Changes in numbers and distribution of wintering Long-tailed Ducks *Clangula hyemalis* in Swedish waters during the last fifty years

*Förändringar i antal och utbredning hos övervintrande alfåglar Clangula hyemalis i svenska farvatten under de senaste femtio åren*

LEIF NILSSON

**Abstract**

The Long-tailed Duck *Clangula hyemalis* is the most common wintering waterfowl in Swedish marine waters but it is not well covered in the International Midwinter Counts due to its offshore distribution making special surveys necessary for the species. Surveys covering the entire Baltic Sea were organized for the first time in 1992/1993 with follow-up surveys in 2007–2011 and 2016. In Sweden, aerial line transect surveys covered all areas of importance for the Long-tailed Duck during the last two all-Baltic surveys. In the 1970s extensive regional surveys were done from coastguard boats and airplane. The total wintering population of Long-tailed Duck was estimated to be around 370,000 individuals in 2016 compared to 436,000 in 2009, and in the order of 1,400,000 in 1992/1993, indicating an ongoing decrease. Comparing the more recent surveys with the surveys from the 1970s, the most marked changes in wintering numbers were found east of Gotland, where only a small proportion of the numbers estimated in the 1970s remained. Decreases were also found in the waters around Öland, whereas no marked changes were noted for the smaller wintering populations of the east coast archipelagos.

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**Introduction**

The Long-tailed Duck *Clangula hyemalis* is the most common wintering waterbird in Swedish waters but due to its marine distribution it is not so well covered in the Midwinter Counts organized annually since 1967 (Nilsson 1972, 1975, 1980, 2012, Nilsson & Haas 2016). Proper monitoring of the Long-tailed Duck requires special surveys in the archipelagos and the offshore areas.

During the years 1965–1978 more than 100 boat surveys were undertaken along the Swedish coasts from the patrol boats of the Swedish Coast Guard (Nilsson 1972, 1980). Extensive aerial surveys were also undertaken mainly in the archipelagos but also along the open coasts of Scania, Öland and Gotland (Nilsson 1975, 1980). It was however not possible to survey the Midsjö Banks and Hoburg Bank far out in the middle of the Baltic Sea even if these areas were known to be sites for large numbers of wintering Long-tailed Ducks.

In the early 1990s, after the political changes in the region, it was for the first time possible to organize extensive offshore surveys of the wintering water-birds in the entire Baltic in 1992–1993. Maps and population estimates were produced for all important waterbirds (Durinck et al. 1994). A second survey of the entire Baltic was organized in 2007–2010, the SOWBAS-project (“Status of Wintering Waterbird Populations in the Baltic Sea”; Skov et al. 2011).

Analysis of the results from the SOWBAS-project showed a decrease in the wintering population of Long-tailed Duck in the Baltic of about 65% since the surveys in 1992/1993, with important decreases also for other wintering seaducks (Skov et al. 2011). Marked decreases in numbers of the species were documented from all parts of the Baltic, including Sweden (Nilsson 2012). As a response to this decrease the species was red-listed and work with a single-species action plan was started by AEWA (African European Waterfowl Agreement).

To follow up the situation for the wintering waterbirds in the area a third all-Baltic survey was organized in the winter 2016. In the last few years the Midwinter Counts have been used as an important part of the indicator “Numbers and trends in breeding and non-breeding marine water birds”
which is now accepted as a Core Indicator among a set of other indicators to monitor the situation in the marine areas of the European Union as a part of the MSFD (Marine Strategy Framework Directive). In this work offshore surveys of wintering water birds will be an important part in the future.

In this paper I analyze the results from the offshore surveys of Swedish waters in 2016 with the main focus on the Long-tailed Duck. Earlier, results from the boat surveys have been summarized by Nilsson (1980), whereas the aerial surveys under SOWBAS were presented by Nilsson (2012). The present paper updates the previous presentations of the development of the wintering populations and compares the winter distribution of the species from the last survey with the results from the previous surveys.

**Material and methods**

In 2016, as in the 2007–2011 surveys, the offshore areas were covered by line transects from an aircraft. The census lines were laid out so that all important water areas (including the offshore banks) in the Swedish part of the Baltic were covered out to a depth of about 30 m. The survey lines started at the shore or, in the extensive east coast archipelagos (mainly the Stockholm archipelago), from the inner larger islands. Generally, there was a distance of 4 km between the survey lines but in some special areas (e.g. Hanö Bight and Falsterbo) there was a distance of 2 km between the lines. The survey lines are shown in the distribution maps from the surveys (Figure 2 for an overview and the regional maps).

For the surveys a Cessna 337 Skymaster, a twin-engined high-winged aircraft with good visibility was used. The flying altitude was about 70 m and the speed 150–180 km/h, i.e. the slowest possible. Aerial surveys were only undertaken in good weather conditions. Fixed waypoints at the ends of each transect were established and navigation was undertaken with the aid of the GPS of the aircraft. Another GPS recorded the actual flight track taking positions every ten seconds. Two observers covered each side of the aircraft. All observations were recorded on tape with time and were later transferred to a database with the positions from the GPS recordings.

During the surveys in 2007–2011, all water birds were counted within a survey belt extending 200 m on either side of the aircraft. This means that we covered a zone 320 m wide as there was a dead angle below the aircraft. During SOWBAS distance sampling was not used but observations outside the survey belt were recorded as additional information. During the 2016 survey the data were recorded in three different bands to make the data collection more similar to the methods used in the other countries: A (=main band) out to 200 m, B 200–500 m and C 500–1000 m. In 2007–2011, counts were only made in the main band.

The counts from the line transects were used to estimate regional totals for the different species using the counts within the main band of the surveys and a factor based on the coverage of the different regions (6.25 and 12.5, respectively for transects separated by 2 and 4 km). For some areas with very marked differences in densities of different species between areas a stratified sampling routine separating low and high density areas was used in the calculations. Even if data were collected from three different bands in 2016, I only used the data from the main band in the calculations presented here to make the results from the surveys in 2007–2011 and 2016 comparable with each other.

In 2016, the offshore areas from Falsterbo in the southwest to the Gävle Bight in the north were covered with transect lines (Figure 2). In the south, some transects in the Öresund could not be surveyed due to flying restrictions in the Control Area of Copenhagen airport. Moreover a few lines in the Stockholm archipelago were not flown as planned partly due to military activities. The differences in coverage was compensated for in the calculations.

The total area was surveyed during ten days between mid-January and mid-March 2016. The total flying time was 65 hours, of which 43 hours were used for actual bird counts. The 2016 winter was mild and there was no ice in the outer marine areas during the survey and only some ice in the inner parts of the archipelagos.

The surveys in the archipelagos in 2016 only covered the outer part with potential areas for species like the Long-tailed Duck. The inner parts of the archipelagos were covered by aerial surveys in the winter 2015. The surveys in the Stockholm archipelago 2015 covered the entire survey lines from the mainland coast to the outer skerries and will be included in the analysis presented here when it comes to distribution. For information about the earlier surveys used in the comparisons see Nilsson (1980, 2012).

**Results**

**The national picture**

At the first total survey of the Baltic in 1992/1993 (Durinck et al. 1994), the wintering population of Long-tailed Duck in Swedish waters was esti-
mated to be 1.4 million (Figure 1, Table 1). At the SOWBAS survey in 2009, the estimated total for Sweden was 436,000 individuals. As for the entire Baltic (Skov et al. 2011) this was a very marked reduction of the population. Numbers were higher at the 2010 survey with an estimate of 700,000 individuals. 2010 and 2011 were however hard ice winters and large important areas in the eastern part of the Baltic like the Riga Bay and Irbe Straits were ice-covered and the Long-tailed Ducks forced to move.

At the survey in 2016, the estimated population was lower still with 370,000. Lacking data yet from the other countries it is difficult to establish whether there was a real decrease in wintering numbers or just a shift in the distribution to other areas in the Baltic.

In the mild winters of 2009 and 2016, the Long-tailed Ducks were found all along the surveyed part of the Swedish Baltic coast (Figure 2). There was however a marked concentration to the three large offshore banks, Södra Midsjöbanken, Norra Midsjöbanken and Hoburgs Bank, where about 70% of all Long-tailed Ducks were found in both years. On the other hand, the Long-tailed Ducks were much

![Image](164)

**Figure 1.** Estimated total numbers of wintering Long-tailed Ducks *Clangula hyemalis* in Swedish waters at the countrywide surveys shown separately for the important offshore banks and the other areas. A regional break-down is presented in Table 1.

**Table 1.** Estimated totals of wintering Long-tailed Ducks *Clangula hyemalis* in different areas along the coasts of Sweden.

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<td>1600</td>
<td>2800</td>
<td>1200</td>
<td>900</td>
<td></td>
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<tr>
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<td>10000</td>
<td>800</td>
<td>1700</td>
<td>2000</td>
<td>4300</td>
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<td>300</td>
<td>400</td>
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<td>5000</td>
<td>7200</td>
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<td>15100</td>
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<td>10000</td>
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<td>Gotlands west coast</td>
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<td>2700</td>
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<td>26100</td>
<td>Ice</td>
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<td></td>
<td></td>
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<tr>
<td>Uppland Northern coast</td>
<td>3700</td>
<td>Ice</td>
<td>2600</td>
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<tr>
<td>Gävle Bight</td>
<td>600</td>
<td>Ice</td>
<td>5800</td>
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<tr>
<td><strong>Total</strong></td>
<td>1418100</td>
<td>435800</td>
<td>700000</td>
<td>471800</td>
<td>369500</td>
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more concentrated in the ice-winters 2010 and 2011 (Nilsson 2012), with 90% seen on the banks in 2010, a winter with heavy ice coverage in the Baltic.

Regional pattern

Small groups and a few larger flocks were found in the southern parts of the Öresund and along the south and southeast coasts of Scania (Figure 3). The total estimate for the area was 4300 in 2016 to be compared to about 10,000 or more during the 1970s. Three surveys during the SOWBAS-survey showed similar distributions (Nilsson 2012). During the sixties and seventies the species was more common in the area with up to a few thousand also in inshore waters (Nilsson 1972, 1980).

The Hanö Bight has been well-known as the southernmost concentration area for Long-tailed Ducks in Sweden with the majority of the birds concentrated to vast shallow areas in the western offshore part of the bight (Figure 4), whereas only very few individuals were seen in the outer parts of the Blekinge archipelago further to the east. During the early years of the study about 25,000 Long-tailed Ducks were estimated to winter in the Hanöbukten area but numbers decreased to about 7000 during the last two surveys. During the sixties and seventies flocks were also regularly seen in the outer parts of the Blekinge archipelago with an estimated total of about 2000 but in more recent years, numbers were appreciably lower here (Table 1).

The Kalmarsund and especially the waters east and north of Öland are important areas for wintering Long-tailed Ducks (Figure 5). Numbers in the Kalmarsund have been quite variable between 2500 and 23,000 during the recent surveys but the area will quite easily get ice-covered (Table 1). The areas east and north of Öland belong to the more important winter areas for the species close to the mainland. Rough estimates from the 1970s indicate that the population then could have been as high as 100,000, but recent estimates are much lower and in 2007–2016 it varied between 13,000 in the mild winter of 2016 and 61,000 during the cold ice-winter 2011, when Kalmarsund and most archipelagos were ice-covered.

As stated above the offshore banks, Midsjö Banks and Hoburg Bank, are the most important Long-tailed Duck areas in Swedish waters with
about 70% of the total Swedish wintering population in normal winters and up to 90% during one of ice winters. The local distribution of the Long-tailed Ducks on the banks are illustrated by the counts in the normal winters (Figure 6 for the Midsjö Banks and Figure 7 for Hoburg Bank).

During the years 2009–2016, the Midsjö Banks have been covered by aerial surveys at six different occasions with the total numbers varying between 44,500 and 213,000 individuals (Table 2). At the first Baltic survey in 1992/1993 the number of Long-tailed Ducks on the Midsjö Banks was estimated to be 81,000. For Hoburg Bank the estimates for 2009 to 2016 varied between 90,000 and 426,000, the highest total was obtained for the ice-winter 2010, when the east coast of the Baltic was mostly ice-covered. In 1992/1993 the estimate for Hoburg Bank was no less than 270,000 Long-tailed Ducks. Unfortunately, there are no older censuses available from these important off-shore banks.

The coasts of Gotland are important areas for wintering Long-tailed Ducks (Figure 8) with many flocks occurring along all parts of the island except at the steep coasts of NW Gotland where flocks are fewer and smaller. The banks between northern Gotland and Gotska Sandön have historically been important for the Long-tailed Ducks.

During the years 2009 to 2016 the estimates from four surveys has varied between 11,000 and 16,000 for the entire east coast. The banks north of Gotland were surveyed in 2010, 2011 and 2016 with 13,500 and 14,500 Long-tailed Ducks found for the first two winters but less than 4000 in 2016. At the surveys in 1992/93 no less than 270,000 were estimated for the east coast of Gotland.

Unfortunately, there are very few historical data from the offshore areas east of Gotland but there is some information from a few coast guard patrols in the area. At one of these patrols to the areas around Fårön in NE and neighboring areas, the observers

Figure 5. Distribution of Long-tailed Ducks *Clangula hyemalis* in the Kalmarsund and around Öland in the winters of 2009 and 2016.

*Utbredning för alfågel *Clangula hyemalis* i Kalmarsund och runt Öland vintrarna 2009 och 2016.*
Figure 6. The distribution of Long-tailed Ducks *Clangula hyemalis* on the Midsjöbanks during the mild winters 2009 and 2016.

Utbredning för alfågel *Clangula hyemalis* på Midsjöbanks under de milda vintrarna 2009 och 2016.

Figure 7. The distribution of Long-tailed Ducks *Clangula hyemalis* on Hoburgs Bank during the mild winters 2009 and 2016.

actually counted 70,000 from the ship. Based on densities obtained from the coast guard patrols and one aerial reconnaissance flight in 1974, the wintering population of the Long-tailed Duck in the offshore areas east of Gotland is roughly estimated to have been in the order of 400,000 in the early seventies (Nilsson 1980). The total numbers wintering here in recent years may be as low as 5% of the numbers during the early seventies.

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<td><strong>Northern</strong></td>
<td>76000</td>
<td>74000</td>
<td>63000</td>
<td>37000</td>
<td>67000</td>
<td>56700</td>
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<tr>
<td><strong>Southern</strong></td>
<td>160000</td>
<td>137000</td>
<td>132000</td>
<td>22000</td>
<td>7500</td>
<td>16500</td>
<td>34500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>213000</td>
<td>206000</td>
<td>85000</td>
<td>44500</td>
<td>83500</td>
<td>91200</td>
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The Long-tailed Duck is widely distributed in the archipelagos from Kalmarsund in the south up to and including the Stockholm archipelago (Figures 9–12). These areas were extensively covered from Coast Guard Patrols and area-based aerial surveys in the 1970s as well as by the aerial transects in later years. This offers good possibilities to compare the situation in the two time periods 1971–1978 and 2009–2016.

![Figure 8. The distribution of Long-tailed Ducks Clangula hyemalis around Gotland in the winters 2011 and 2016. Uthredning för alfågel Clangula hyemalis runt Gotland vintrarna 2011 och 2016.](image)
The archipelagos of Kalmar, Östergötland and Södermanland counties (Figures 9, 10) are rather narrow. In the 1970s Long-tailed Ducks were commonly found in the middle and outer parts of the archipelagos and the accumulated map (Figure 9) show occurrences of flocks along the entire coastline. In the later surveys in 2009 and 2016, flocks were found in all parts in 2009, whereas hardly any Long-tailed Ducks were found in some parts of the area in 2016. Compared to the 1970s, the Long-tailed Ducks were more common in the outer parts of the island zone with fewer in the zone with skerries further out.

There were no marked changes in numbers between the seventies (15,000), 1992/1993 (19,000) and 2010 (18,000) for these parts of the archipelagos (Table 1). On the other hand, about 27,000 were estimated for the area based on the aerial surveys in 2009 compared to less than 10,000 in 2016.

In contrast with the archipelagos discussed in the previous paragraphs, the Stockholm archipelago is much wider with a distance of up to 70 km from the mainland coast to the outer skerries in some parts. The Stockholm archipelago was also intensively surveyed from Coast Guard patrols and area-based aerial counts during the 1970s. In later years, one area-based survey (2004) and three transect counts were made of the Long-tailed Duck areas.

Comparing the distribution patterns in the 1970s and 2004–2016 based on the accumulated totals from all counts, some marked differences were found between the two time-periods (Figure 11). In 2004–2016 much smaller numbers of Long-tailed Ducks were found in the southern parts of the archipelago compared to the 1970s. A similar difference was found for the outermost areas in the central part of the archipelago, where relatively few flocks were found in the later period. In both periods, the northern parts of the archipelago were important for the species, but more Long-tailed Ducks were found closer to the mainland in the latter period compared to the 1970s. Comparing the three years with transect surveys (Figure 12), the Long-tailed Ducks were more spread in 2009 than in 2015 and 2016, when a marked concentration was found in the central parts of the northern archipelago.

There were no clear changes in the number of wintering Long-tailed Ducks in the Stockholm archipelago between 1970–1974 and 2009, but in contrast to all other areas the highest estimate was obtained for 2016 (Table 1).

North of the Stockholm archipelago, Long-tailed Ducks were also found in winter along the coasts of Uppsala county and in the Gävle Bight (Figure 13). These areas were surveyed both in 2009 and 2016 with smaller numbers found scattered on the banks Finngrunden and in some parts of the archipelago. No historical data are available from this northernmost winter area of the species.

**Discussion**

The results of the censuses of Swedish offshore waters presented in this report and previous papers (Nilsson 2008, 2012) as well as the two international publications from the first two all-Baltic surveys (Durinck et al. 1994, Skov et al. 2011) clearly shows the importance of the Swedish offshore waters for the Long-tailed Duck, especially the importance of the three offshore banks: the Midsjö Banks and Hoburg Bank. The three banks together...
hold at least 70% of the Swedish Long-tailed Duck population in winter. During the first two all-Baltic surveys, the Swedish waters had about 30% of the total population, implying that the three offshore banks in the Swedish zone together harbors at least 20% of the total population and sometimes in hard winters even more (Nilsson 2012).

The previous all-Baltic survey in 2007–2009 showed a very marked decrease in the overall wintering population of Long-tailed Ducks since the first survey in 1992/1993 (Skov et al. 2011). Similarly, a marked decrease was found in the wintering populations in Swedish waters (cf. also Nilsson 2012). Between 2009 and the survey in 2016, the decrease continued and the Swedish wintering population was about 15% lower than in 2009. Until the international counts have been analyzed and made available it would however be premature to try to establish if this was a part of a general pattern or an effect of a redistribution.

In spring, the Long-tailed Ducks migrate to the breeding areas in northern Russia, a major part of the population passing the Gulf of Finland during their migration, large numbers of migrating Long-tailed Ducks being counted from sites in Finland and Estonia during a restricted period (Bergman 1974, Hario et al. 2009). Counts at Söderskär on the Finnish coast showed an increase in the number of passing Long-tailed Ducks from about 1970 to the early 1990s, followed by a marked decrease (Hario et al. 2009, see also Kauppinen & Leivo.
The highest counts of spring migrants coincided with the first all Baltic survey (1992/1993), which yielded much higher estimates than the 2007–2009 survey.

A regional breakdown of the census results from different time periods (Table 1) show marked differences in the population development between different Swedish regions. The most marked decrease was found for the areas east of Gotland also including the Hoburg Bank. Marked decreases were also found for the waters north and east of Öland but the magnitude of the decrease was much smaller than for the areas east of Gotland.

On the mainland coast, the Long-tailed Duck is found wintering in the outer parts of the archipelagos from the Kalmarsund in the south to the coasts of Uppland in the north. Numbers here are much smaller than at the offshore banks, but there was no clear trend in the wintering numbers taking the archipelagos as a unit. As a matter of fact, the numbers estimated for the Stockholm archipelago was the highest during the study. It may however be noted that wintering Long-tailed Ducks nearly disappeared from the inshore parts of the south coast of Sweden during the study period.

Different factors have been discussed in relation to the decline such as oil pollution, bycatches in fishing equipment and decreased habitat quality (Larsson & Tydén 2005, Stempniewicz 1994, Mathiasson 1970, Skov et al. 2011, Zydelis et al. 2009) and probably the decline is caused by a combination of different factors. The regional differences in the extent of the decline in Swedish waters with the most marked decline for the waters east of Gotland is however a strong indication that oil pollution is an important factor behind the decline. These areas are close to the main shipping line through the Baltic to St Petersburg and other im-
important cities in the eastern part of the Baltic. There is also an extensive but illegal cleaning of the tanks offshore with regular small oil spills at sea.

Acknowledgements
The offshore aerial surveys reported here as well as the Swedish Midwinter Counts are supported by grants from Naturvårdsväket (the Swedish Environmental Protection Agency). The same applies to the aerial surveys in the seventies which were also supported by the Swedish Airforce, which provided free flying time. I am also grateful for the support of the Swedish Coast Guard that allowed duck counters onboard their patrol ships during the surveys in the sixties and seventies.

The aerial surveys could not have been done without the help of a number of skilled observers and I will give my sincere thanks to David Erterius, Martin Granbom, Martin Green, Fredrik Haas, Nils Kjellen, Johan Nilsson, Gabriel Norevik, Roine Strandberg and Mikael Svensson for many observer hours over the open sea.

References


Hario, M., Rintala, J. & Nordenswan, G. 2009. (Dynamics of wintering long-tailed ducks in the Baltic Sea – the con-


Long-tailed Ducks are counted from aircarft (this study, upper photo) or from boat or land.

Alfåglar räknas från flygplan (i denna undersökning; övre fotot) eller från båt eller land.

teringar genomfördes också i skärgårdarna samt efter de öppna kusterna av Skåne, Öland och Gotland. Däremot var det inte möjligt att inventera ut-sjöbankar som Hoburgs Bank och Midsjöbankarna, även om dessa var viktiga lokaler för alfågeln.

I början av 1990-talet, efter de politiska förändringarna i området, kunde för första gången hela Östersjön inventeras med avseende på övervin-

Under de milda vintrarna noterades övervint-
rande alfåglar inom hela det inventerade områdena (Figur 1, se också Nilsson 2012). En mycket be-

Vid inventeringen 2016, som liksom 2009 genom-
fördes under en mild vinter, visade en beräknad summa för de svenska farvattnen på 370000, en fortsatt nedgång. Det är dock omöjligt att avgöra om detta är en del av en allmän minskning eller om alfåglarna ändrat vinterutbredning till viss del, eftersom resultaten från övriga delar av Östersjön ännu inte presenterats.

Under de milda vintrarna noterades övervint-

Under de milda vintrarna noterades övervint-
tre utsjöbankarna. Hoburgs Bank, Södra och Norra Midsjöbanken. Vid båda tillfällena återfanns ca 70% av alfåglarna på dessa tre bankar. Isvintern 2010 var koncentrationen till bankarna ännu mer markerad, 90% av beståndet låg här.

Regionala mönster
Den regionala fördelningen av de övervintrande alfåglarna vid den senaste inventeringen 2016 redovisas i en serie detaljerade kartor (Figur 3-13), vilka där så är tillämpligt också visar utbredningen vid tidigare tillfällen.


Vattnen i Kalmarsund och Öland utgör viktiga vinterområden för alfågeln (Figur 5). I Kalmarsund varierar antalet mycket beroende på isförhållanden, medan farvattnen öster om Öland, speciellt i den norra delen hyser större mängder. Grova skattnings- ningar från 1970-talet tyder på att antalet alfåglar här kan ha varit så högt som 100 000, medan sedan tida beräkningar visat på lägre tall, 13000 en mild vinter som 2016 och 61000 under en av isvintren. Betydelsen för Midsjöbankarna och Hoburgs bank som alfågellokal har redan kommenterats. Området utgör tillsammans det absolut viktigaste området för arten med 70% av totalbeståndet under normala vintrar. Tyvärr saknas jämförelse inventeringar från tidigare år. Alfåglarna förekom spredda över hela bankarna (Figur 6,7).


Antalsmässigt förekom inga större skillnader i antalet alfåglar efter kusterna i de sydligare ostkustskärgårdarna fram till och med 2009, men 2016 var antalet i dessa tre län väsentligt lägre än tidigare. I Stockholms lån noterades däremot inga skillnader i antalet övervintrande alfåglar mellan de olika perioderna, enbart en del variation. Antalet övervintrare 2016 var det högsta noterade för området.

Diskussion


Minskningen i antalet övervintrande alfåglar är inte densamma inom hela det svenska övervintringsområdet utan är mest markant för områdena öster om Gotland, men återfinns också utanför Öland. Däremot har endast mindre förändringar eller enbart fluktuationer noterats för kustområden och skärgårdar, där antalet övervintrande alfåglar dock är betydligt lägre. Tyvärr saknas äldre data från de viktiga utsjöbankarna.