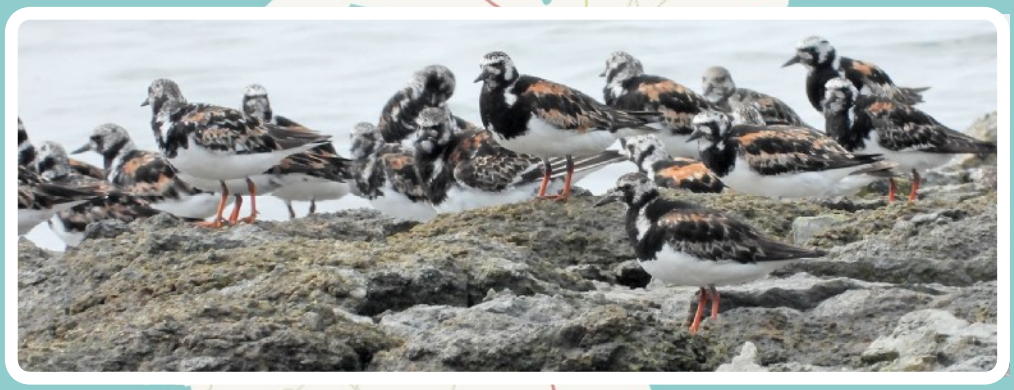
Aphae Island - Shorebird Counts

2010 - 2020

Andreas Kim



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Recommended quotes
Andreas Kim 2020, Aphae Island - Shorebird countss 2010-2020

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Picturelist
- Andreas Kim
  Page: Cover, 2, 3TL, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19,20, 21, 22, 23, 25, 26T
- SeokYee Kim
  Page: 3B
- KyeongGyu Lee
  Page: 3TR, 26B

Dunlin
Calidris alpina

Executive Summary

Aphae Island is an important stopover and staging site for migratory birds nationally and internationally. Documented monitoring of the site started with the first counts from the Shorebird Network Korea and has improved over the years. Even though in recent years the number of counts has increased, the published and unpublished data indicates that these counts still do not reflect the correct number of birds the site supports. Therefor a monitoring plan, that considers all known aspects of timing, length of stay of birds should be setup, and the resources to execute this plan should be made available. Birds and people use the tidal-areas alike and disturbances for birds are happening often, especially when the birds have their resting times on the few bigger roosting locations that are available for the birds. To reduce these disturbances even more, the projects for shielding certain areas along the tidal-areas should be continued. In addition an educational program should be developed that can educate especially the local communities about the birds, their migration, the importance of the site for the birds but also about the obligations from international agreements for the protection of migratory birds and how the local communities can contribute for a good coexistence. Furthermore, a more often presence in the local media with positive stories about projects, bird- and migration highlights can increase the understanding and support for the site. This report analyzes and discusses the available datasets, lists some key recommendations and encourages administrations to consider these.

Introduction

With the establishment of the Shorebird Network Korea regular countings of shorebirds were conducted during the migration seasons in spring and autumn. The first count was done the autumn of 2010. This report looks at these count data sets for Aphae island with a focus on season and the tidal-area the birds were counted on. The latter information was recorded separately since 2016. For the season the graphs show data from 2010 to 2020 and for the tidal-areas from 2016 to 2020. This report intentionally does not look on the absolute count numbers because for the goal of this report they are not relevant but will be part of a separate paper that is in preparation.

With this data, the global and local conservation status of the species and the years of experience of monitoring the site, this report wants to create a basis for discussions and planning by establishing an understanding what improvments for monitoring, improvments to the site and conservation activities can be useful for a better management of the site.

Aphae Island

Aphae Island is a 'Y'-Shape Island located directly west of the city of Mokpo and a bridge connects it to the mainland since 2010. It is the most eastern island with tidal mudflats and it, with numerous surrounding islands and their tidal-flats, is part of a county's wetland protection area as well as included in the UNESCO Shinan Dadohae Biosphere Reserve. Due to its 'Y'-shape the island has three huge tidal-flat areas, commonly named as Eastern, Northern and Southern tidal-flat. They provide different values for birds.

도면 1 압해도갯벌 **Fig. 1** Aphae Island and tidal-flats

Aphae Island Eastern Tidal-flat

Aphae Island Northern Tidal-flat

Aphae Island Southern Tidal-flat

Datasets

The dataset that are used for this report are only officially published records. From autumn 2010 to spring 2014, these counts were conducted by the Shorebird Network Korea and were published in several reports (SNK2010-2014). The autumn 2014 and spring 2016 counts were organized by the Ministry of Oceans and Fisheries and were published in one report (MOF2015). From spring 2016, the National Institute for Biological Resources (NIBR) organized all counts. Even though we have no knowledge of any publication of the count data, we consider them as published because they were provided for such purpose. In addition, for two species the data of the Winter Bird Census conducted by the Ministry of Environment, which are published in annual reports (MOE2010-2020), is used.

In all years, the same team of experts carried out the counts and therefore a consistency of the data can be assumed. In the period of the SNK, only two counts per season were conducted: in spring one in April and one in May, in autumn either one in August and one in September or one in September and one in October. In the autumn 2015 no official count was conducted. From 2016 on, the number of counts per season varies between two and six.

For this report, only sixteen species out of the recorded list of thirty are selected. The species not selected have only few count records, which are not suitable for wider analysis. Even though some of these species have an elevated status on the IUCN Red List of Threatened Species (IUCN2020), their few records and small numbers do not make them key target species for conservation efforts at this site.

For all except two, the selected species have a declining global population trend. The two exceptions are Common Greenshank *Tringa nebularia*, which has a stable trend and the trend for the Mongolian Plover is unknown.

For each select species the data is presented on the following pages with two charts. The first chart shows the counts totals by season (spring and autumn) from 2010 to 2020. From 2016 on, the counts were recorded for the three tidal-areas (east, north, south) of the site and the second chart presents these counts.

A separate project, which started in 2017, determined all possible roosting locations for shorebirds on Aphae Island. Many possible locations especially on the eastern tidal-area but also on the northern one that are suitable for birds were identified. Access and monitoring these locations is challenging and resource intensive and so comprehensive data for these locations is only slowly building up.

세 조수 지역의 카운팅팀 Countingteam at the three tidal-areas

Table 1. Selected shorebird species recorded on the Aphae Island tidal-flats with Global Conservation Status (GCS) (IUCN 2019), National Redlist Status (KCS) (NIBR 2014) and number of sightings of marked individuals during the monitoring period (Cnt).

#	Name English	Name Scientific	GCS	KCS	Population trend
S-1	Eurasian Oystercatcher	*Haematopus o. osculans*	NT	VU	↓ decreasing
S-2	Grey Plover	*Pluvialis squatarola*			↓ decreasing
S-3	Kentish Plover	*Charadrius alexandrinus*			↓ decreasing
S-4	Mongolian Plover	*Charadrius mongolus*			unknown
S-5	Bar-tailed Godwit	*Limosa lapponica*	NT		↓ decreasing
S-6	Whimbrel	*Numenius phaeopus*			↓ decreasing
S-7	Eurasian Curlew	*Numenius arquata*	NT		↓ decreasing
S-8	Far Eastern Curlew	*Numenius madagascariensis*	EN	VU	↓ decreasing
S-9	Common Greenshank	*Tringa nebularia*			stable
S-10	Grey-tailed Tattler	*Tringa brevipes*	NT		↓ decreasing
S-11	Terek Sandpiper	*Xenus cinereus*			↓ decreasing
S-12	Ruddy Turnstone	*Arenaria interpres*			↓ decreasing
S-13	Great Knot	*Calidris tenuirostris*	EN		↓ decreasing
S-14	Red-necked Stint	*Calidris ruficollis*	NT		↓ decreasing
S-15	Dunlin	*Calidris alpina*			↓ decreasing
	Other species that depend on tidal-flats and are of special interest				
S-16	Chinese Egret	*Egretta eulophotes*	VU	VU	↓ decreasing

Eurasian Oystercatcher *Haematopus ostralegus*

The datasets show that the Oystercatcher are a regular spring visitor to the side. The first birds arrive as early as February and therefore the count schedule in the first years missed the peak staging period in the early spring. The later years with earlier counts in the season show a constant number of birds which then declines by mid-April when the birds head out to their nesting islets.

There have been only very few birds recorded during the autumn migration periods. As there were also newly banded birds in that group, it is presumed that these birds were still learning their migration routes to the more northern sites in the Korean peninsula.

The Oystercatcher use almost exclusively the southern tidal-area. Only three times very few birds were also recorded on the northern area.

Eurasian Oystercatcher *Haematopus ostralegus* (Spring)

Eurasian Oystercatcher *Haematopus ostralegus* (Autumn)

Fig. S-1-1 Spring and autumn counts

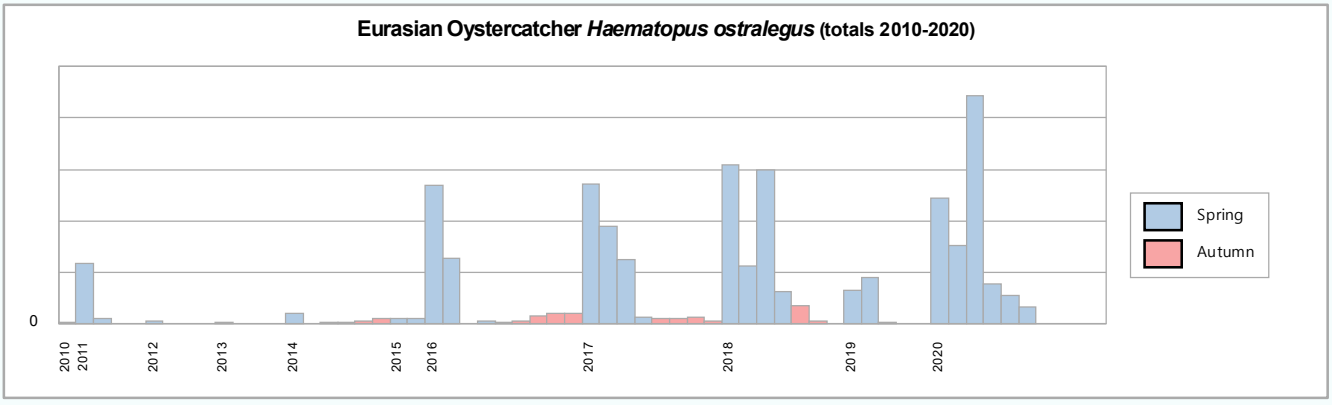
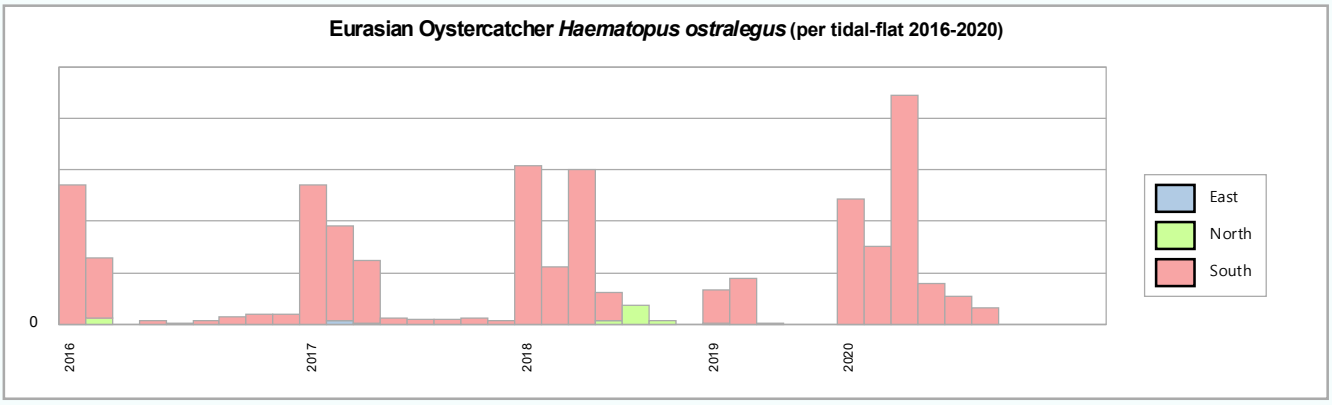


Fig. S-1-2 Counts per tidal-flat



Grey Plover *Pluvialis squatarola*

The Grey Plover is one of the most numerous species counted at the site. This species is recorded in the spring and autumn migration seasons for longer periods. This indicates that these birds use the site as staging site.

Records show this species on all three tidal areas. The large majority of birds prefer the northern tidal-area. Small numbers can always be seen on the southern tidal-flat with some more coming over from the northern area when rising tides cover all mud areas. The counts in recent years indicate that there are several locations on the eastern tidal-area that the birds regularly use.

The MoE Winter Bird Censuses have records with single digit numbers for January and December 2014, January 2017 and three-digit numbers for January 2010 and December 2016.

Grey Plover *Pluvialis squatarola* (Spring)

Grey Plover *Pluvialis squatarola* (Autumn)

Fig. S-2-1 Spring and autumn counts

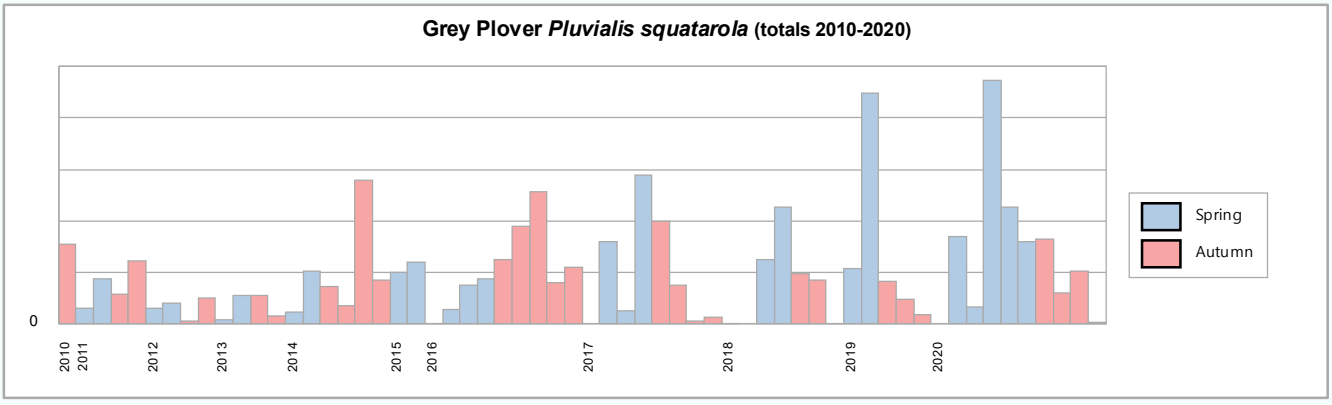
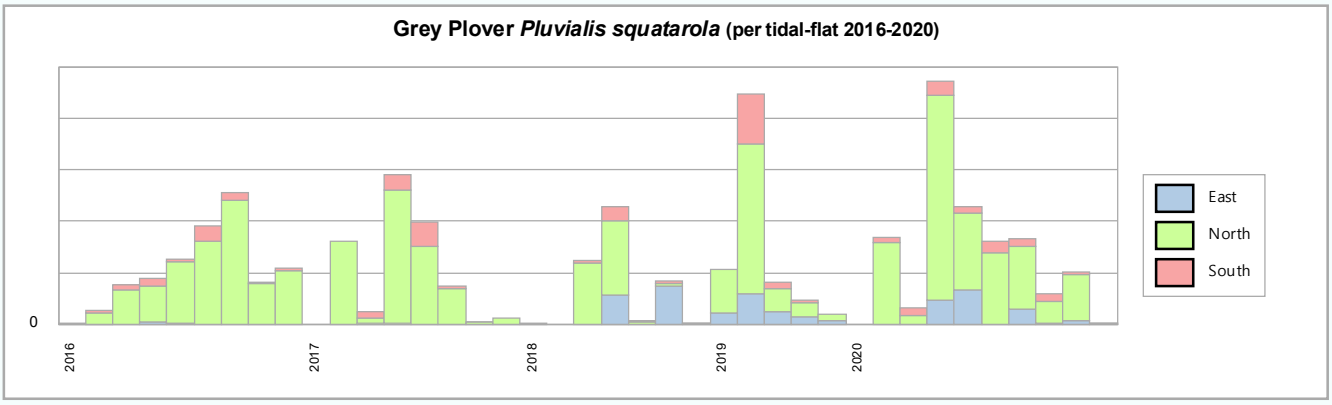


Fig. S-2-2 Counts per tidal-flat



Kentish Plover *Charadrius alexandrinus*

This species is recorded every year at the site with higher two-digit numbers in spring and up to four-digit numbers in autumn. The site is therefore a main migration site for these birds on their way to the wintering grounds.

Birds have been found on all three tidal-areas with the majority and mostly on the southern tidal-area. The records show, that smaller number of birds also use the small available sandy areas on the northern tidal-area. Even though there are few records for the eastern tidal-area, at present more investigation on all possible roosting locations is needed.

There are five records published in the MoE Winter Bird Censuses: low two-digit numbers for January 2011 and 2014, higher two-digit numbers for January 2012 and 2013 and a low three-digit count in December 2014.

Kentish Plover *Charadrius alexandrinus* (Spring)

Kentish Plover *Charadrius alexandrinus* (Autumn)

Fig. S-3-1 Spring and autumn counts

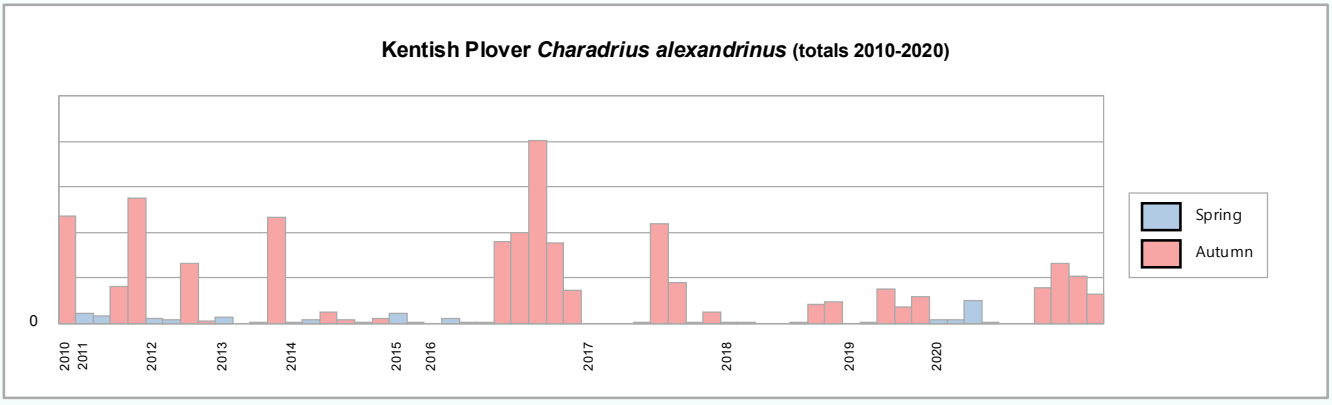
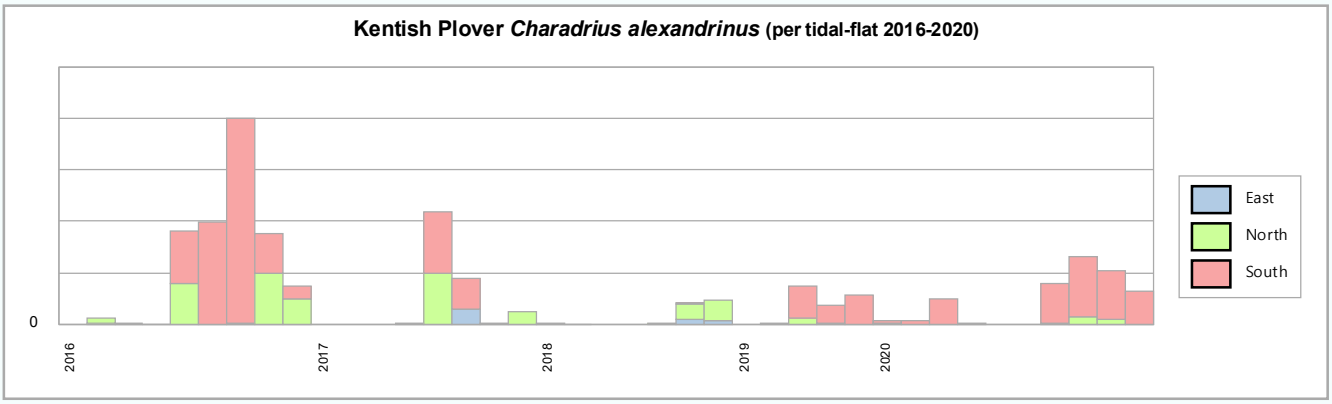


Fig. S-3-2 Counts per tidal-flat



Mongolian Plover *Charadrius mongolus*

Mongolian Plover are regular, but not with every count, recorded in both migration seasons with more records in the autumn counts. The count numbers vary greatly not only between the different migration seasons but also often within one season. Over the years, there are always seasons with high numbers with seasons in between with much lower numbers and it seems there is no stable population visiting the site.

All three tidal-areas are used by this species. As varying the count numbers are, so is the usage of the tidal-areas. On some counts the big majority is on the southern area while on others it is the northern one. Sometimes small flocks can also be found at locations on the eastern tidal-area.

ongolian Plover *Charadrius mongolus* (Spring)

Mongolian Plover *Charadrius mongolus* (Autumn)

Fig. S-4-1 Spring and autumn counts

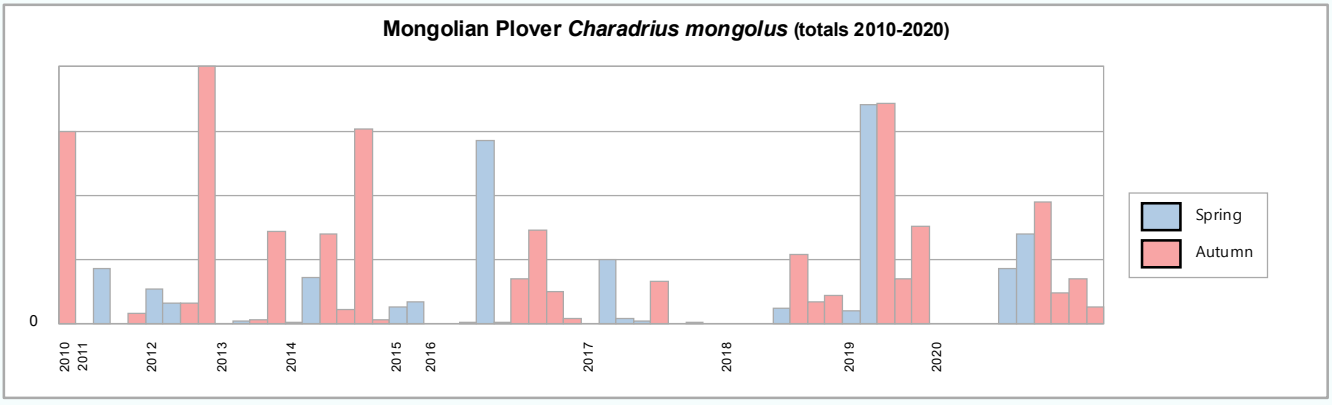
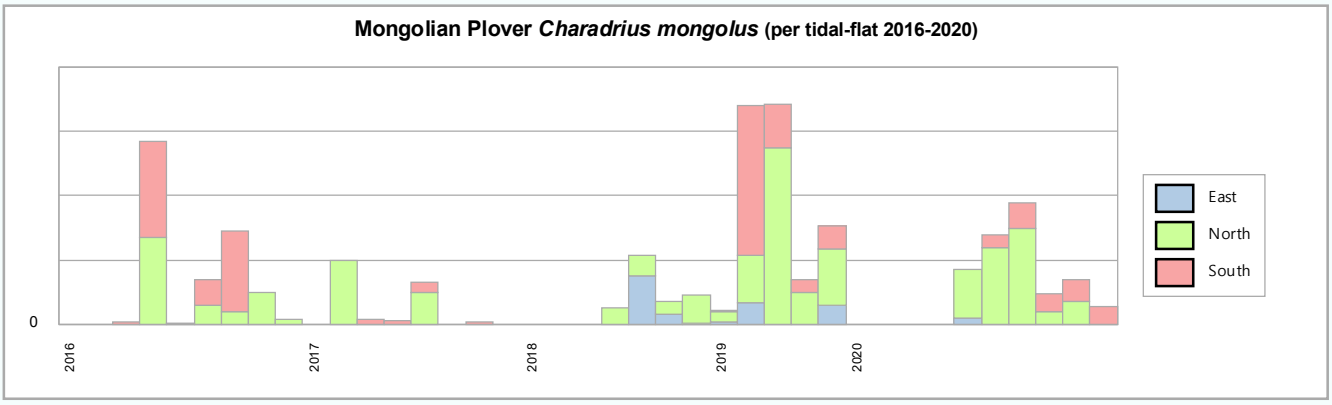


Fig. S-4-2 Counts per tidal-flat



Bar-tailed Godwit *Limosa lapponica*

These Godwits are recorded mainly in the spring. The count numbers vary greatly between the years before and after 2016/2016. From monitoring of banded birds (KIM2020) we know that many Bar-tailed Godwit use the site only for a short stopover, especially in the first half of the migration season. This accounts for the great variations of numbers between the counts. The numbers recorded in autumn seasons are so small that the mostly are not shown in the graph.

All tidal-areas are used with a clear preference for the northern and southern area. Observations showed that groups of birds regularly move from the northern area to the southern area when high-tides submerge the mud-flat areas on the northern part. In the autumn seasons, birds were also recorded on the northern and southern area.

Bar-tailed Godwit *Limosa lapponica* (Spring)

Bar-tailed Godwit *Limosa lapponica* (Autumn)

Fig. S-5-1 Spring and autumn counts

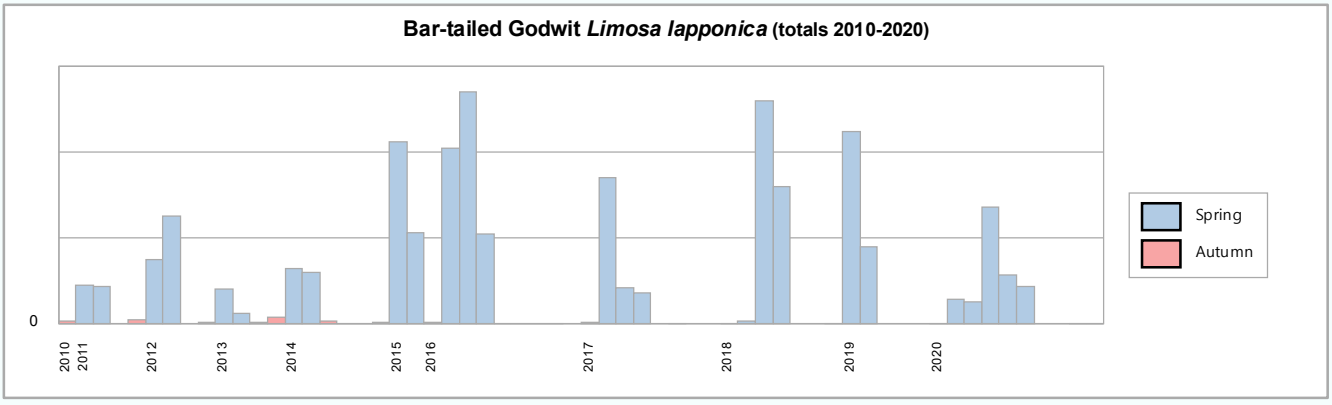
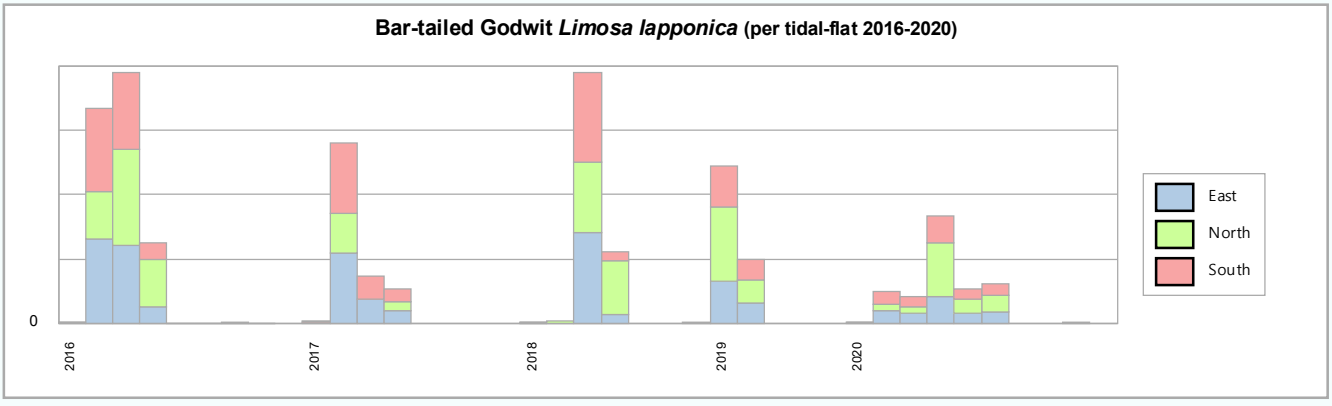


Fig. S-5-2 Counts per tidal-flat



Whimbrel *Numenius phaeopus*

The site is visited in both migration seasons by Whimbrel. Among the long-distant migrants, the birds arrive in spring usually by mid-April and in autumn; they are among the birds that leave the latest. The counts vary but can be considered stable with an average long-term view across the ten years.

The records show that the birds use all three tidal-areas. Apparently, on average the smallest number of birds is using the southern tidal-area while the majority uses the northern one. Two counts show that the eastern tidal-area was used by up to c. a quarter of that count.

Whimbrel *Numenius phaeopus* (Spring)

Whimbrel *Numenius phaeopus* (Autumn)

Fig. S-6-1 Spring and autumn counts

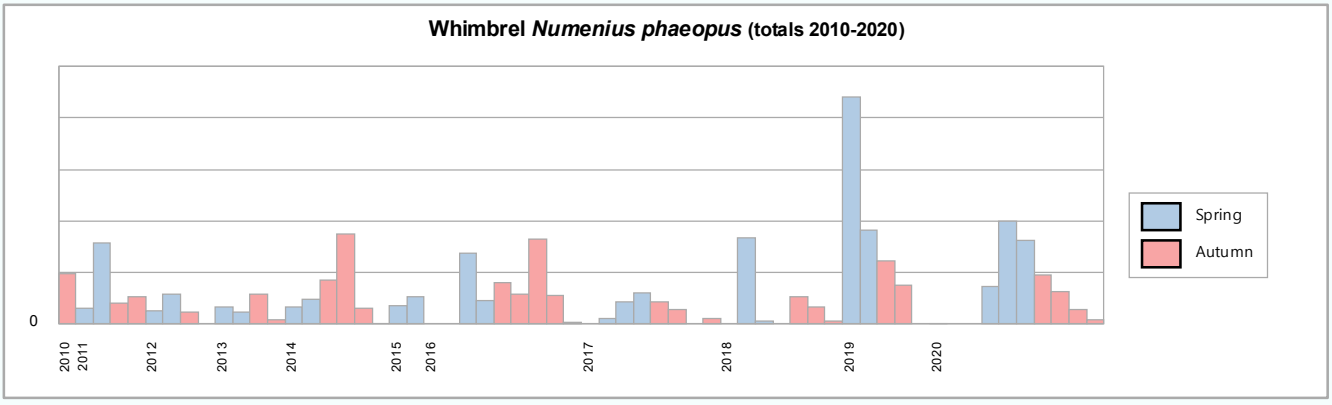
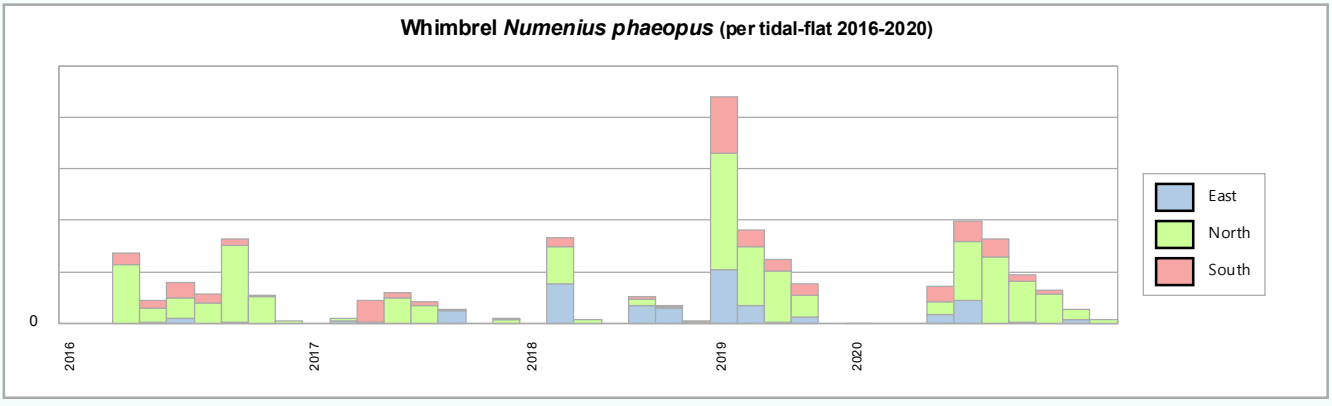


Fig. S-6-2 Counts per tidal-flat



Eurasian Curlew *Numenius arquata*

The Eurasian Curlew was only recorded in seven of the last ten years of which three years have a count number of below five individuals. There is an equal number of counts for spring and autumn.

Birds use the northern and the southern tidal-area with records showing more birds on the northern tidal-area.

Interestingly the MoE Winter Bird Censuses have records for the Eurasian Curlew for every January of the ten years. These counts are in the range or much higher than the autumn counts and so indicating that these Curlews are arriving very late on the site.

Eurasian Curlew *Numenius arquata* (Spring)

Eurasian Curlew *Numenius arquata* (Autumn)

Fig. S-7-1 Spring and autumn counts

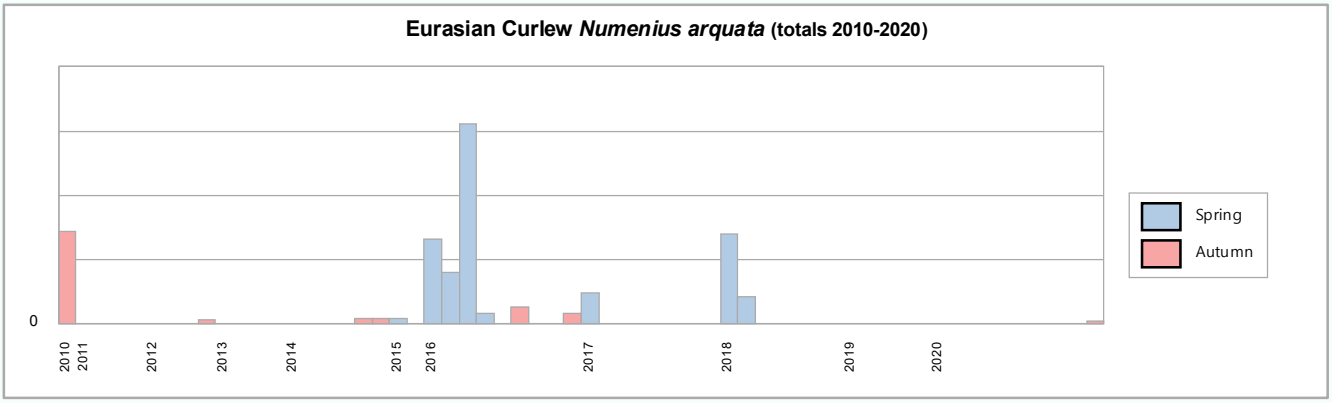


Fig. S-7-2 Counts per tidal-flat

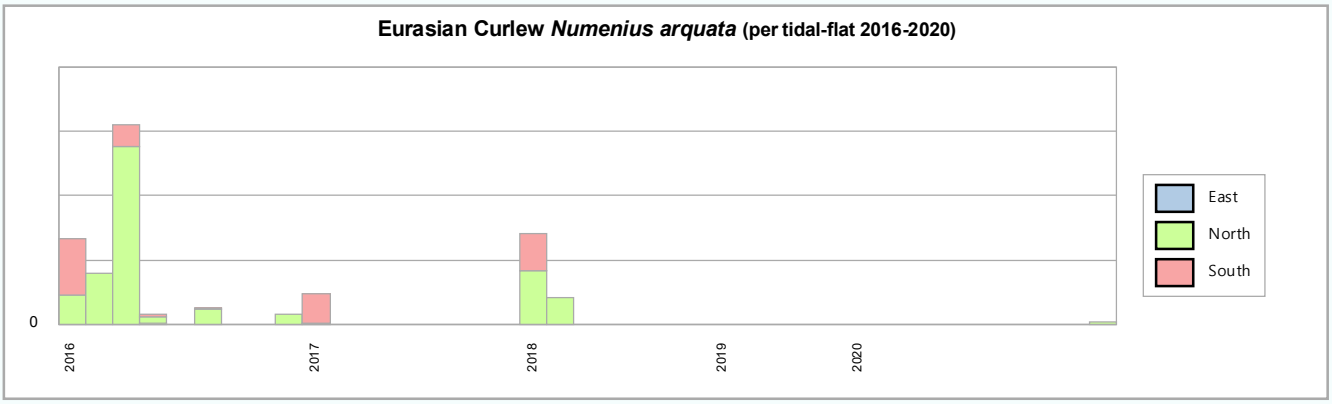
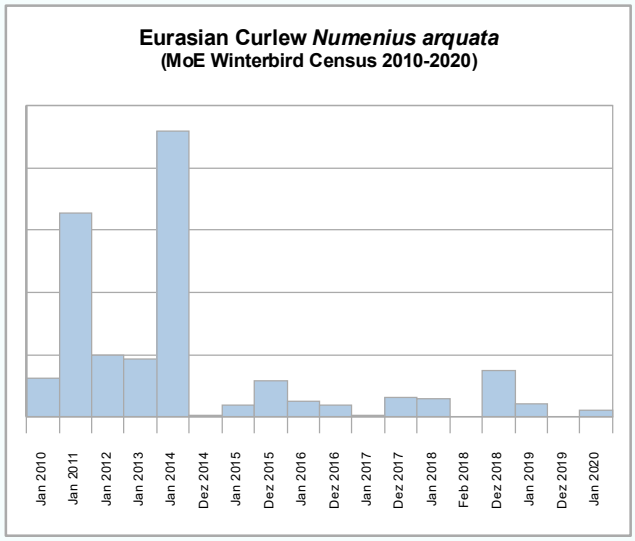


Fig. S-7-3 Spring and autumn counts



Eurasian Curlew *Numenius arquata* (Autumn)

Eurasian Curlew *Numenius arquata* (Autumn)

Far Eastern Curlew *Numenius madagascariensis*

This globally endangered species is recorded at the site regularly. The count numbers are up to the middle double-digit range, but count numbers vary largely and have declined in recent years. Some of the recent count numbers are in the low one-digit range. Birds are recorded in both migration seasons: some years with more in the spring and others with more in autumn.

Records show counts on all tidal-areas with no clear preference for the northern or southern area. Only two counts have birds on the eastern tidal-area and on one of the other areas, five counts have birds on the northern and southern area and all other counts with records have only one tidal-area with count numbers.

Far Eastern Curlew *Numenius madagascariensis* (Spring)

Far Eastern Curlew *Numenius madagascariensis* (Autumn)

Fig. S-8-1 Spring and autumn counts

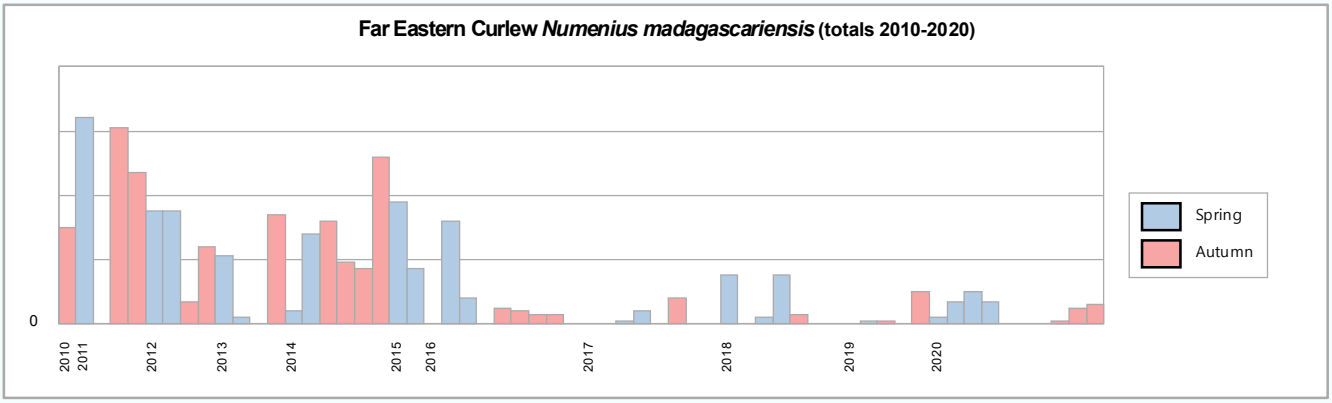
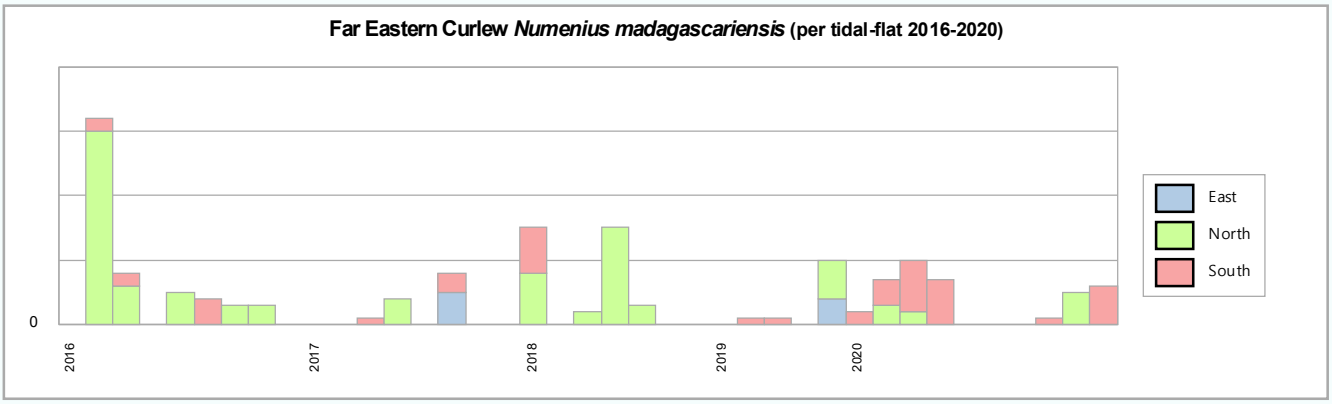


Fig. S-8-2 Counts per tidal-flat



Common Greenshank *Tringa nebularia*

The Common Greenshank is a species that is a regular visitor of the site and the first birds usually arrive by mid-April. Normal count numbers are in the low to mid 3-digit range while peeks can also reach 4-digit numbers. Birds are recorded in both seasons with regularly the higher numbers in the autumn.

All three tidal-areas are used by this species and there is no clear preference for one of them; some counts have the majority of birds on one-tidal area, while other counts have an almost equal number for all areas. In terms of roosting places, the Common Greenshank seems to be very accepting because birds were often found at edges of shrimp ponds and in rice-fields. The count numbers are normally then added to the tidal-area these locations are adjacent to.

Common Greenshank *Tringa nebularia* (Spring)

Common Greenshank *Tringa nebularia* (Autumn)

Fig. S-9-1 Spring and autumn counts

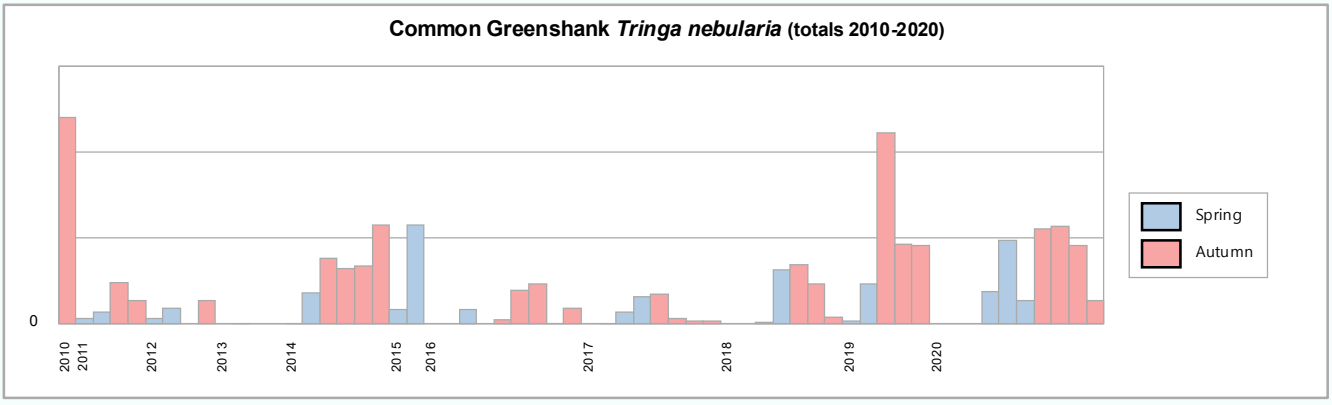
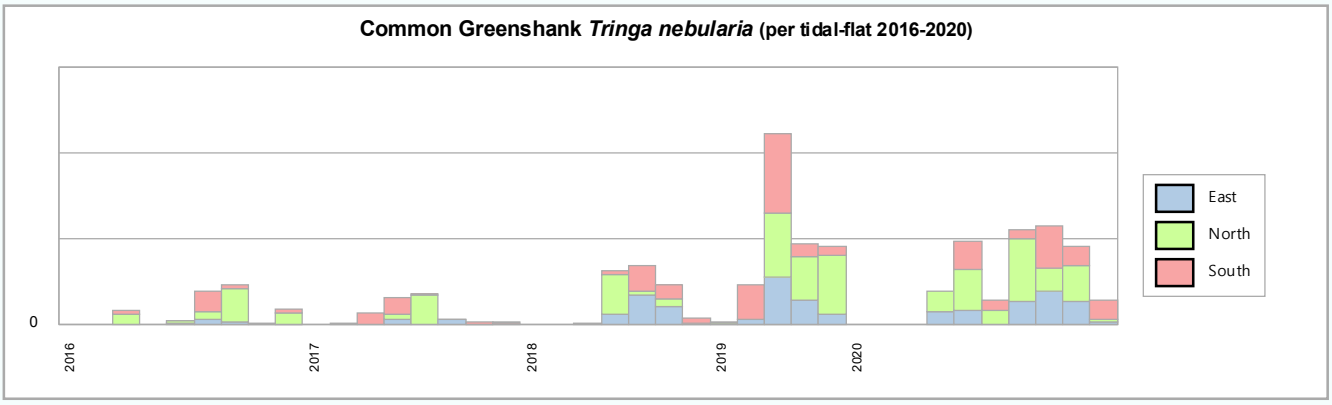


Fig. S-9-2 Counts per tidal-flat



Grey-tailed Tattler *Heteroscelus brevipes*

This species is recoded in less than half of all counts but is still recorded in every year. The Grey-tailed Tattler comes to the site in the spring and the autumn season. The count numbers vary largely between counts and seasons.

The species has been recorded on all three tidal-areas. The number of counts that recorded Grey-tailed Tattler is only a third of the counts that recorded the different tidal-areas. The number of birds on the southern tidal-area are rather small compared with the numbers for the other two areas. The number of counts that recorded this species is not sufficient to tell if there is a preference for the eastern or southern tidal-area.

Grey-tailed Tattler *Heteroscelus brevipes* (Spring)

Grey-tailed Tattler *Heteroscelus brevipes* (Autumn)

Fig. S-10-1 Spring and autumn counts

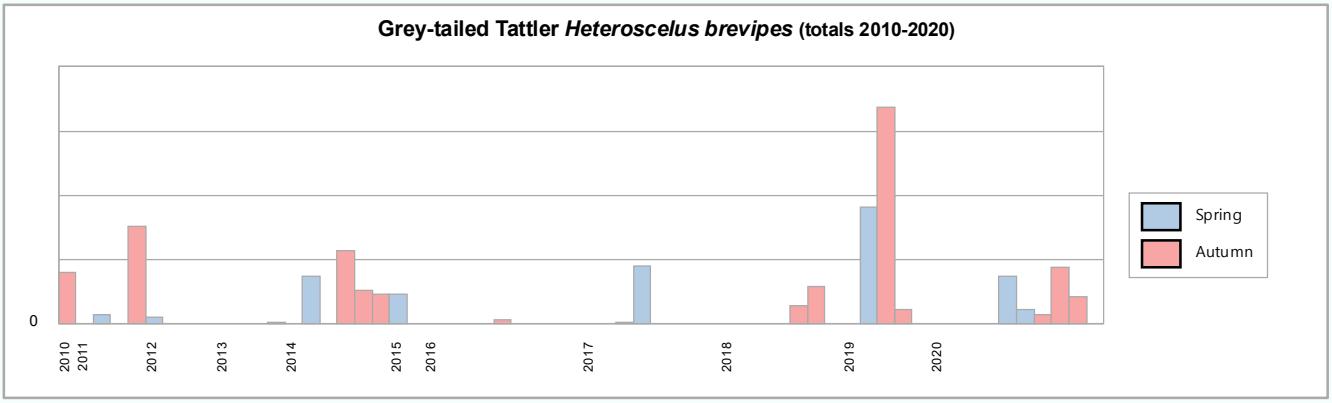
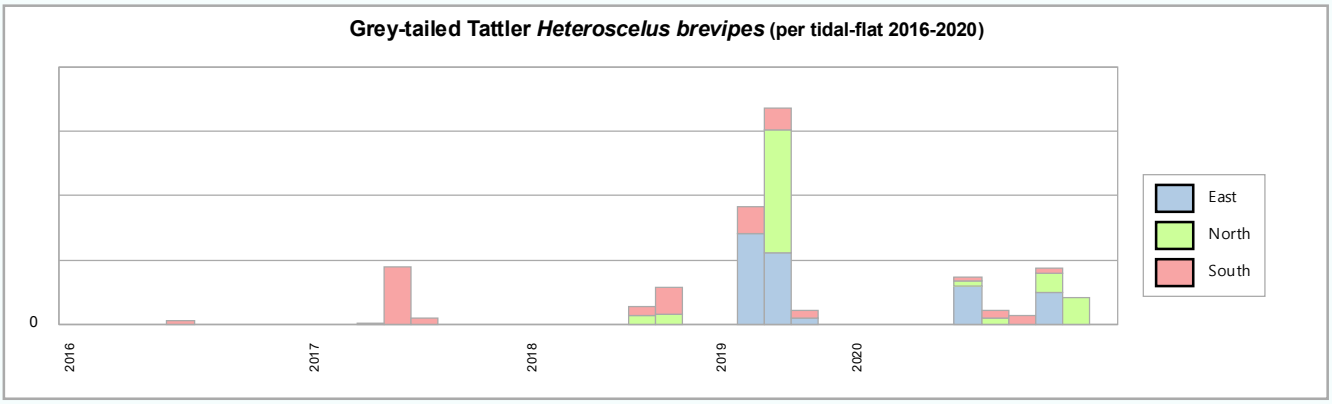


Fig. S-10-2 Counts per tidal-flat



Terek Sandpiper *Xenus cinereus*

Terek Sandpiper are annually recorded at the site and visits in the spring migration season with slightly smaller number than in the autumn season. This species belongs to the late migraters and birds can be observed in autumn until late October. The count numbers vary but can be considered as having a stable level over all the years.

This species uses all three tidal areas of the site. The records for the southern tidal-area always show smaller numbers than for the other two areas. In one season the count numbers for the northern area are much higher than for the eastern area but in the following years they are more equal and so it is difficult to say which area the birds really prefer.

Terek Sandpiper *Xenus cinereus* (Spring)

Terek Sandpiper *Xenus cinereus* (Autumn)

Fig. S-11-1 Spring and autumn counts

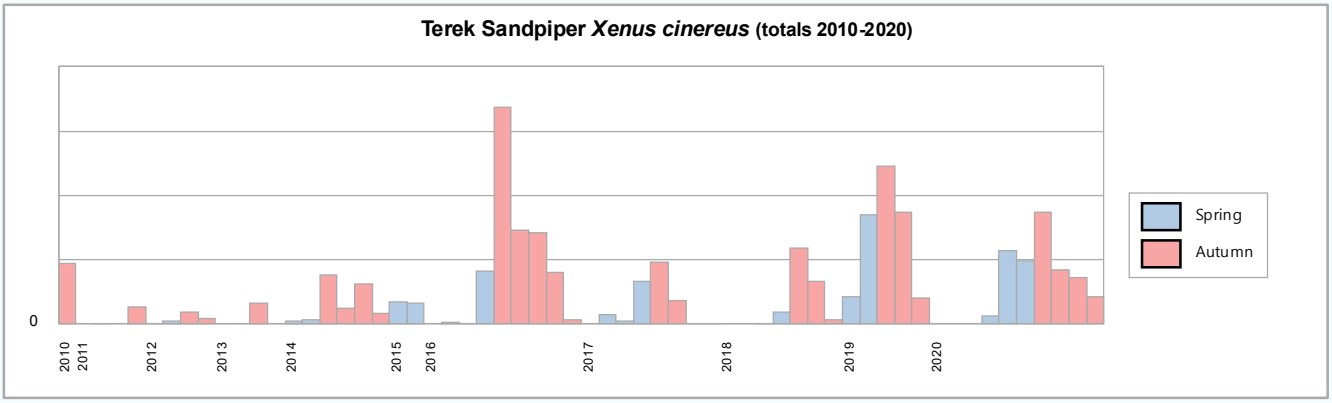
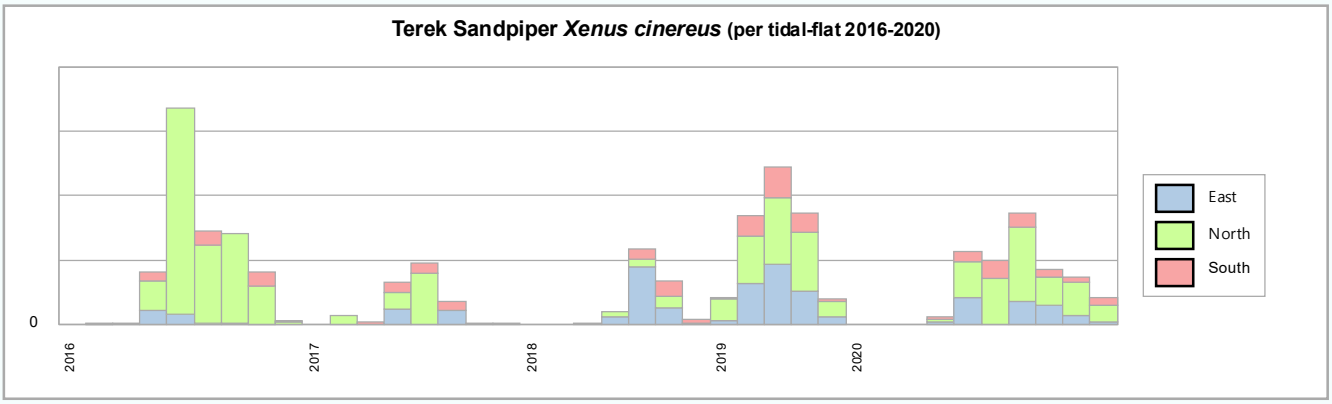


Fig. S-11-2 Counts per tidal-flat



Ruddy Turnstone *Arenaria interpres*

The Ruddy Turnstone is a species that arrives at the site usually by mid-April and is recorded in both, the spring and autumn, migration seasons with largely varying numbers, but many counts do not record the species at all. Some spring seasons have higher count numbers and some autumn ones have. The highest counts were always in late April or early May and in the autumn season the highest peak numbers were recorded between late August and mid-September.

Birds were seen on all tidal-areas. Usually only small numbers of birds use the southern tidal-area. Most records are for the northern tidal-area and in the last three spring migrations seasons flocks have been recorded on the eastern tidal-area.

Ruddy Turnstone *Arenaria interpres* (Spring)

Ruddy Turnstone *Arenaria interpres* (Autumn)

Fig. S-12-1 Spring and autumn counts

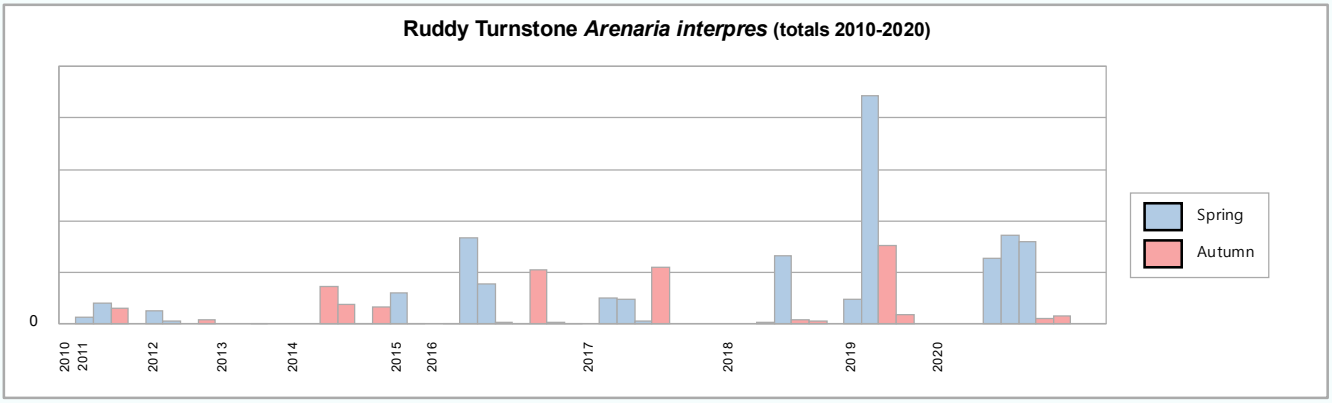
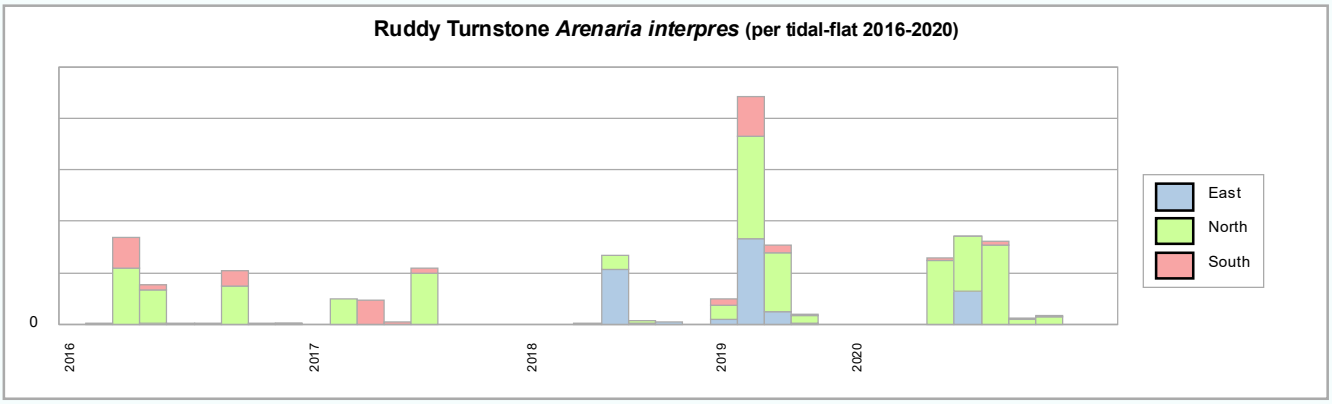


Fig. S-12-2 Counts per tidal-flat



Great Knot *Calidris tenuirostris*

This species is regularly recorded at the site, in earlier years with larger numbers and in recent years with only rather small count numbers. Not all counts or seasons have records for this species. Great Knot come to the site in both migration seasons. Research on banded birds has shown that in the spring seasons small groups of Great Knot very often come to the site for a short stopover for only a few days.

Most records are for the southern tidal-area. There is only one record that has counts for the northern and southern tidal-area with the majority of birds on the northern part. There are also counts of only one individual on the northern tidal-area that do not show in the graph. The species has not been recorded on the eastern tidal-area.

Great Knot *Calidris tenuirostris* (Spring)

Great Knot *Calidris tenuirostris* (Autumn)

Fig. S-13-1 Spring and autumn counts

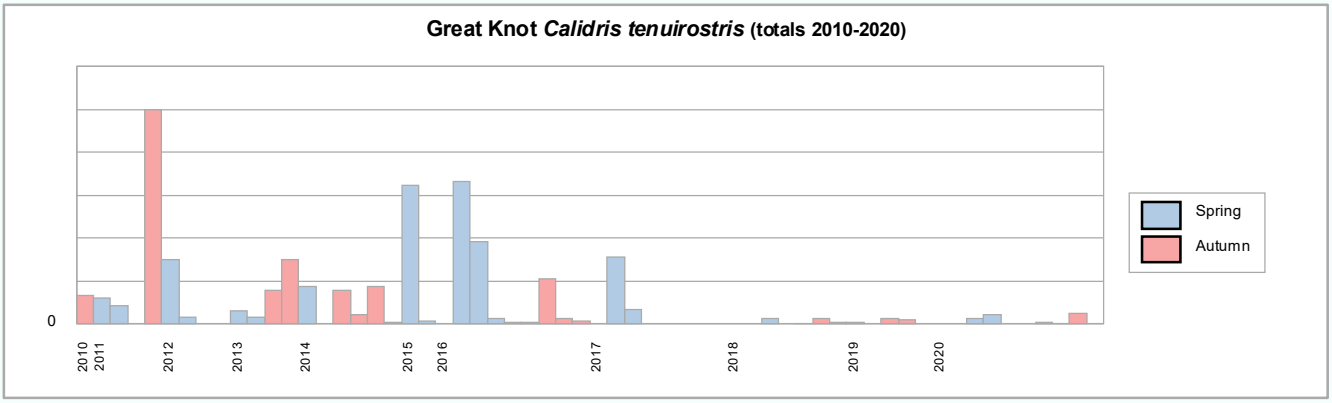
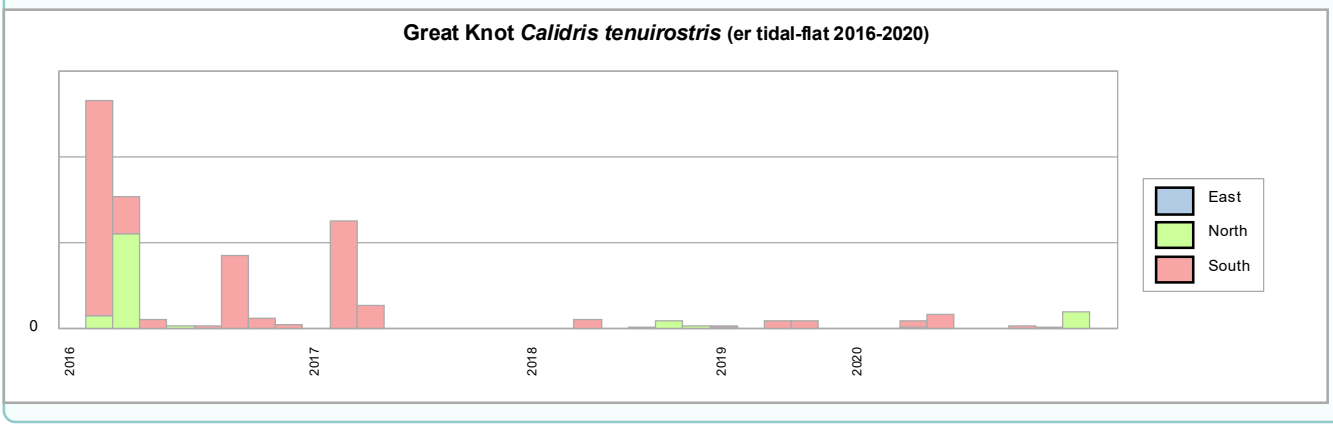


Fig. S-13-2 Counts per tidal-flat



Red-necked Stint *Calidris ruficollis*

Red-necked Stints are regularly recorded at the site in both, the spring and autumn season. The count numbers vary largely between the seasons; spring seasons compared and autumn seasons compared. Not all seasons and not all counts have this species recorded.

All three tidal-areas are used. While in one year, the majority of birds used the southern tidal-area, in a different year the northern part was used by the bigger number of birds. The record for the eastern tidal-area have only one-digit numbers.

The MoE Winter Bird Censuses have a record of 600 for January 2010 and a record of 30 for January 2013. One has to wonder if the record for 2010 can really be correct because it would mean that c. 85% of the birds recorded in the autumn count would not have migrated to the usual wintering grounds.

Red-necked Stint *Calidris ruficollis* (Spring)

Red-necked Stint *Calidris ruficollis* (Autumn)

Fig. S-14-1 Spring and autumn counts

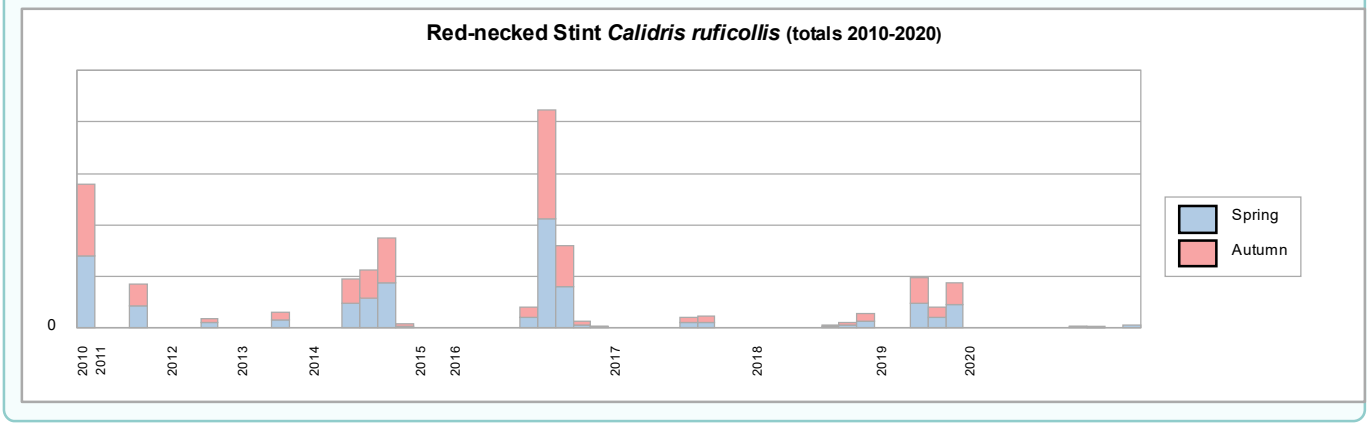
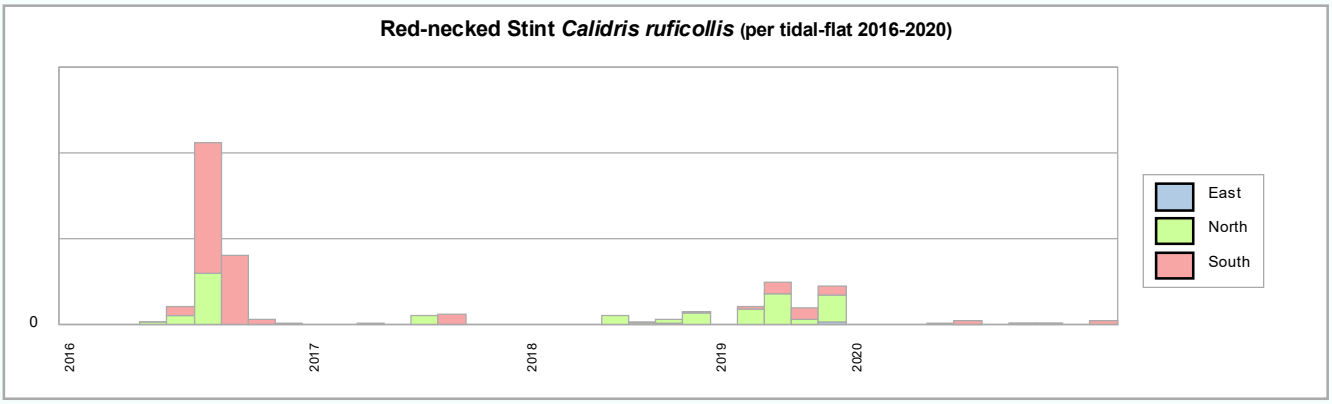


Fig. S-14-2 Counts per tidal-flat



Dunlin *Calidris alpina*

The Dunlin is the most numerous species recorded at Aphae Island. In the spring migration seasons several thousands of birds visit the site while the autumn seasons show only a maximum of about 20% of the spring numbers.

Birds are found on all three tidal-areas. The current data show that the northern tidal-area seems to have a higher preference than the southern area. For the eastern area many possible roosting locations that are suitable for this species have been discovered just recently and as surveying these locations is rather challenging, comprehensive data for this area is still in the buildup.

This species is also regularly recorded in the MoE Winterbird Census, which is conducted in December and January.

Dunlin *Calidris alpina* (Spring)

Dunlin *Calidris alpina* (Autumn)

Fig. S-15-1 Spring and autumn counts

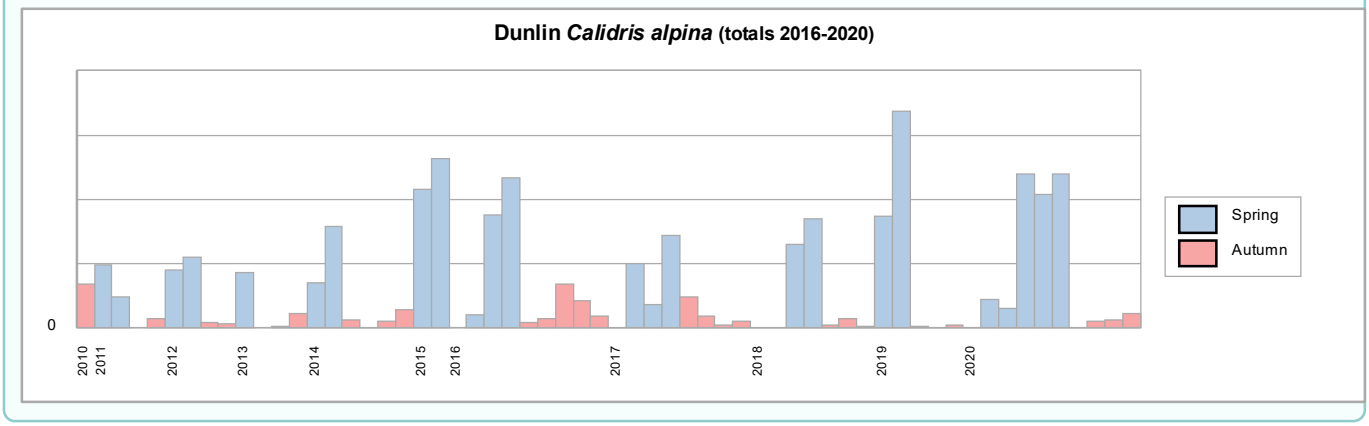


Fig. S-15-2 Counts per tidal-flat

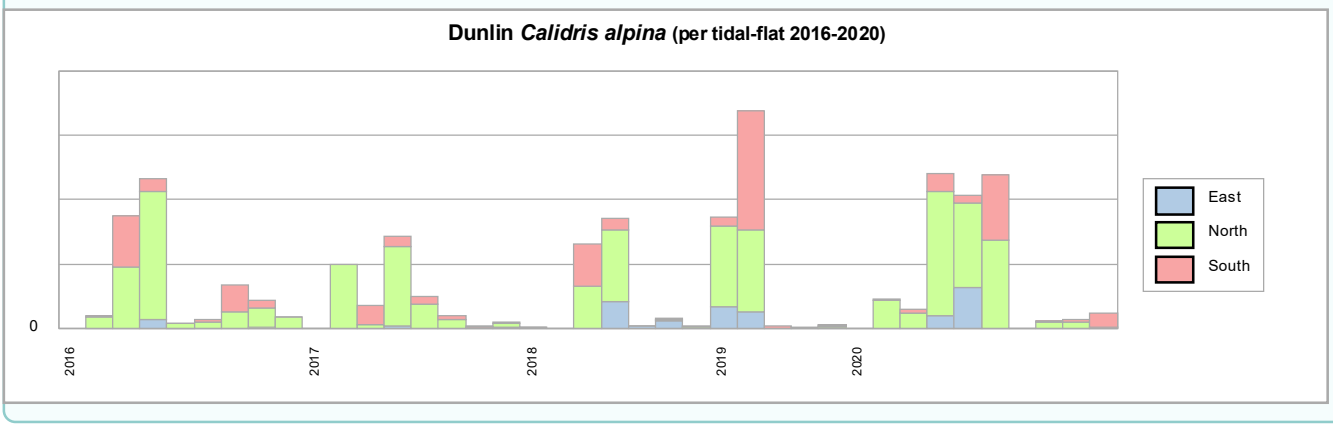
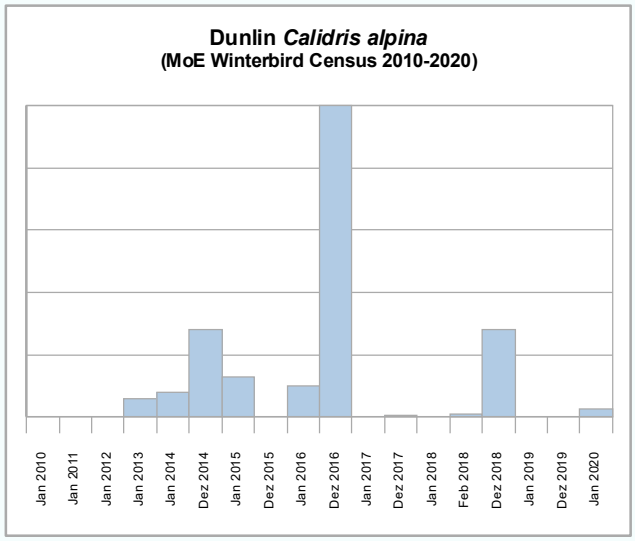


Fig. S-15-3 Spring and autumn counts



Dunlin *Calidris alpina* (Autumn)

Dunlin *Calidris alpina* (Spring) in assemblance with other species

Chinese Egret *Egretta eulophotes*

This globally and nationally red-listed egret depends on tidal-areas. In spring, only single-digit numbers are recorded, which seems reasonable because the nesting island is only c. 50km north of the site. In autumn up to low 3-digit-numbers are on the record. The reason for the huge difference in numbers between spring and autumn might be that Aphae Island along with other tidal-flat areas in the region provide the necessary feeding ground to prepare for the southward migrations.

Records exists for all three tidal-areas, the preference for most of the birds is the southern tidal-area. Observations suggest that this is because of not only suitable feeding options but also of preferred roosting areas. Nonetheless, there are counts that recorded birds only on the northern and eastern tidal-areas.

Chinese Egret *Egretta eulophotes* (Spring)

Chinese Egret *Egretta eulophotes* (Autumn)

Fig. S-16-1 Spring and autumn counts

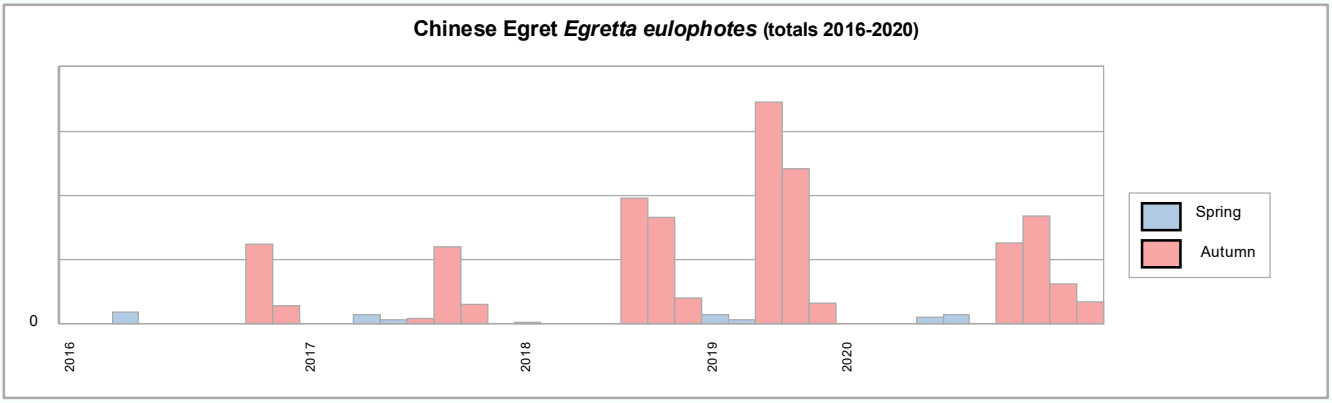
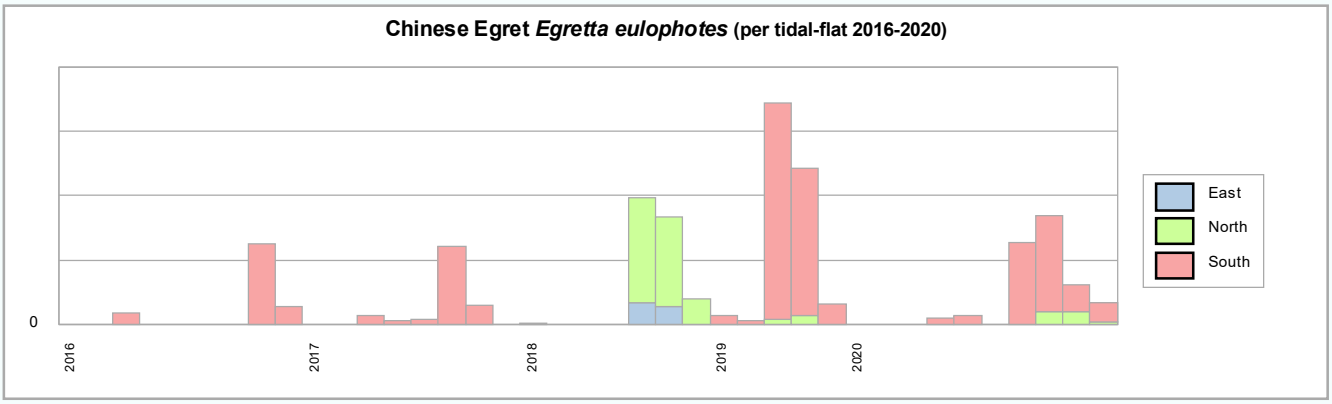


Fig. S-16-2 Counts per tidal-flat



Discussions

Monitoring

The datasets show the monitoring schedule for the site has changed over the years from two counts per migration season with one count per month to a bi-weekly schedule. This explains the more stable count number patterns for some species. For example, Eurasian Oystercatcher arrive at the site as early as February and most have moved to the nesting islets by mid-April. The early schedule missed most of the birds and the current schedule might start too late at the end of March to records all birds. A second example is the Eurasian Curlew. While in recent years, there are no autumn records or records with only very small single-digit numbers, the Winter Bird Censuses have records of higher numbers in Januaries. This indicates that the birds that stay in the winter arrive after the end of the counting schedule.

As the report on banded shorebirds (Kim2020) pointed out, for many long-distance migrants Aphae Island is in spring rather a stopover site than a staging site and many birds stay only very few days at the site before they move on to the staging areas. This means that a bi-weekly schedule misses out many birds that do their stopover just in between two counts. Therefor a bi-weekly schedule still cannot give the correct count number for some species that the site supports.

In lack of records of marked birds, seven records in the last 10 years, which could help to determine such pattern, no information for the autumn season is available. A solution to fill this information gap could be a banding program that enables the monitoring on one hand if adult birds that are banded in the spring do return in autumn or have only possible sightings elsewhere in the flyway and different migration routes in spring and autumn.

The fact that the different species all have a different migration pattern and therefor also different migration schedules and peak periods at a site, a bi-weekly counting schedule might be good enough to record the presence of a species but might not produce the peak numbers.

Three of the autumn records of banded birds

A separate project had evaluated the coastline around the island hand has identified 60 locations that are suitable for roosting. Most of the newly identified locations are on the eastern and northern tidal-area. A separate report for this project is in preparation. The important finding of this project for this discussion is that it is very resource incentive in terms of time and travel to visit all these locations in the proper amount of time to make correct counts. Therefor count numbers especially for the eastern area are still in buildup and can vary.

With a long-term view, it seems that more people conducting the counts will be needed. One option that can be discussed is to establish an education and training program for interested people from the local community.

Disturbances

For several species, we see largely varying number between seasons but also within one season. That there can be big differences between the dataset of the first years with only on count per month and the recent years is easy to understand. However, the differences within one season is a subject for discussion.

It is well understood that the shorebirds that are in the period of putting on fat reserves for their next migration flight try to avoid raising the body temperature. We can observe this behavior from about mid to late April when birds use also not so favorable locations for roosting that are very close to their feeding positions but have to endure various disturbances.

The question to look at is if these disturbances account for such varying count numbers especially for birds that are on the site in the last half of the migration season and therefore can be considered as staging on the site. Do continuous disturbances make birds not use roosting locations and have them move to other places? We have plenty of observations that big flocks of birds just take to air when the tide rises on the northern tidal-area, then fly into different directions, and do not use roosting locations on Aphae Island.

Three examples can show such disturbances. On the northern tidal-area was a bigger sandbank, which was used by many birds for roosting. A few years ago, a big hole was created by excavating large amounts of sand. In addition, a big amount of plastic parts covers the sand bank now. This has reduced the area of sand that birds can use on high tide for roosting dramatically. As the monitoring shows, birds still try to make use of the remaining sand areas, but the number has largely decreased. A restoration of this roosting place or even with some expansion and shielding can provide a positive change.

Degraded roosting location on the northern tidal-area

On the southern tidal-area is a road to the islet Daesom that is regularly used on higher tides by many birds. After the tidal peak when the road starts to emerge from the water again, very often one can observe people driving to that islet to make use of the high tide for their fishing business. Unfortunately very often driving is relatively fast and birds are flushed and forced to make an emergency takeoff. This is especially negative for the birds towards the end of the migration seasons when birds need to save their energy for the migration flights.

Road to Islet Daesom

At the western end of the southern tidal-area is a sandbank that is use primarily by egrets and especially the threatened Chinese Egret. Shorebird also use this sandbank often. Over the years, a free running dog could be seen on this sandbank. A study in Europe on disturbance of People and dog on shorebirds (Gómez-Serrano2020) showed that disturbance by people alone has a rate of c. 48% while people with dogs of over 92%. It is easy to imagine what level of disturbance a free running dog can cause.

An education program for the local community can help to explain the birds and their status as well as the important role Aphae Island has for all these threatened species and might help that people adapt a more careful behavior during the seasons the birds dependent on the island.

Birds and dog on sandbank

In 2020 a first very good step was done by installing shielding board-walls along two stretches at the southern tidal-area to block disturbances from passing people, where a path is directly along the edge of the tidal-flat and birds come very close. Observations during the autumn season suggest that birds roosting close to the walls much more relaxed than before and seemed to be far less alarmed when someone is passing by. Nonetheless, there are a few more locations where such a shielding can reduce disturbances enormously especially, where bicycle-drivers are passing roosting birds there very closely with higher speed.

A very new disturbance that needs to be mentioned occurred in 2020 from rice-fields adjacent to the southern tidal-area. Farmers had installed small autonomous cannons that regularly triggered a loud blank shot to scare away birds from the fields. These shots could be heard all along the tidal-area. The monitoring time at the tidal-areas were too short to give any comment what effect these bangs for the birds on the tidal-flat had. If the usage of these cannons will be continued in the coming year, a close attention should be given to this.

Wall shielding the tidal-flat

Recommendations

With the establishment of the Shorebird Network Korea, the counts published were only two per season and did not reflect the real number of birds the site supports. The number of counts has increased in the last years and more datasets are available but count numbers still show big variations. In addition, a separate project has discovered many more locations around the island that shorebirds use and need to be visited for counting. The report recommends for Monitoring:

- Development of a monitoring plan that allows very frequent counts to reflect the characteristic of this site with many birds having only a very short stopover stay.
- Provide the resources to enable the counting of all relevant locations around the island during the two migration seasons. Especially the northern and eastern tidal-areas have many locations that are impossible to count in time with a one or two person team during a tide-cycle.
- Publication of the count data and more media presence so that not only scientists but also the local communities can have an understanding of the value of the site for migratory birds.

Shorebirds and other birds using the tidal-areas encounter many disturbances because people use many parts of these areas also. With the fact that the national government has signed several international conventions and agreements like the “Ramsar Convention on wise use of wetlands through local and international actions” (RAMSAR) in force since 1997 or the “Republic of Korea–Australia Migratory Bird Agreement” (ROKAMBA) in 2007 makes it very logical that efforts should be undertaken to protect migratory birds at this site. The first visible steps in 2020 have also drawn some negative responses. The report of course encourages doing all what is possible to enhance the situation and protect the birds during the migration periods by continuing with the steps already taken but wants to highlight especially two activities or projects:

- Development of an educational program for the local communities, so that people can learn about the birds, their migration and conservation status; the importance nationally and internationally of the tidal-areas for the birds and their migration and survival of the species; the international agreements the government has signed; how people can contribute with their behavior to the protection and the migration success during the migration seasons but also with reporting of sightings and observations to the understanding how birds use the site
- Restoration of former and creating of new roosting locations for shorebirds that birds don’t have to leave the tidal-areas during high-tides

Appendix

Countdata Totals

Table A1. Countdata Totals for selected species

Species	2010	2011				2012				2013				2014						2015		2016									
	Sep 13	Apr 23	May 22	Aug 15	Sep 13	Apr 22	May 06	Sep 15	Oct 14	Apr 28	May 12	Sep 08	Oct 14	Apr 21	May 10	Aug 11	Aug 30	Sep 13	Oct 10	Apr 18	May 05	Mar 25	Apr 08	Apr 20	May 05	Aug 21	Sep 04	Sep 18	Oct 01	Oct 16
검은머리물떼새 Far Eastern Oystercatcher *Haematopus ostralegus*	2	59	5			3				1				10		2	1	3	5	5	5	135	64		3	1	3	7	10	10
개꿩 Grey Plover *Pluvialis squatarola*	772	150	432	291	617	150	205	27	250	43	281	275	76	115	514	360	173	1397	427	498	595	3	134	380	443	630	950	1280	402	549
흰물떼새 Kentish Plover *Charadrius alexandrinus*	1180	110	72	400	1370	50	30	650	21	58		4	1160	7	38	118	42	3	54	105	9		53	4	2	900	990	2005	875	365
왕눈물떼새 Mongolian Plover *Charadrius mongolus*	597		172		33	110	65	63	800	1	10	14	288	5	142	280	43	605	12	52	69			6	570	4	140	290	100	15
큰뒷부리도요 Bar-tailed Godwit *Limosa lapponica*	27	450	431		53	750	1260		11	410	119	13	77	650	601	38	4	7	13	2122	1057	12	2043	2700	1048	2	1	3	1	
중부리도요 Whimbrel *Numenius phaeopus*	193	58	312	80	105	50	114	45		63	45	117	13	63	93	168	347	58	3	72	104			272	89	160	115	327	108	8
마도요 Eurasian Curlew *Numenius arquata*	72								3									4	4	4		66	40	155	8		13			8
알락꼬리마도요 Far Eastern Curlew *Numenius madagascariensis*	30	64		61	47	35	35	7	24	21	2		34	4	28	32	19	17	52	38	17		32	8		5	4	3	3	
청다리도요 Common Greenshank *Tringa nebularia*	1200	28	67	240	133	30	91		139		2			4	183	383	325	340	579	85	579			81		20	195	230	2	91
뒷부리도요 Terek Sandpiper *Xenus cinereus*	466		6	84	135	3	18	93	41			156		21	26	376	123	305	80	167	159		7	5	405	1680	726	705	401	32
노랑발도요 Grey-tailed Tattler *Heteroscelus brevipes*	40		7	76	57	5						1			37	57	26	23	23	23					3					
꼬까도요 Ruddy Turnstone *Arenaria interpres*		26	78	61		48	12		17			2				147	76	3	64	121	3		2	335	153	5	3	210	5	3
붉은어깨도요 Great Knot *Calidris tenuirostris*	54	47	33		400	120	13			23	12	62	119	70		63	17	69	3	258	5		265	153	10	2	2	85	11	4
좀도요 Red-necked Stint *Calidris ruficollis*	700		690	212		45	510	45		56	29	73			57	240	282	435	18	40	435				15	100	1060	400	30	9
민물도요 Dunlin *Calidris alpina*	1360	1950	950		280	1800	2200	153	107	1700		42	433	1400	3140	230	3	192	576	4293	5251		393	3500	4650	167	282	1350	850	365

Species	2017								2018							2019					2020									
	Mar 26	Apr 17	Apr 26	May 14	Aug 20	Sep 24	Oct 10	Oct 21	Mar 22	Mar 28	Apr 16	Apr 28	Aug 15	Sep 09	Oct 09	Apr 21	May 06	Aug 18	Aug 31	Sep 30	Mar 22	Apr 04	Apr 05	Apr 18	May 04	May 05	Aug 22	Sep 05	Sep 19	Oct 17
검은머리물떼새 Far Eastern Oystercatcher *Haematopus ostralegus*	136	95	62	6	5	5	6	3	154	56	150	31	18	3		33	45	1			122	76	222	39	27	16				
개꿩 Grey Plover *Pluvialis squatarola*		800	124	1451	995	375	27	60	7		620	1140	483	425	5	535	2237	407	235	92		848	160	2361	1136	800	829	298	510	10
흰물떼새 Kentish Plover *Charadrius alexandrinus*				5	1090	450	9	120	10	1			13	208	230		10	375	178	283	37	36	250	12			394	661	514	318
왕눈물떼새 Mongolian Plover *Charadrius mongolus*		200	15	9	130		5					50	215	69	89	41	681	685	138	304					170	279	377	96	140	53
큰뒷부리도요 Bar-tailed Godwit *Limosa lapponica*	14	1710	427	365		1			9	34	2600	1598			5	2245	900				6	291	259	1358	570	441			6	16
중부리도요 Whimbrel *Numenius phaeopus*		20	87	119	84	55		18			12	334	105	67	11	880	364	247	152		1			145	399	326	190	127	53	
마도요 Eurasian Curlew *Numenius arquata*	24								70	21																				2
알락꼬리마도요 Far Eastern Curlew *Numenius madagascariensis*			1	4		8			15		2	15	3				1	1		6	2	7	10	7				1	5	6
청다리도요 Common Greenshank *Tringa nebularia*		2	67	156	174	31	16	15			8	314	342	230	37	13	233	1112	466	454				190	484	137	551	571	455	138
뒷부리도요 Terek Sandpiper *Xenus cinereus*		70	17	325	478	180	4	5			5	95	588	334	34	210	848	1227	864	197				58	569	491	867	424	361	208
노랑발도요 Grey-tailed Tattler *Heteroscelus brevipes*			1	45	5							14	29			91	168								37	11	9	44	21	
꼬까도요 Ruddy Turnstone *Arenaria interpres*		100	93	9	220						6	266	14	10		97	886	305	37					256	344	321	22	32		
붉은어깨도요 Great Knot *Calidris tenuirostris*		125	26								10		1	9	2	3		9	8				9	16			2	1	19	
좀도요 Red-necked Stint *Calidris ruficollis*			6		50	55						30	15	26	69		101	244	98	221				5	18		9	7		22
민물도요 Dunlin *Calidris alpina*	6	2000	725	2855	970	375	86	200	16	1	2600	3400	71	303	61	3465	6750	55	12	97	4	892	590	4793	4141	4786	3	210	258	462

Counts per tidal-flat

Table A2. Far Eastern Oystercatcher *Haematopus ostralegus*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			135
2016 Apr 08		6	58
2016 Apr 20			
2016 May 05			3
2016 Aug 21			1
2016 Sep 04			3
2016 Sep 18			7
2016 Oct 01			10
2016 Oct 16			10
2017 Mar 26			136
2017 Apr 17	4		91
2017 Apr 26	1		61
2017 May 14			6
2017 Aug 20			5
2017 Sep 24			5
2017 Oct 10			6
2017 Oct 21			3
2018 Mar 22			154
2018 Mar 28			56
2018 Apr 16			150
2018 Apr 28		3	28
2018 Aug 15		18	
2018 Sep 09		3	
2018 Oct 09			
2019 Apr 21	1		32
2019 May 06			45
2019 Aug 18			1
2019 Aug 31			
2019 Sep 30			
2020 Mar 22			122
2020 Apr 04			76
2020 Apr 05			222
2020 Apr 18			39
2020 May 04			27
2020 May 05			16
2020 Aug 22			
2020 Sep 05			
2020 Sep 19			
2020 Oct 18			

Table A3. Grey Plover *Pluvialis squatarola*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			3
2016 Apr 08	1	103	30
2016 Apr 20		330	50
2016 May 05	20	350	73
2016 Aug 21	10	600	20
2016 Sep 04		800	150
2016 Sep 18		1200	80
2016 Oct 01		400	2
2016 Oct 16		523	26
2017 Mar 26			
2017 Apr 17		800	
2017 Apr 26	13	44	67
2017 May 14	5	1300	146
2017 Aug 20		750	245
2017 Sep 24		350	25
2017 Oct 10		26	1
2017 Oct 21		60	
2018 Mar 22		7	
2018 Mar 28			
2018 Apr 16		600	20
2018 Apr 28	285	720	135
2018 Aug 15	450	23	10
2018 Sep 09	370	23	32
2018 Oct 09		3	2
2019 Apr 21	110	425	0
2019 May 06	300	1450	487
2019 Aug 18	120	220	67
2019 Aug 31	70	140	25
2019 Sep 30	30	62	0
2020 Mar 22			
2020 Apr 04		793	55
2020 Apr 05		90	70
2020 Apr 18	230	2000	131
2020 May 04	330	750	56
2020 May 05		690	110
2020 Aug 22	150	600	79
2020 Sep 05	15	200	83
2020 Sep 19	35	450	25
2020 Oct 18	9	1	

Table A4. Kentish Plover *Charadrius alexandrinus*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08	3	50	
2016 Apr 20			4
2016 May 05			2
2016 Aug 21		400	500
2016 Sep 04			990
2016 Sep 18			2000
2016 Oct 01		500	375
2016 Oct 16		250	115
2017 Mar 26			
2017 Apr 17			
2017 Apr 26			
2017 May 14		5	
2017 Aug 20		500	590
2017 Sep 24	150		300
2017 Oct 10			9
2017 Oct 21		120	
2018 Mar 22			10
2018 Mar 28		1	
2018 Apr 16			
2018 Apr 28			
2018 Aug 15		13	
2018 Sep 09	50	148	10
2018 Oct 09	30	200	
2019 Apr 21			
2019 May 06		10	
2019 Aug 18		60	315
2019 Aug 31		10	168
2019 Sep 30			283
2020 Mar 22	14		23
2020 Apr 04			36
2020 Apr 05			250
2020 Apr 18			12
2020 May 04			
2020 May 05			
2020 Aug 22		5	389
2020 Sep 05		75	586
2020 Sep 19		50	464
2020 Oct 18			318

Table A5. Mongolian Plover *Charadrius mongolus*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08			
2016 Apr 20			6
2016 May 05		270	300
2016 Aug 21		4	0
2016 Sep 04		60	80
2016 Sep 18		40	250
2016 Oct 01		100	0
2016 Oct 16		15	0
2017 Mar 26			
2017 Apr 17		200	0
2017 Apr 26			15
2017 May 14			9
2017 Aug 20		100	30
2017 Sep 24			
2017 Oct 10			5
2017 Oct 21			
2018 Mar 22			
2018 Mar 28			
2018 Apr 16			
2018 Apr 28		50	
2018 Aug 15	150	65	
2018 Sep 09	30	39	
2018 Oct 09	3	86	
2019 Apr 21	5	32	4
2019 May 06	66	150	465
2019 Aug 18		550	135
2019 Aug 31		100	38
2019 Sep 30	60	173	71
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18			
2020 May 04	20	150	
2020 May 05		237	42
2020 Aug 22		297	80
2020 Sep 05		40	56
2020 Sep 19		70	70
2020 Oct 18			53

Table A6. Bar-tailed Godwit *Limosa lapponica*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			12
2016 Apr 08	3	740	1300
2016 Apr 20		1500	1200
2016 May 05	48	750	250
2016 Aug 21			2
2016 Sep 04			1
2016 Sep 18			3
2016 Oct 01			1
2016 Oct 16			
2017 Mar 26			14
2017 Apr 17	10	600	1100
2017 Apr 26	58	5	364
2017 May 14	25	150	190
2017 Aug 20			
2017 Sep 24	1		
2017 Oct 10			
2017 Oct 21			
2018 Mar 22		8	1
2018 Mar 28		34	
2018 Apr 16	100	1100	1400
2018 Apr 28	618	850	130
2018 Aug 15			
2018 Sep 09			
2018 Oct 09		5	
2019 Apr 21	445	1155	645
2019 May 06	233	350	317
2019 Aug 18			
2019 Aug 31			
2019 Sep 30			
2020 Mar 22			6
2020 Apr 04		97	194
2020 Apr 05		112	147
2020 Apr 18	110	830	418
2020 May 04	190	233	147
2020 May 05		270	171
2020 Aug 22			
2020 Sep 05			
2020 Sep 19		6	
2020 Oct 18	8		

Table A7. Whimbrel *Numenius phaeopus*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08			
2016 Apr 20		230	42
2016 May 05	2	57	30
2016 Aug 21	20	80	60
2016 Sep 04		77	38
2016 Sep 18	2	300	25
2016 Oct 01	1	100	7
2016 Oct 16		8	
2017 Mar 26			
2017 Apr 17	10	10	
2017 Apr 26	4	1	82
2017 May 14		100	19
2017 Aug 20		70	14
2017 Sep 24	50		5
2017 Oct 10			
2017 Oct 21		15	3
2018 Mar 22			
2018 Mar 28			
2018 Apr 16		12	
2018 Apr 28	155	140	39
2018 Aug 15	70	25	10
2018 Sep 09	60	4	3
2018 Oct 09	5	6	
2019 Apr 21	210	450	220
2019 May 06	66	230	68
2019 Aug 18	2	203	42
2019 Aug 31	25	85	42
2019 Sep 30			
2020 Mar 22	1		
2020 Apr 04			
2020 Apr 05			
2020 Apr 18	32	50	63
2020 May 04	90	225	84
2020 May 05		257	69
2020 Aug 22	5	160	25
2020 Sep 05		115	12
2020 Sep 19	14	39	
2020 Oct 18	1	15	

Table A8. Eurasian Curlew *Numenius arquata*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25		23	43
2016 Apr 08		40	
2016 Apr 20		138	17
2016 May 05	1	5	2
2016 Aug 21			
2016 Sep 04		12	1
2016 Sep 18			
2016 Oct 01			
2016 Oct 16		8	
2017 Mar 26	1		23
2017 Apr 17			
2017 Apr 26			
2017 May 14			
2017 Aug 20			
2017 Sep 24			
2017 Oct 10			
2017 Oct 21			
2018 Mar 22		42	28
2018 Mar 28		21	
2018 Apr 16			

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28			
2018 Aug 15			
2018 Sep 09			
2018 Oct 09			
2019 Apr 21			
2019 May 06			
2019 Aug 18			
2019 Aug 31			
2019 Sep 30			
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18			
2020 May 04			
2020 May 05			
2020 Aug 22			
2020 Sep 05			
2020 Sep 19			
2020 Oct 18			

Table A9. Far Eastern Curlew *Numenius madagascariensis*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08		30	2
2016 Apr 20		6	2
2016 May 05			
2016 Aug 21		5	
2016 Sep 04			4
2016 Sep 18		3	
2016 Oct 01		3	
2016 Oct 16			
2017 Mar 26			
2017 Apr 17			
2017 Apr 26			1
2017 May 14		4	
2017 Aug 20			
2017 Sep 24	5		3
2017 Oct 10			
2017 Oct 21			
2018 Mar 22		8	7
2018 Mar 28			
2018 Apr 16		2	

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28		15	
2018 Aug 15		3	
2018 Sep 09			
2018 Oct 09			
2019 Apr 21			
2019 May 06			1
2019 Aug 18			1
2019 Aug 31			
2019 Sep 30	4	6	
2020 Mar 22			2
2020 Apr 04		3	4
2020 Apr 05		2	8
2020 Apr 18			7
2020 May 04			
2020 May 05			
2020 Aug 22			
2020 Sep 05			1
2020 Sep 19		5	
2020 Oct 18			6

Table A10. Common Greenshank *Tringa nebularia*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08			
2016 Apr 20		60	21
2016 May 05			
2016 Aug 21	8	10	2
2016 Sep 04	25	50	120
2016 Sep 18	10	200	20
2016 Oct 01	2		
2016 Oct 16	1	64	26
2017 Mar 26			
2017 Apr 17	2		
2017 Apr 26			67
2017 May 14	25	30	101
2017 Aug 20		170	4
2017 Sep 24	25		6
2017 Oct 10		1	15
2017 Oct 21	5		10
2018 Mar 22			
2018 Mar 28			
2018 Apr 16		8	

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28	57	230	27
2018 Aug 15	170	20	152
2018 Sep 09	100	45	85
2018 Oct 09		7	30
2019 Apr 21	7	6	
2019 May 06	27		206
2019 Aug 18	276	370	466
2019 Aug 31	140	255	71
2019 Sep 30	55	350	49
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18	70	120	
2020 May 04	80	240	164
2020 May 05		80	57
2020 Aug 22	135	365	51
2020 Sep 05	191	135	245
2020 Sep 19	132	211	112
2020 Oct 18			

Table A11. Grey-tailed Tattler *Heteroscelus brevipes*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08			
2016 Apr 20			
2016 May 05			
2016 Aug 21			3
2016 Sep 04			
2016 Sep 18			
2016 Oct 01			
2016 Oct 16			
2017 Mar 26			
2017 Apr 17			
2017 Apr 26			1
2017 May 14			45
2017 Aug 20			5
2017 Sep 24			
2017 Oct 10			
2017 Oct 21			
2018 Mar 22			
2018 Mar 28			
2018 Apr 16			

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28			
2018 Aug 15		7	7
2018 Sep 09		8	21
2018 Oct 09			
2019 Apr 21			
2019 May 06	70		21
2019 Aug 18	56	95	17
2019 Aug 31	5		6
2019 Sep 30			
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18			
2020 May 04	30	4	3
2020 May 05		5	6
2020 Aug 22	2		7
2020 Sep 05	25	15	4
2020 Sep 19		21	
2020 Oct 18			

Table A12. Terek Sandpiper *Xenus cinereus*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08		2	5
2016 Apr 20			5
2016 May 05	110	225	70
2016 Aug 21	80	1600	
2016 Sep 04	10	600	116
2016 Sep 18	5	700	
2016 Oct 01	1	300	100
2016 Oct 16		16	16
2017 Mar 26			
2017 Apr 17		70	
2017 Apr 26			17
2017 May 14	115	130	80
2017 Aug 20		400	78
2017 Sep 24	105		75
2017 Oct 10			4
2017 Oct 21			5
2018 Mar 22			
2018 Mar 28			
2018 Apr 16			5

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28	58	37	
2018 Aug 15	450	57	81
2018 Sep 09	125	91	118
2018 Oct 09		11	23
2019 Apr 21	30	170	10
2019 May 06	313	370	165
2019 Aug 18	463	520	244
2019 Aug 31	260	450	154
2019 Sep 30	62	110	25
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18	20	20	18
2020 May 04	210	277	82
2020 May 05		355	136
2020 Aug 22	179	579	109
2020 Sep 05	143	220	61
2020 Sep 19	70	252	39
2020 Oct 18	21	129	58

Table A13. Ruddy Turnstone *Arenaria interpres*

일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25			
2016 Apr 08			2
2016 Apr 20		220	115
2016 May 05	3	130	20
2016 Aug 21		5	
2016 Sep 04			3
2016 Sep 18		150	60
2016 Oct 01			5
2016 Oct 16		2	1
2017 Mar 26			
2017 Apr 17		100	
2017 Apr 26			93
2017 May 14			9
2017 Aug 20		200	20
2017 Sep 24			
2017 Oct 10			
2017 Oct 21			
2018 Mar 22			
2018 Mar 28			
2018 Apr 16		6	

일자 Date	동쪽 East	북쪽 North	남쪽 South
2018 Apr 28	215	51	
2018 Aug 15		11	
2018 Sep 09	10		
2018 Oct 09			
2019 Apr 21	20	52	25
2019 May 06	331	400	155
2019 Aug 18	50	230	25
2019 Aug 31	5	30	2
2019 Sep 30			
2020 Mar 22			
2020 Apr 04			
2020 Apr 05			
2020 Apr 18		250	6
2020 May 04	130	211	3
2020 May 05		307	14
2020 Aug 22	5	20	2
2020 Sep 05		30	2
2020 Sep 19			
2020 Oct 18			

Table A14. Great Knot *Calidris tenuirostris*

일자 Date	동쪽 East	북쪽 North	남쪽 South	일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25				2018 Apr 28			
2016 Apr 08		15	250	2018 Aug 15		1	
2016 Apr 20		110	43	2018 Sep 09		9	
2016 May 05			10	2018 Oct 09		2	
2016 Aug 21		2		2019 Apr 21		1	2
2016 Sep 04			2	2019 May 06			
2016 Sep 18			85	2019 Aug 18			9
2016 Oct 01			11	2019 Aug 31			8
2016 Oct 16			4	2019 Sep 30			
2017 Mar 26				2020 Mar 22			
2017 Apr 17			125	2020 Apr 04			
2017 Apr 26			26	2020 Apr 05		1	8
2017 May 14				2020 Apr 18			16
2017 Aug 20				2020 May 04			
2017 Sep 24				2020 May 05			
2017 Oct 10				2020 Aug 22			2
2017 Oct 21				2020 Sep 05			1
2018 Mar 22				2020 Sep 19		19	
2018 Mar 28				2020 Oct 18			
2018 Apr 16			10				

Table A15. Red-necked Stint *Calidris ruficollis*

일자 Date	동쪽 East	북쪽 North	남쪽 South	일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25				2018 Apr 28		30	
2016 Apr 08				2018 Aug 15	2	13	
2016 Apr 20				2018 Sep 09	4	22	
2016 May 05		10	5	2018 Oct 09		64	5
2016 Aug 21		50	50	2019 Apr 21			
2016 Sep 04		300	760	2019 May 06		85	16
2016 Sep 18			400	2019 Aug 18		180	64
2016 Oct 01			30	2019 Aug 31		30	68
2016 Oct 16		9		2019 Sep 30	10	160	51
2017 Mar 26				2020 Mar 22			
2017 Apr 17				2020 Apr 04			
2017 Apr 26			6	2020 Apr 05			
2017 May 14				2020 Apr 18	5		
2017 Aug 20		50		2020 May 04	1		17
2017 Sep 24			55	2020 May 05			
2017 Oct 10				2020 Aug 22		5	4
2017 Oct 21				2020 Sep 05		5	2
2018 Mar 22				2020 Sep 19			
2018 Mar 28				2020 Oct 18			22
2018 Apr 16							

Table A16. Dunlin *Calidris alpina*

일자 Date	동쪽 East	북쪽 North	남쪽 South	일자 Date	동쪽 East	북쪽 North	남쪽 South
2016 Mar 25				2018 Apr 28	830	2230	340
2016 Apr 08		353	40	2018 Aug 15	50	21	
2016 Apr 20		1900	1600	2018 Sep 09	225	53	25
2016 May 05	250	4000	400	2018 Oct 09	10	51	
2016 Aug 21	2	150	15	2019 Apr 21	650	2540	275
2016 Sep 04		200	82	2019 May 06	500	2540	3710
2016 Sep 18		500	850	2019 Aug 18			55
2016 Oct 01	10	600	240	2019 Aug 31			12
2016 Oct 16		350	15	2019 Sep 30	20	50	27
2017 Mar 26			6	2020 Mar 22			4
2017 Apr 17		2000		2020 Apr 04		850	42
2017 Apr 26		115	610	2020 Apr 05		450	140
2017 May 14	50	2500	305	2020 Apr 18	390	3850	553
2017 Aug 20		750	220	2020 May 04	1250	2650	241
2017 Sep 24		250	125	2020 May 05		2745	2041
2017 Oct 10		25	61	2020 Aug 22		3	
2017 Oct 21	10	150	40	2020 Sep 05		200	10
2018 Mar 22		10	6	2020 Sep 19		201	57
2018 Mar 28		1		2020 Oct 18	30		432
2018 Apr 16		1300	1300				

Table A17. Chinese Egret *Egretta eulophotes*

일자 Date	동쪽 East	북쪽 North	남쪽 South	합계 Total	일자 Date	동쪽 East	북쪽 North	남쪽 South	합계 Total
2016 Mar 25					2018 Apr 28			2	**2**
2016 Apr 08					2018 Aug 15	17	81		**98**
2016 Apr 20			9	**9**	2018 Sep 09	14	69		**83**
2016 May 05					2018 Oct 09		20		**20**
2016 Aug 21					2019 Apr 21			7	**7**
2016 Sep 04					2019 May 06			3	**3**
2016 Sep 18					2019 Aug 18		4	168	**172**
2016 Oct 01			62	**62**	2019 Aug 31		7	114	**121**
2016 Oct 16			14	**14**	2019 Sep 30			16	**16**
2017 Mar 26					2020 Mar 22				
2017 Apr 17					2020 Apr 04				
2017 Apr 26			7	**7**	2020 Apr 05				
2017 May 14			3	**3**	2020 Apr 18			5	**5**
2017 Aug 20			4	**4**	2020 May 04			7	**7**
2017 Sep 24			60	**60**	2020 May 05				
2017 Oct 10			15	**15**	2020 Aug 22			63	**63**
2017 Oct 21					2020 Sep 05		10	74	**84**
2018 Mar 22			1	**1**	2020 Sep 19		10	21	**31**
2018 Mar 28					2020 Oct 18		2	15	**17**
2018 Apr 16									

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Dunlin
Calidris alpina