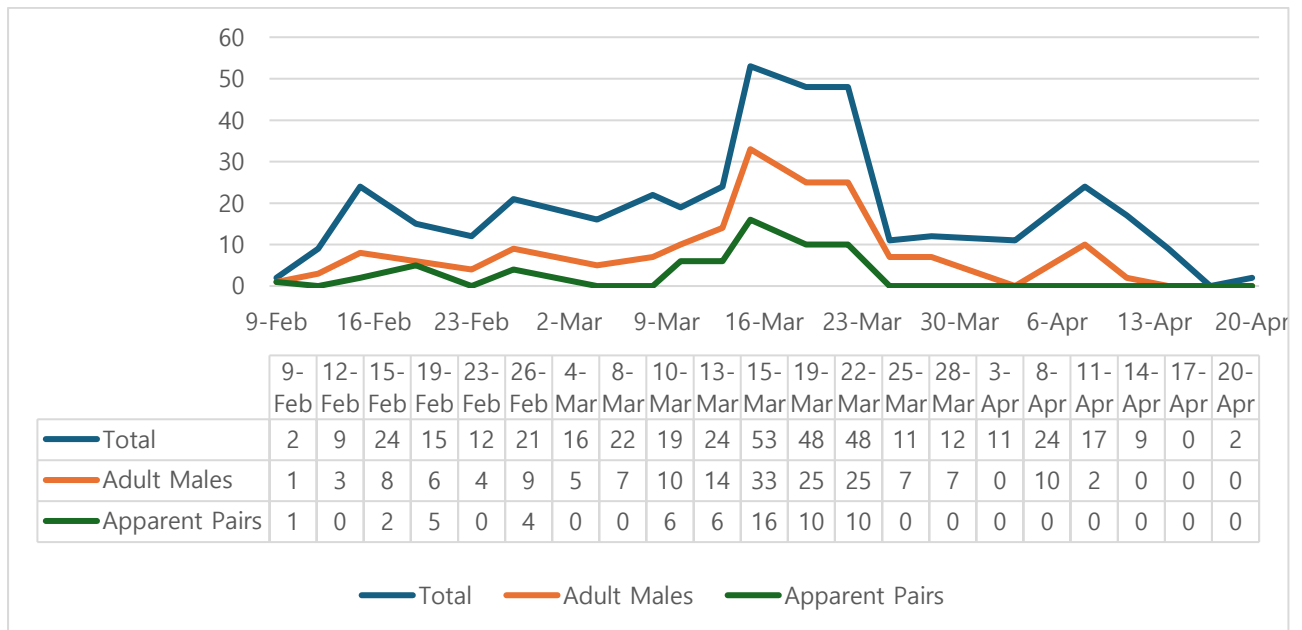


Figure 9. Number of Scaly-sided Merganser by day count recorded during northward migration, 2026.

Table 10. Counts of Scaly-sided Mergansers during northward migration in 2026 with counts by Count Site, expressed as Day-counts, Cumulative Total of the Difference in Day-counts and the Cumulative Total of the Difference each count between Count Sites

Date	Count Area #												Day-count Total	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
	1	2	3	4	5	6	7	8	9	10	11	12			
12/2	-	-	-	-	-	-	1	0	0	0	8	0	9	9	9
15/2	-	-	-	-	-	-	0	0	7	0	17	0	24	24	25
19/2	-	-	-	-	-	-	0	0	0	2	13	0	15	24	27
23/2	0	0	0	0	0	0	0	0	1	2	9	0	12	24	28
26/2	-	-	-	-	-	0	2	0	4	4	11	0	21	33	37
4/3	0	0	0	0	0	0	0	0	0	0	16	0	16	33	42
8/3	2	0	0	0	0	2	0	0	0	10	8	0	22	38	46
10/3	0	0	0	0	0	1	0	0	0	7	11	0	19	38	49
13/3	-	-	-	-	0	0	0	5	1	10	9	0	25	44	58
15/3	0	0	0	0	0	0	0	0	8	27	18	0	53	62	91
19/3	0	0	0	0	0	0	4	0	2	24	18	0	48	62	95
22/3	0	0	0	0	0	0	1	0	0	22	2	0	25	62	95
25/3	0	0	0	0	0	0	0	0	0	3	8	0	11	62	101
28/3	2	2	0	0	0	0	0	6	0	0	2	0	12	63	111
3/4	-	-	-	-	-	0	0	0	0	11	0	0	11	63	122
8/4	0	0	0	3	0	0	0	0	4	17	0	0	24	76	135
11/4	0	0	6	0	0	0	0	0	0	11	0	0	17	76	139
14/4	0	0	0	0	0	0	0	0	0	9	0	0	9	76	139
17/4	0	0	0	0	0	0	0	0	0	0	0	0	0	76	139
20/4	0	0	0	0	0	0	0	0	0	2	0	0	2	78	141

Note: dashes indicate that no count was made at this count site on that date

2021-2026

Peak Day-counts and Geometric Means

Based on the highest day-count each migration season alone, during the northward migration period we found more than 1% of population of Scaly-sided Merganser along the key 21km stretch of the Imjin River in the Yeoncheon Imjin River FNS in four out of five years (Table 11), with a 5-year geometric mean of 53. Allowing for an estimate of turnover, we found a 4-year geometric mean estimated at between 59-102 individuals (1-2% of the population).

Table 11. Number of Scaly-sided Merganser counted in the Yeoncheon Imjin River FNS each migration season (2022-2026)

Year	Peak Day-count	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
2022	56	-	-
2023	56	63	141
2024	47	54	90
2025	41	57	61
2026	53	78	141

Based on peak day-counts alone, during the southward migration period we found more than 1% of population in all years (Table 12), with a 5-year geometric mean of 106 (2-3%). Using our methods for estimating turnover, we found a 3-year geometric mean estimated at between 162-275 (3.6%-6%).

Table 12. Southward Migration Period

	Peak Day Count	Cumulative difference of each increase between day-counts	Cumulative difference of each increase between Count Sites each day-count
2021	144 (150)	-	(198)
2022	96	-	-
2023	91	116	275
2024	105	159	237
2025	100	230	319

Timing of Migration

Our research found that northward migration at least in some years started in mid-late February (earliest was between February 12th-15th in 2026), peaked each year in March, and extended into April, with the latest record two on April 20th (2026). Each northward migration contained a series of peaks and troughs with the highest day-counts concentrated in the second decade of March. Some of the troughs might be due in part to incomplete counts (meaning reduced counts on those dates); while the higher peaks indicate immigration to the Imjin River. In all years, the majority of late-migrating birds were immatures or “female-types”.

Figure 10 shows all counts of Scaly-sided Merganser made during the northward migration period between March 5th and April 20th 2022-2026. At least in 2026 (purple), the peaks were slightly lower than in 2022 (blue), and numbers remained higher later in the season. This did not appear to be because of differences in local temperatures: April in 2022 was 2.1C above the average, and April in 2026 was 2.6C above the average (data.kma.go.kr). Because of differences in count effort, and also differences in weather, between years, it is difficult to ascribe a reason to such differences.

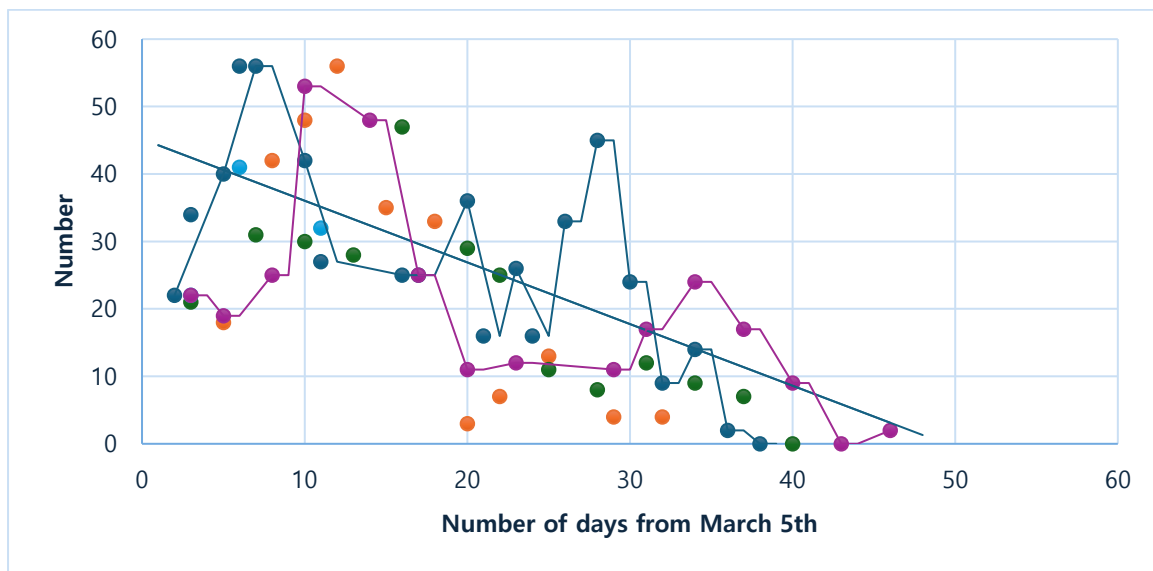


Figure 10. Number of Scaly-sided Merganser counted at the 12 Count Sites along the Imjin River during northward migration each year between 2022 (blue) and 2026 (purple).

Southward migration

The first Scaly-sided Merganser tend to arrive in the Yeoncheon Imjin River FNS on or before October 20th; migration peaks in mid-November; and in those years with sufficient count effort, influxes of birds continue into December, with the latest such peak being recorded on December 20th (Figure 12).

Figure 11 shows the highest counts each 5-day period each year (2021-2025) made during southward migration from October 20th to December 20th (the exception being the six-day period from October 25-31st). The trend lines for 2022 (orange) and 2025 (purple) are shown.

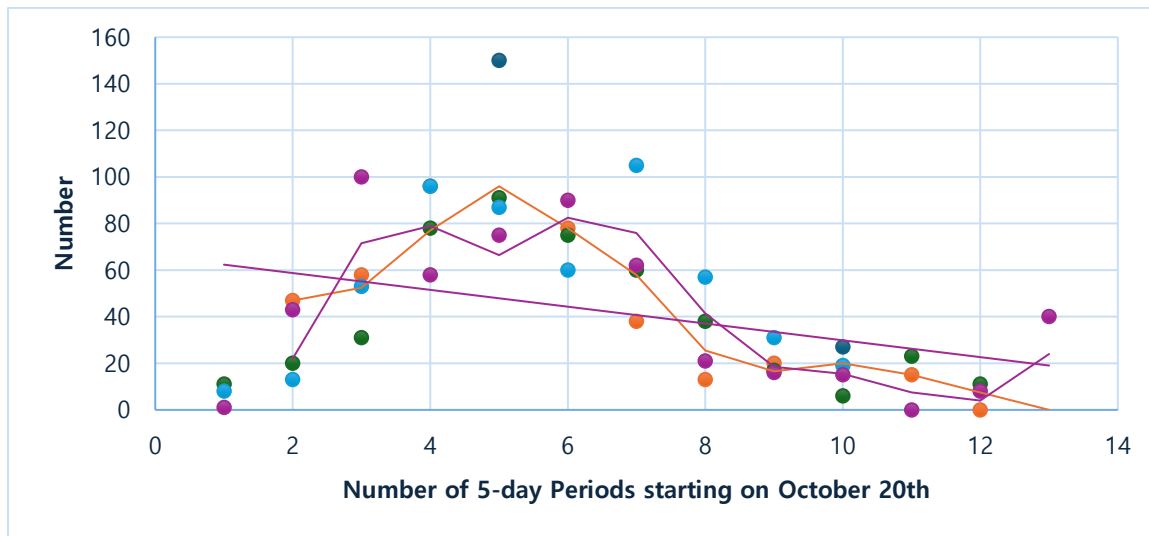


Figure 11. Number of Scaly-sided Merganser counted at the 12 Count Sites along the Imjin River during southward migration divided into 5-day periods each year between 2021 (blue) and 2025 (purple).

Distribution of Scaly-sided Merganser along the Imjin River

Since the start of our surveys of Scaly-sided Merganser in the Yeoncheon Imjin River Biosphere Reserve in late 2021, there have been substantial changes to adjacent habitat especially in Count Sites 7, 8, 9, 10 and 11. Research in the ROK and in PR China suggest such changes will likely be detrimental to the species (e.g., Moores & Kim 2014; Zeng et al. 2015; Moores et al. 2023b). This includes: at Count Site 7, the construction of private housing to the west of the river, and the widening of the bund road to the east, and the opening of a park golf course close to the river in 2025. In 2026, a new pet park is being constructed close to the east bank of the river in Count Site 8; and in 2024-2025, there was substantial construction along the western side of Count Sites 8 and 9, with repairs to a pumping station and especially the construction of new roads and camping areas to the west. In count site 10, a camp site was expanded in 2022 and 2023; and changes in Count Site 11 include the opening of a hiking trail along the river in 2022; and the construction of a large new centre by local government in late 2025.

Although counts of more than 25 individual Scaly-sided Merganser were recorded during southward migration in 2021 at Count Sites 6 and 7, review of count data confirms that almost all similarly high counts during both migration periods in subsequent years have only been at Count Sites 10 and 11. In Table 13, the total number of Scaly-sided Merganser each day-count at each count site were added together through the northward migration period in 2022 (count sites for only 13 out of 21 day-counts were available) and in 2026 (19 dates); and for the southward migration period in 2023 (22 dates) and 2025 (19 dates).

A direct comparison of these counts suggests that the total number of Scaly-sided Merganser was higher in 2022 and 2023 than in the same seasons in 2026 and 2025. In all four migration periods the most important count sites were Count Site 10 and Count Site 11 (containing 31.5-48% and 20.5-39.5% respectively of all Scaly-sided Mergansers counted). Changes in numbers between most sites between years appeared to be minor, with the most substantial decline in numbers being in Count sites 10 and 11; and the most substantial increase being in Count Site 12 during southward migration, presumably because of the displacement of disturbed birds from Count Site 11 due to construction and the increased number of human visitors to the river there.

Table 13. Addition of numbers of Scaly-sided Merganser recorded during each migration season at each of the 12 Count Sites, with percentage of the total that migration season.

Count	Northward Migration				Southward Migration			
Site #	2022		2026		2023		2025	
1	2	0.5%	4	1%	8	1%	0	0
2	0	0	2	0.5%	7	1%	0	0
3	2	0.5%	6	1.5%	37	5%	0	0
4	2	0.5%	3	1%	5	0.5%	10	1.5%
5	4	1%	0	0	4	0.5%	10	1.5%
6	2	0.5%	2	0.5%	14	2%	64	9.5%
7	19	5%	7	2%	44	5.5%	58	9%
8	14	4.5%	11	2.5%	72	9.5%	19	3%
9	4	1%	27	3%	55	7%	125	19%
10	183	48%	154	44%	330	43%	206	31.5%
11	152	39.5%	131	38%	186	24.5%	135	20.5%
12	0	0	0	0	4	0.5%	31	4.5%
Grand Total	384		347		766		659	

Concluding Remarks

A constant monitoring program is needed in the Yeoncheon Imjin River FNS together with analysis of environmental variables in order to identify whether the (strongly) suspected decline and concentration of Scaly-sided Mergansers since 2021 has been caused by (1) changes in the Imjin River itself; (2) changes in the habitats adjacent to the river; (3) a decrease in that part of the population that migrates through the Korean Peninsula or (4) a combination of all three.

As part of our obligations under KRA 1.5 (“Partners and local stakeholders are engaged in responding to activities which may threaten Flyway Network sites”), Birds Korea continues to provide detailed advice to Yeoncheon County on ways to reduce disturbance to Scaly-sided Merganser through annual biodiversity reports and at seminars and meetings. Urgent measures we have already identified include e.g., placing screens along a sensitive stretch between Count Sites 10 and 11; ensuring the new pet park is at least 100m from the river next to Count Site 8; and relocating the walking trail and park golf course away from the river next to Count Site 7. Although provincial and especially central government bodies (including the Cultural Heritage Administration and various bodies within the national Ministry of Climate, Energy and Environment) likely have sufficient funds to conduct such work, this appears not to be the case at the county level (in Yeoncheon and elsewhere).

There is therefore a need, based on our experience here and at other Flyway Network Sites, for a formal mechanism through which key stakeholders, including managers and NGO members of Task Forces, can more easily appeal or apply for funds from national government bodies and / or major corporations for essential work. This could be as simple as an open letter from the EAAF Partnership confirming the need for additional support for that Flyway Network Site.

In addition to survey work and the writing of this report, part of the small grant was also allocated to making two designs for signboards that could then be placed in the Yeoncheon Imjin River FNS – helping to raise awareness both of the Scaly-sided Merganser and of the international importance of the Imjin River to biodiversity in accordance with Partnership Objective 2.

The first sign was designed following input from 4th year school students at a school in Yeoncheon County under the direction of Teacher Kim Hyeonseo for use on two noticeboards which have now been funded and placed by Yeoncheon County. Kim Hyeonseo first provided introductory information on the Scaly-sided Merganser to her students. This was then followed by a school visit by Lee Su-Young and Lee Soo-Jin (of Birds Korea Yeoncheon), to provide more detailed information and to answer students' questions before they worked on text and images.



Figure 12. Lee Su-Young explaining about the migration of Scaly-sided Merganser; and the resultant signboard placed in the Yeoncheon Imjin River FNS by Yeoncheon County.

The second signboard design is currently being created by a local artist with submission by the end of November 2026, with subsequent placement by Yeoncheon County (perhaps in 2027).

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