Upwind or downwind? The spring arrival of Arctic Terns *Sterna paradisaea* at Troms, North Norway.

ROBERT T. BARRETT*

Department of Natural Sciences, Tromsø University Museum, PO Box 6050 Langnes, NO-9037 Tromsø, Norway.

*Correspondance author

Email: rob.barrett@uit.no

Arctic Terns *Sterna paradisaea* have a record-long migration from their breeding grounds in the Arctic to wintering areas in the Antarctic and back. They had nevertheless a remarkably constant return date to North Norway over a 35-y period (1981-2015), arriving in Troms within a 13-d time window in mid- to late May. Since 1993, arrival dates have advanced by ca. 4 d. No relationships were found between arrival dates and large-scale weather proxies such as the North Atlantic Oscillation or sea temperatures, but when approaching Troms, headwinds tended to delay arrivals whereas tailwinds advanced them.

There has been much focus on phenological changes in ecosystems in these times of climate change, and a general trend towards earlier spring passages of birds through study sites or earlier arrivals at breeding grounds in temperate areas has been evident (e.g. Jonzén *et al* 2006, Both *et al* 2010). North Norway is no exception, where the majority of 42 migrant bird species advanced their arrival dates at a mean of 0.41 d y^{-1} between 1980 and 2010 with most of the advance occurring after the mid-1990s (Barrett 2011). This study also corroborated earlier evidence that long-distance migrants advanced spring migration in response to climate change less than short-distance migrants (e.g. Lehikoinen *et al* 2004, Hubálek & Capek 2008). This is possibly because the latter are “better informed” about conditions at their target both before starting and *en route* and can respond accordingly (Rubolini *et al* 2010). Nearly all birds migrating to North Norway do so over land or along the coast and can thus assess conditions on the way, as shown by the partial response by many species to changing spring temperatures and date of snow melt along the migration route (Barrett 2011).

Long-distance migrants and especially species migrating over large bodies of water cannot, however, access cues about conditions at their destination, and decisions concerning when and how fast to move and how long to spend at stopovers must be based on other factors such as weather conditions and food availability at sea (Gordo 2007). In North Norway, one such species is the Arctic Tern *Sterna paradisaea* whose migration is record-long (Fijn *et al* 2013, solely over the oceans and, like birds migrating to e.g. Iceland or Greenland, might respond to large-scale external cues to ensure landfall at the optimal time (Gunnarsson & Tómasson 2011). One widely-used and useful exploratory variable in this context is the North Atlantic Oscillation (NAO) Index (e.g. Vähätalo *et al* 2004). The NAO index provides a large spatially-scaled proxy of weather conditions in the North Atlantic including changes in the surface westerly winds across the North Atlantic into Europe. Positive values are associated with more and stronger storms moving on a northerly track and warm and wet conditions in western Europe whereas negative values correspond to suppressed westerlies and cold winters and springs in Northern Europe (Hurrell 1995). Arctic Terns are light in weight with long, slender wings adapted for energy-saving flight at low speeds, although air speeds during migration of 9-12 m s^{-1} (ca. 30-40 km h^{-1}) have been documented (Alerstam 1985, Wakeling & Hodgson 1992). Because wind speed and flight direction in relation to wind may explain 60% of the variation in ground speed among seabirds with flapping flight (Spear & Ainley 1997a), Arctic Terns are very receptive to wind speed and direction at low spatial and temporal scales. As such, wind conditions can be expected to delay or accelerate their passage on a day-to-day basis.

The Arctic Tern breeds around the North Pole in temperate and arctic zones and has one of the longest migrations known. During the non-breeding season, birds move often in small flocks of up to 25-30 birds (Gudmundsson *et al* 1992) over distances up to 90 000 km to the Southern Ocean and Antarctica and back via well-defined staging areas at e.g. the Newfoundland Basin (for Greenland, Iceland and Dutch birds), the Benguela Current off Namibia and the subtropical Indian ocean (Dutch birds) (Egevang *et al* 2010, Fijn *et al* 2013). The global population is estimated to be somewhere between 1-3 million pairs with ca. 0.5-2 million pairs in Europe and the North Atlantic (Mitchell *et al* 2004). In Norway, the population is estimated as around 40 000 pairs, including 5-10 000 pairs along the Barents

Sea mainland coast and 5-6 000 pairs on Svalbard (Fauchald *et al* 2015, Shimmings & Øien 2015).

Despite its extraordinary migration, very little data concerning the phenology of movements to and from the breeding grounds were found in the literature, e.g. through a search in ISI Web of Knowledge. Recent tracking data have, however, revealed a remarkably rapid return from the wintering areas, with departure dates from the Antarctic at the end of March to mid-April and arrival at the breeding colony a little more than one month later (Egevang *et al* 2010, Fijn *et al* 2013). This is corroborated by observational data of Arctic Terns moving northwards across the UK during the last half of April and early May or arriving at Danish colonies in March-May (Kramer 1995, Møller *et al* 2006, Vinicombe 2014). The first arrivals on the South Norwegian coast are at the end of April/early May, and in the north of the country in mid-May (Barrett 2002, Bakken *et al* 2003). A recent analysis showed no apparent temporal long-term change in arrival dates (Barrett 2011), but with five more years of data this study explores further the arrival of Arctic Terns to North Norway in relation to large-scale and local weather parameters.

MATERIAL AND METHODS

This analysis is based on about 530 observation dates of the first individuals of Arctic Terns seen between 1981 and 2015 by bird watchers and members of the public in the coastal county of Troms (ca. 68° - 70° N, 16° - 22°E) that were reported either directly to me or, since 2009, published online at www.artsobservasjoner.no. The municipality covers ca. 26 000 km^2 and consists of large islands, long fjords and sounds and a mountainous terrain.
To exclude extreme outlying early arrivals of "rogue" individuals (Sparks *et al* 2001) and unless otherwise stated, all statistics were based on the second observation date of the Arctic Tern in Tromsø in years when there was a minimum of 10 observations in the database. The apparent dates of the main wave of first arrivals into Troms, defined as the days on which hundreds of birds were reported – either large flocks at few sites or small flocks at many sites, were used as a second measure of arrival phenology.

As a proxy of large-scale weather conditions prior to and during the migration northwards, principal-component-based indices of the NAO were downloaded from www.climatedataguide.ucar.edu/climate-data/hurrell-north-atlantic-oscillation-nao-index-pc-based. Smaller-scale indices were downloaded from the Norwegian Meteorological Institute at www.eklima.no. Wind direction was proxied for each year using the mean frequency distribution of wind in the SW (representing tailwinds) and NE quarters (representing headwinds) (compass bearings 165-254° and 345-74° respectively) that were recorded four times a day at six-hour intervals at Andenes (69° 19'N, 16° 07'E) during the 10 d prior to arrival date (either 2nd observation date or date of main arrival. Crosswinds were winds coming out of the two remaining quarters. Andenes was chosen as it is the meteorological station closest (ca 30 km) to the southwest coast of the county of Troms. Monthly means of sea surface temperatures in May off Andenes and at the spring migration staging area in the mid-North Atlantic (at 50 ^{o}N, 41 ^{o}W, Fijn *et al* 2013) were downloaded from www.iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.EMC/.CMB/.GLOBAL/.Reyn_SmithOIv2/.

Regression analyses were carried out using Minitab 15 statistical software and segmented piecewise regression analyses were applied using the interactive method downloaded from the Excel Resources web page at www.processtrends.com/downloads.htm (D. Kelly O'Day).

RESULTS

Between 1981 and 2015, the first Arctic Terns were observed in Troms between 11 and 21 May (Fig 1, Supplementary data - Table 1). Using dates of the second observation, a simple linear regression analysis implied that there was no trend towards earlier arrivals with time between 1981 and 2015 (2nd obs. = 76.8 – 0.03 Year, r^2 = 0.02, P = 0.48). A closer visual inspection of the plot suggested, however, that the relationship might be non-linear with an initial period of no apparent trend followed by an advancement of arrival dates (Fig 1). An interactive segmented piecewise regression analysis confirmed this with no trend during the first decade but after 1993, 2nd arrival dates advanced at a rate of 0.16 d y^{-1} (2nd obs. = 347.3 – 0.16 Year, r^2 = 0.29, P = 0.014). Similarly, there was no trend in the main arrival dates until

2001, after which they advanced at a rate of 0.23 d y^{-1} (main wave = 486 – 0.23 Year, r^2 = 0.39, P = 0.012) (Fig. 1).

There were no significant relationships between 2nd arrival dates or the main wave and any of the three NAO indices for May, March-May or Dec-March (Table 1). At the smaller scale, the mean frequency of tail- and headwinds during the 10 d prior to the terns' arrival in Troms varied considerably from year to year (Fig 2). For example, in 1987 and 2008, only 11% of the winds recorded at Andenes were tailwinds (i.e. in the SW quarter) whereas in 2010, 50% were tailwinds during the 10 d before the 2nd observation. Similarly, in 2000 and 2010, only 6-9 % were headwinds respectively (i.e. in the NE quarter) whereas in 1987, 64% were headwinds. There were no long-term trends in the frequencies of head- or tailwinds. There were close correlations between dates of arrival and the difference in the proportions of head- and tailwinds each year, with arrivals being later when there were more NE winds and earlier when there were more SW winds (Fig 3). Alternatively, head- and tailwinds were each significantly associated with arrival date, with terns being delayed during years with headwinds and arriving earlier in years with tailwinds (Figs 4-5). The mean speeds of head- and tailwinds were 4.9 (SE=0.2) and 5.1 (SE=0.2) m s^{-1} respectively. There were no correlations between arrival dates and frequencies of crosswinds (2nd arrival, y = 17.2 – 0.61, r^2 = 0.00, P = 0.853; main wave, y = 19.4 + 1.24, r^2 = 0.01, P = 0.644) . Despite considerable variation in the sea surface temperatures at the stopover site in the mid-North Atlantic in April and off Andenes in May (Fig 6), there were no significant relationships between arrival dates and these parameters (Tab. 2).

DISCUSSION

Since this study began in the 1980s, the spring arrival of Arctic Terns in Troms has been very consistent with first observations varying between 11 and 20 May. Among 42 migrant species (Table I in Barrett 2011) arriving in Troms, 2nd observation dates varied by as much as 60 d with a mean of 31 (SE = 1.8) for all species. While some species underwent a large change in migration phenology, Red Knot *Calidris canutus*, Ruff *Philomachus pugnax* and Arctic Tern underwent relatively little change, varying by 8, 11 and 13 d respectively (unpubl. data, Supplementary data - Table 1). This is remarkable considering the distances travelled by Arctic Terns but consistent with other short time windows recorded for the species during spring migration. Examples are contracted departure dates from the wintering region and crossing of the Equator (12-19 April and 25 April-7 May resp. for 10 geolocator-marked Greenland birds, Egevang *et al* 2010), transit dates across southern England (between 27 April and 7 May in 1980-1991, Kramer 1995 or last 20 d in April in 1978-2013, Vinicombe 2014) and arrival dates at Iceland (variation = 15 d, 29 April-14 May between 1988 and 2009, Fig 4 in Gunnarsson & Tómasson 2011).

Whereas an earlier analysis from Troms based on data from 1980-2010 and a similar one from Iceland in the same time period (1988-2009) found no evidence of changes in arrival dates of Arctic Terns at their breeding grounds (Barrett 2011, Gunnarsson & Tómasson 2011), an additional five years of data revealed an advance in arrivals of Norwegian birds after the mid-1990s (this study). Although there was no direct relationship between arrival dates and sea surface temperature at Andenes, 1996-2005 was a period of a rapid increase in temperature (from 5.2-7.0 ^{0}C, Fig. 6) and of a rapid increase in heat content of the Norwegian Sea (Mork 2015). Such large amplitudes in ocean climate changes, irrespective of direction, are known to have negative effects on seabirds, presumably through the disruption of the food webs (Irons *et al* 2008 and refs. therein). Whether the terns are responding in the same manner to such an oceanic climate shift by returning earlier is unknown.

The northward migration of Arctic Terns is very rapid at speeds of > 500 km d^{-1} and at least Dutch birds stop over for a few days at a mid-North Atlantic staging area ca 1000 km NNW of the Azores in mid-April (Fijn *et al* 2013). This staging area is ca 2 000 km SSW of southern Norway, a distance that could be covered in 4-5 days when flying at a speed of 500 km d^{-1}. Arrivals of Arctic Terns in the south of Norway at the end of April (Bakken *et al* 2003) and 10-20 d later ca 1 000 km further north (this study) suggest that Norwegian terns, if they also stop over in the same staging area and if they maintain the same flight speed, leave this area a week or two later than e.g. the Dutch birds. This would imply either a later departure from the Antarctic or a longer stop over. It is, for example, possible that departure time is delayed for these high-latitude breeding birds in relation to the Dutch birds, as found in Bar-tailed Godwits *Limosa lapponica baueri* migrating from New Zealand to Alaska whose departure time was strongly correlated with breeding latitudes (Conklin et al. 2010). An alternative is that Norwegian birds migrate more slowly than Dutch birds. There was no evidence that oceanographic conditions in the area had any effect on the migration schedule.

The lack of relationship between the large-scale weather proxy NAO and arrival dates corroborates an earlier study that included the Arctic Tern in Iceland, where an analysis of arrival dates of 17 species crossing the Atlantic from Europe showed that species wintering closest to Iceland responded to favourable winds and warmer springs on the island by departing earlier from the European mainland. Those wintering south of northern France, including the Arctic Tern, showed no such response presumably because they were less able to assess conditions in their target area (Gunnarsson & Tómasson 2011). As such, departure dates and at least early scheduling of migratory movements of Arctic Terns that winter in the far south can be expected to be unaffected by weather system fluctuations in the North Atlantic. A similar reasoning was proposed by Hubálek & Capek (2008) who suggested that different mechanisms govern the scheduling of migration of short- and long-distance migrants in Central Europe.

Whereas the initial timing of the Arctic Tern migration northwards may be largely controlled by endogenous circannual and circadian rhythms that are strong in long-distance migrants (Gwinner 1996, Wormworth & Şekercioğlu 2011), arrival dates in North Norway respond to local wind conditions. While crosswinds had no effect, head- and tailwinds resulted in delays and advances respectively with an overall difference in arrival dates of 3-4 days (Fig 5). This is despite the fact that terns fly mostly across the wind (Spear & Ainley 1997a) and thus an expectation that higher frequencies of crosswinds would result in an advance of arrival dates. Although terns increase airspeed when flying into the wind (Gudmundsson *et al* 1992), with increases up to 100 % faster than when flying downwind (e.g. 14.2 vs 6.6 m s^{-1} respec. [Spear & Ainley 1997b] or 12.2 vs 8.9 m s^{-1} respec. [Wakeling & Hodgson 1992]), groundspeeds are the opposite and correspondingly faster when flying downwind (12.1 vs 7.3 m s^{-1} respec. [Spear & Ainley 1997b]). With mean headwinds equalling those of tailwinds (ca. 5 m s^{-1}) at Andenes, arrivals can thus be expected to be earlier when tailwinds are more frequent in the 10 d prior to arrival. As such, any increase in SW winds as a result of climate change can be expected to result in an advance in spring arrival dates of the Arctic Tern in North Norway.

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REFERENCES

Alerstam, T. (1985) Strategies of migratory flight, illustrated by arctic and common terns, *Sterna paradisaea* and *Sterna hirundo*. *Contributions in Marine Science* **27**, 580-603.

Bakken, V., Runde, O. & Tjørve, E. (2003) *Norsk Ringmerkingsatlas. Vol. 1.* Stavanger Museum, Stavanger, Norway.

Barrett, R.T. (2002) The phenology of spring bird migration to North Norway. *Bird Study* **49**, 270-277.

Barrett, R.T. (2011) Recent response to climate change among migrant birds in northern Norway. *Ringing and Migration* **26**, 83-93.

Both, C., Van Turnhout, C.A.M., Bijlsma, R.G., Siepel, H., Van Strien, A.J. & Foppen, R.B.P. (2010) Avian population consequences of climate change are most severe for long-distance migrants in seasonal habitats. *Proceedings of the Royal Society, Series B* **227**, 1259-1266.

Conklin, J.R., Battley, P.F., Potter, M.A. & Fox, J.W. (2010). Breeding latitude drives individual schedules in a trans-hemispheric migrant bird. Nature Communications **1:67**, DOI:10.1038/ncomms1072.

Egevang, C., Stenhouse, I.J., Phillips, R.A., Petersen, A., Fox, J.W. & Silk, J.R.D. (2010) Tracking of Arctic Terns *Sterna paradisaea* reveals longest animal migration. *Proceedings of the National Academy of Science, USA* **107**, 2078-2081.

Fauchald, P. Anker-Nilssen, T., Barrett, R.T., Bustnes, J.O., Bårdsen, B.-J., Christensen-Dalsgaard, S., Descamps, S., Engen, S., Erikstad, K.E., Hanssen, S.A., Lorentsen, S.-H., Moe, B., Reiertsen, T.K., Strøm, H. & Systad, G.H. (2015) *The status and trends of seabirds* *breeding in Norway and Svalbard*. NINA Report 1151, Norwegian Institute of Nature Research, Trondheim, Norway.

Fijn, R.C., Hiemstra, D., Phillips, R.A. & van der Winden, J. (2013) Arctic Terns *Sterna paradisaea* from the Netherlands migrate record distances across three oceans to Wilkes Land, East Antarctica. *Ardea* **101**, 3-12.

Gordo, O. (2007) Why are bird migration dates shifting? A review of weather and climate effects on avian migratory phenology. *Climate Research* **35**, 37-58.

Gudmundsson, G.A., Alerstam, T. & Larsson, B. (1992) Radar observations of northbound migration of the Arctic Tern, *Sterna paradisaea*, at the Antarctic Peninsula. *Antarctic Science* **4**, 163-170.

Gunnarsson, T.G. & Tómasson, G. (2011) Flexibility in spring arrival of migratory birds at northern latitudes under rapid temperature changes. *Bird Study* **58**, 1-12.

Gwinner, E. (1996) Circadian and circannual programmes in avian migration. *Journal of Experimental Biology* **199**, 39-48.

Hubálek, Z. & Capek, M. (2008) Migration distance and the effect of North Atlantic Oscillation on the spring arrival of birds in Central Europe. *Folia Zoologica* **57**, 212-220.

Hurrell, J.W. (1995) Decadal trends in the North Atlantic Oscillation: Regional temperatures and precipitation. *Science* **269**, 676-679.

Irons, D.B., Anker-Nilssen, T., Gaston, A.J., Byrd, G.V., Gilchrist, G., Hario, M., Hjernquist, M., Krasnov, J.V., Mosbech, A., Olsen, B., Petersen, A., Reid, J.B., Robertson, G.J., Strøm, H. and Wohl, K. (2008) Fluctuations in circumpolar seabird populations linked to climate oscillations. *Global Change Biology* **14**, 1455-1463.

Jonzén, N., Lindén A., Ergon, T., Knudsen, E., Vik, J.O., Rubolini, D., Piacentini, D., Brinch, C., Spina, F., Karlsson, L., Stervander, M., Andersson, A., Waldenström, J., Lehikoinen, A., Edvardsen, E., Solvang, R. & Stenseth, N.C. (2006) Rapid advance of spring arrival dates in long-distance migratory birds. *Science* **312**, 1959-1961.

Kramer, D. (1995) Inland spring passage of Arctic Terns in southern Britain. *British Birds* **88**, 211-217.

Lehikoinen, E., Sparks, T.H. & Zalakevicius, M. (2004) Arrival and departure dates. *Advances in Ecological Research* **35**, 1-31.

Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T.E. (2004) *Seabird Populations of Britain and Ireland. Results of the Seabird 2000 Census (1998-2002)*. T. & A.D. Poyser, London, UK.

Mork, K.A. (2015) Norskehavet, 91-92 in: *Havforskningsrapporten 2015* Pp. 91-92 in Bakketeig, I.E., Gjøsæter, H., Hauge, M., Sunnset, B.H. & Toft, K.Ø. (eds.). Fisken og havet, særnummer 1-2015. Havforskningsinstituttet, Bergen, Norway.

Møller, A.P., Flensted-Jensen, E. & Mardal, W. (2006) Dispersal and climate change: a case study of the Arctic Tern *Sterna paradisaea*. *Global Change Biology* **12**, 2005-2013.

Rubolini, D., Sainio, N. & Møller, A.P. (2010) Migratory behaviour constrains the phenological response of birds to climate change. *Climate Research* **42**, 45-55.

Shimmings, P. & Øien, I. J. (2015) *Bestandsestimater for norske hekkefugler*. Norsk Ornitologisk Forening-rapport 2015-2, Trondheim, Norway.

Spear, L.B. & Ainley, D.G. (1997a) Flight speed of seabirds in relation to wind direction and wing morphology. *Ibis* **139**, 221-233.

Spear, L.B. & Ainley, D.G. (1997b) Flight speed of seabirds in relation to wind speed and direction. *Ibis* **139**, 234-251.

Vähätalo, A.V., Rainio, K., Lehikoinen, A. & Lehikoinen, E. (2004) Spring arrival of birds depends on the North Atlantic Oscillation. *Journal of Avian Biology* **35**,210-216.

Vinicombe, K. (2014) The migration of common and Arctic Terns in southern England. *British Birds* **107**, 195-206.

Wakeling, J.M. & Hodgson, J. (1992) Optimisation of the flight speed of the little, common and sandwich tern. *Journal of Experimental Biology* **169**, 261-266.

Wormworth, J. & Şekercioğlu, Ç. (2011) *Winged Sentinels. Birds and Climate Change*. Cambridge University Press, Cambridge, UK.

Table 1. The results of regressions of arrival dates of the second individuals and the main waves of migrating Arctic Terns to Troms on three concurrent North Atlantic Oscillation (NAO) indices.

	NAO index	Slope	r^2	*P*
2^{nd} arrival	May	-0.95	0.13	0.074
	March-May	-0.50	0.09	0.134
	Dec-March	-0.04	0.03	0.399
Main wave	May	-0.71	0.07	0.210
	March-May	-0.10	0.00	0.767
	Dec-March	-0.22	0.07	0.198

Table 2. The results of regressions of arrival dates of the second individuals and the main waves of migrating Arctic Terns to Troms on mean sea surface temperatures (SST) off Andenes in May and at the stopover site in the mid North Atlantic in April.

	SST	Slope	r^2	*P*
2^{nd} arrival	Andenes	-0.25	0.01	0.738
	Mid N. Atlantic	0.38	0.05	0.261
Main wave	Andenes	-0.37	0.01	0.620
	Mid N. Atlantic	-0.29	0.03	0.401

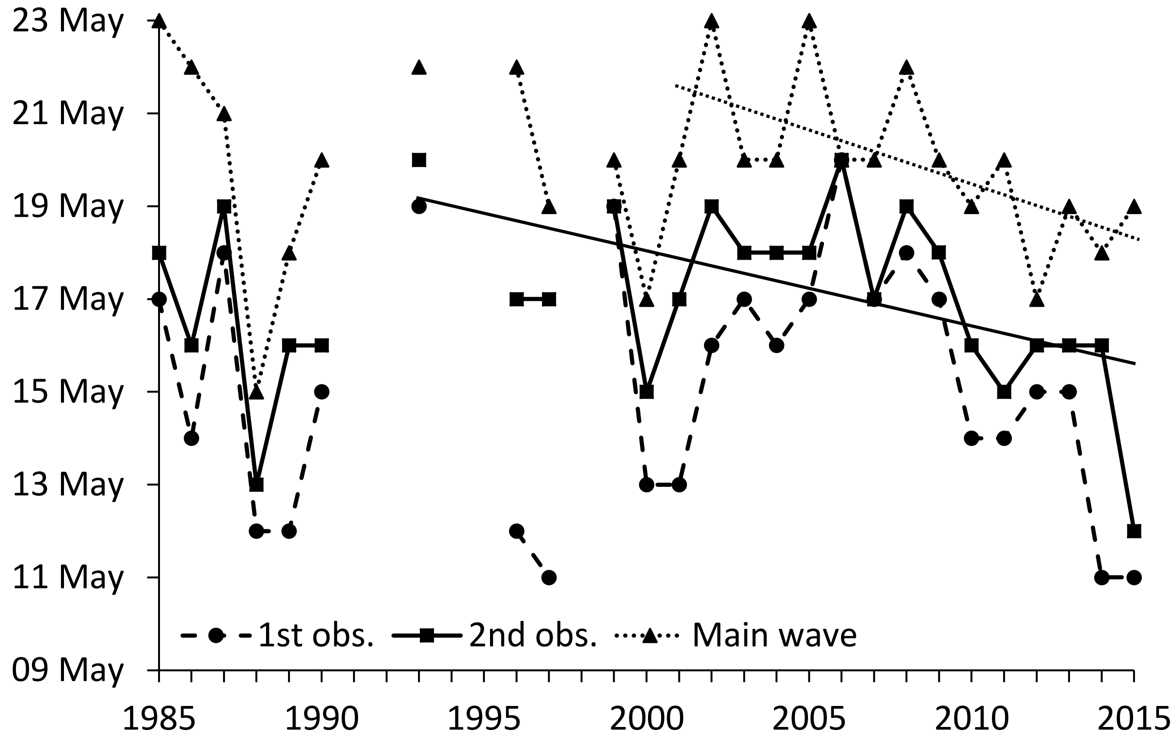

Figure 1. Dates of 1st and 2nd observations and the main wave of arrivals of Arctic Terns during the spring migration in Troms, N. Norway between 1981 and 2015. Significant advances in arrival dates are shown by trend lines – see Results.

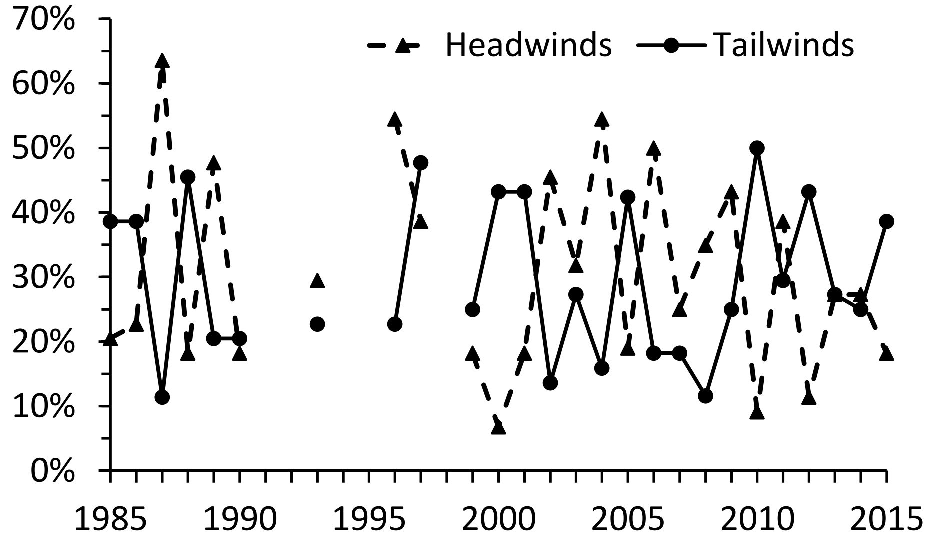

Figure 2. Mean annual frequencies of head- and tailwinds experienced by Arctic Terns during 10 d prior to their arrival during spring migration in Troms, N. Norway.

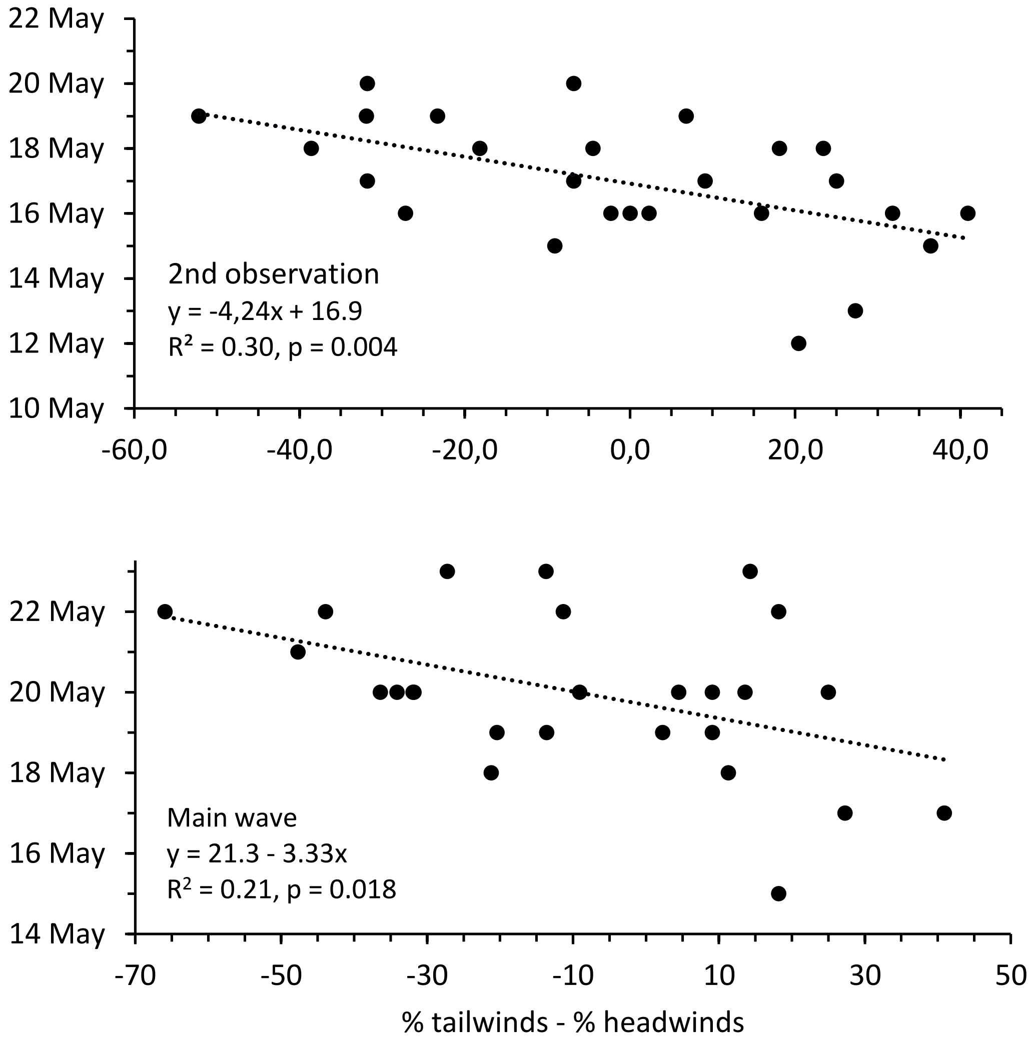

Figure 3. Arrival dates (2nd observation and main wave) of Arctic Terns in Troms, North Norway during the spring migration in relation to the difference in frequencies of head- and tailwinds at the southern border of the county during the 10 d prior to arrival.

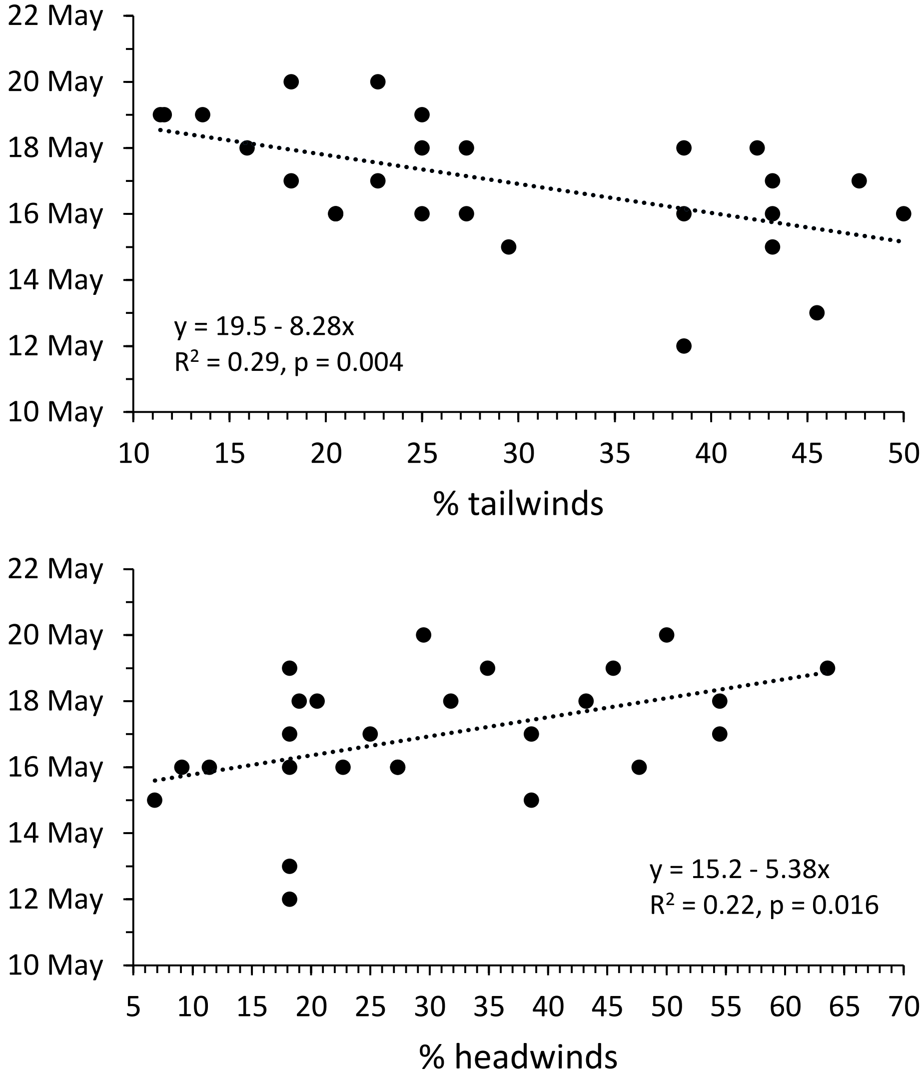

Figure 4. Dates of the 2nd observation of Arctic Terns in Troms, North Norway during the spring migration in relation to the frequencies of head- and tailwinds at the southern border of the county during the 10 d prior to arrival.

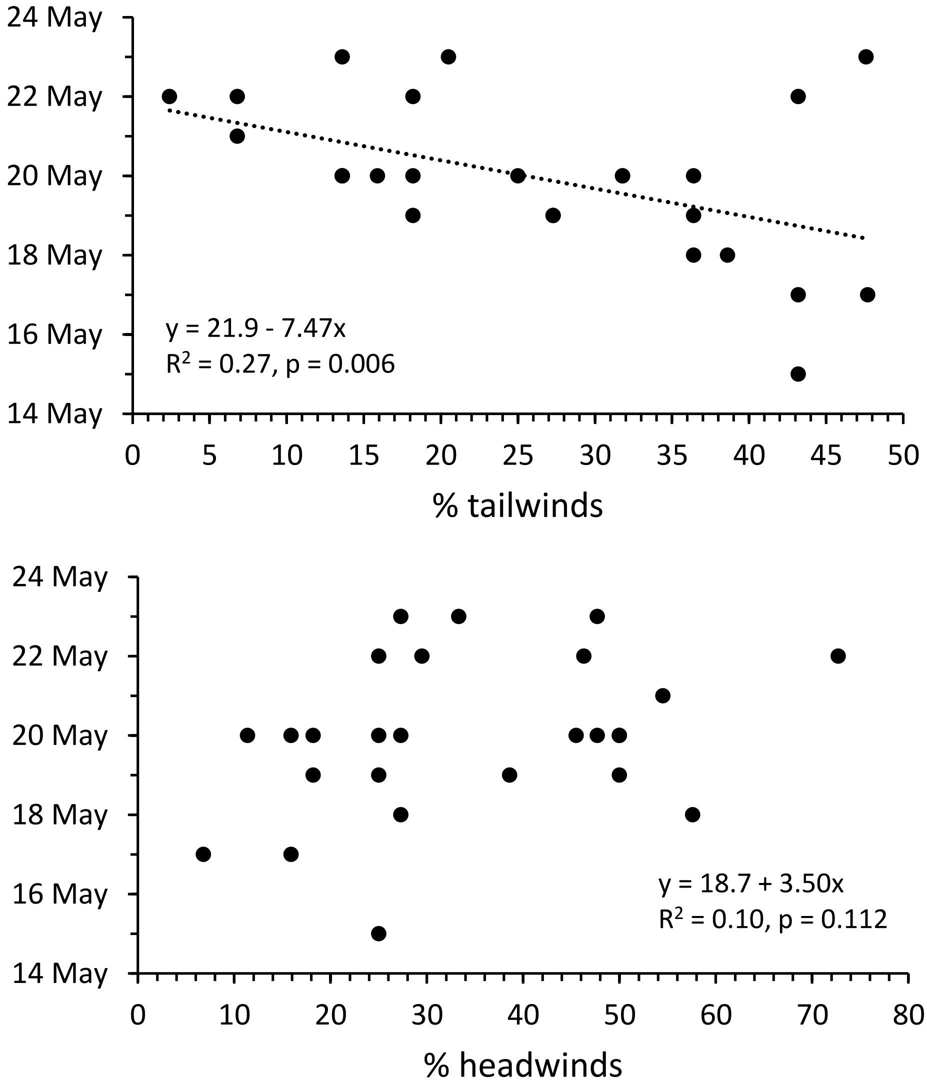

Figure 5. Dates of the main wave of arrival of Arctic Terns in Troms, North Norway during the spring migration in relation to the frequencies of head- and tailwinds at the southern border of the county during the 10 d prior to arrival.

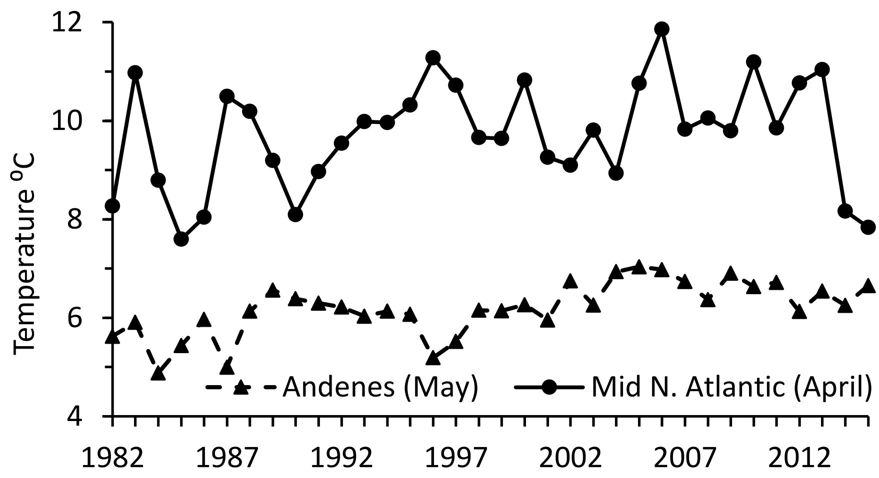

Figure 6. Mean sea surface temperatures in the mid-North Atlantic (50 ^{o}N, 41 ^{o}W) in April and off Andenes, N. Norway in May and 1982-2015.

Supplementary data - Table 1. Dates (d after 1 May) on which the first (1st) and second (2nd) observations of Arctic Terns were reported in Troms, North Norway and the estimated dates of the main wave of first arrivals (Main) in 1981-2015. N = no. of observations in database.

	1st	2nd	Main	N
1981	19	21	21	5
1982	13	22	23	8
1983	15	24	24	4
1984	13	15	16	9
1985	17	18	23	13
1986	14	16	22	10
1987	18	19	21	12
1988	12	13	15	12
1989	12	16	18	13
1990	15	16	20	11
1991	12	17	19	7
1992	15	16	16	9
1993	19	20	22	11
1994	22	22	23	3
1995	19	22	23	9
1996	12	17	22	10
1997	11	17	19	13
1998	18	19	20	9
1999	19	19	20	13
2000	13	15	17	15
2001	13	17	20	15
2002	16	19	23	20
2003	17	18	20	14
2004	16	18	20	16
2005	17	18	23	28
2006	20	20	20	20
2007	17	17	20	21
2008	18	19	22	21
2009	17	18	20	22
2010	14	16	19	30
2011	14	15	20	29
2012	15	16	17	22
2013	15	16	19	24
2014	11	16	18	27
2015	11	12	19	22