Woodpigeons’ and wild-birds’ migration-decision-making abiotic factor : evidence based data concerning Air Pressure increasing monitored for 24 years of 152 peaks/waves in autumn in Italy and Europe

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Key-words : Woodpigeon,wild birds,mass migration,Air Pressure, peaks/waves ,evidence based,references

Abstract

Seasonal migratory peaks are represented as the most important and exhaustive expression of the migratory impulse of migratory birds, impulse itself subject to the determinism of biotic and abiotic factors connected to each other in terms of sensitive migratory ecology.(32,33,34,12bis)
In 24 years – almost a quarter of a century – we have been able (Club Italiano del Colombaccio) to extract 152 events of migratory peaks of the Columba palumbus species in Europe and more directly on-the-field in Italy.
By linking these migratory data (milions of recorded birds)(48,52,53,82,31) with highly qualified meteorological data in detail (HistoricaArchives)(77,78,79,80,36,84), and selecting from among all the abiotic factors(85,91) those of

Atmospheric Pressure (a strictly physical element in the context of the habitat of life of birds, such as atmospheric air) we obtain the following evidence: the increasing A.P. value more than 10 hPa – as most important abiotic factor of the migration take-off timing ‘s decision making- has been evidenced in 94,44{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of Peaks/Waves , 12-48 hours before the take-offs .(36,40,44,73)

The sensitive response that occurs simultaneously in thousands of wood pigeons (and in other avian species) that leave massively for migration, cannot fail to have an organ and / or integrated body sensory system dedicated to receiving this physical stimulus (increase in atmospheric pressure) and at the present time the only supposed organ can only be Vitali’s Para-tympanic Organ (PTO).
The analysis – and its results recorded on 152 events over 24 years -wants to draw the attention of Research Institutions so that they can develop studies and insights on PTO still totally lacking after more than a century from the discovery of the PTO.
The analysis – and its results recorded on 152 events over 24 years –

INTRODUCTION

Bird migrations remain a fascinating and still mysterious phenomenon of Nature closely linked to the evolution of animal species on planet Earth itself materially evolved (continental drift) and evolving (climate change). Despite the immense interest in study that it arouses, a sense organ (PTO) (38,39,73,12,12bis) identified for more than a century (1911) (1,73)is not yet sufficiently studied and, more particularly, no research has been developed linking it as the supposed “biological barometer / altimeter ” to the sensitive-migratory ecology of wild birds (94). Occasional references are found in Literature, but specific data-base analyzes and documents are

still totally lacking as for wild birds.

Our retroactive research contributions (73,35,36,40,48,52 and Italian Journal Woodpigeon Research - https://journal.ilcolombaccio.it/ , INDEX)-always carried out in terms of Citizen Science have tried invain to attract the attention and initiatives of institutional researchers (Ornithology, Ecology, Molecular Biology, Anatomy,Natural Sciences, etc.).
With reference to a single migratory species (Columba palumbus) we have been able to develop a migration forecasting method (75,76) by linking the weather forecast (atmospheric pressure increases) and seasonal timing of migration on the territories of origin and transit with forecast reliability results above 90. {a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}, especially with a focus on transit areas of origin (Falsterbo Sweden) and stop-overs (Italy- personal experience on the field) and in this case with video highlights of mass take-offs of hundreds of thousands of Wood Pigeons, all at the same forecasted time at scheduled times.(75,76)
All our predictions were right and most impressive result (2017) is

https://youtu.be/pGK6z9SY8Cg (*****)

(if Link results not efficient copy/pasate on Youtube search)

Other mass-take-off on from Mesola forest documented by video 6 November 2020 ,after an Air Pressure jump (18 hPa) from high stable Air Pressure condition from 1012 hPa to 1030 hPa in 48h.

The value of predictions of results in scientific research is confirmed in Literature. (72)

Certainly more probative are the selective analyzes obtained with real-time monitoring from observation and visual counting

“in the 500 m visual field” recorded in experienced in migration for over 20 years (Citizen Science – Italian Journal Woodpigeon Research), and at the same time extraction – with study license – of data collected by institutions (Falsterbo – GIFS) in crucial monitoring points in Sweden and France (Pyrenees): analysis focus on “mass take-off and transit, peaks and waves” as maximum expressions of the migratory impulse of the Columba palumbus species.
The result is therefore “evidence based data” and “evidence based events” in Europe (52) in multiannual collecti
Materials and Method.

All the personal References (2014-2022) (73)and the Italian Club del Colombaccio (1997-2022) (constitute the consolidated basis of details on the identification and analysis of “mass take-offs, peaks, waves” and on the evolution of detection and monitoring methods. .(31,50,82)
All the extraction of meteorological (85,91) and climatological data (81,84) then connected to the dating of the migratory events were carried out by the Historical Archives of specific established Websites, which can be checked online. (77,78,79,80,84)

Table 1

AIR PRESSURE increasing (+ hPa .max) 12-48 h before the take-off of the Peak/Wave)Italy

YEAR number of events +hPa/12-48h before

1998 one 15 hPa
1999 two 20 -10
2000 one 10
2001 one 15
2002 one 10
2003 one 22
2004 one not-available
2005 one 11

2006 two 10-22
2007 one 10
2008 two 10-11
2009 two 11-13
2010 one 15
2011 two 15-10
2012 one 20
2013 two 10-12
2014 one 14
2015 one 11
2016 two 11-10
2017 two 11-12
2018 two negative
2019 two 11-10
2020 two 11-negative
2021 two 11-16

TABLE 1 – The present list is over 24 years ‘ monitoring of autumn migration of Woodpigeons (Columba palumbus) crossing Italian Peninsula and collected 37 selected peaks/waves ,corresponding to the the periods of the most intense migration in Italy which are highlighted in specific references (73,35,36,40,48,52 and Italian Journal Woodpigeon Research -https://journal.ilcolombaccio.it/ , INDEX.). For each migration peak / wave the correspondence of the atmospheric pressure increase values detected in precise qualified websites with detailed historical archive (references 77,78,79.80,84) was assessed. The statistical approach is for 23 years (one year 2004 – onepeak- is without meteo-data available) and 36 peaks: 34 have evidence of increased Air Pressure happened 12-48 h before the take-off from the origin / transit area (mostly Istria Croatia and Adriatic coast Italy) .The data (1998-2007)are fully documented and supported by detailed GRAPHICS (temperature,Air Pressure,Wind force,Wind direction on Weather Archives no more available after 2008)reported in Monograph “Autumn Migration of Woodpigeons in Italy” Ed.Aracne,Rome,2018 from pag . 128 to

pag.135.(36).All the selected events (days/years) are according specific seasonal periods-timing identified and reported in References (73,35,36,40,48,52 and Italian Journal Woodpigeon Research -https://journal.ilcolombaccio.it/ , INDEX)-

The increasing A.P. value more than 10 hPa – as most important abiotic factor of the migration take-off timing ‘s decision making- has been evidenced in 94,44{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of high Peaks/Waves (*)

(*)We define (35) (from The General Pattern of Seasonal Dynamics of The Autumn Migration of The Wood Pigeon Columba PalumbusinItaly.(35)Availablefrom: https://www.researchgate.net/publication/328336987_The_General_Pattern_of_Seasonal_Dynamics_of_The_Autumn_Migration_of_The_Wood_Pigeon_Columba_Palumbus_in_Italy) the term peak day as a day within which the number of obser-ved birds exceeds 5{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of the individuals observed within the season (all birds observedfrom the beginning to the end of the observation period = 100{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}). This means that ifduring a period of two, three or more consecutive days the share of birds each day isabove 5{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of the total number of observed birds, all these days will be called ‘peakdays’. For a more precise description, peak days with different values are designatedas ‘low peaks’ – 5.1-10.0{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of the yearly total, ‘moderate peaks’ – 10.1-15.0{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} and‘high peaks’ – >15{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}. Still the term ‘peak’ refers to one day. When we use the per-centage value of the share of the day in the entire study, calculation of the SimilarityIndex (SI – discussed below) is natural and easily understandable.We use the term

wave of migration to refer to a period of several days in sequencein which the migration is more intensive than in periods with lower numbers(shares). The wave can contain both peak days and days with very low numbers.Within the entire period of seasonal migration, waves are usually smaller at the be-ginning and at the end of migration period than in the middle period of migration,and of course the probability that real peak days will occur then is lower.To study whether two curves representing migration dynamics are similar or dis-similar in terms of the course of migration, we can use statistical tools, such as chi-square or similarity indices.

In our first detailed analysis (1997- 2014) our summary was as follows

“In this detailed paper we have tried to detect all the possible abiotic data on three areas of transit of woodpigeons (Columba palumbus) on autumn migration (Falsterbo Sweden – French Pyrenees – I Appennine mountains and valleys of Iatly), processing and reporting of their date..
Our focus was to identify the main abiotic factor related to the weather that can be defined as the proximate cause or “finger-pressing-the-button” for the take-off flights of the autumn migration from nesting areas near both transit areas. The analysis was conducted on census data in transit, in the Archives of various institutions. The total quantity of birds counted in migration over 40 years (from 1973 to 2014) was 42,936,667. Over the past 15 years (1999-2013) 47 peak days-of- mgration were identified in Sweden, 42 peaks in the Pyrenees and 12 in Italy, i.e. 101 peaks in total. These peaks were compared with the weather conditions recorded day by day and hour by hour and detailed in the Archives of Weather History. The analysis carried out mainly with data rates of incidence of abiotic factors has revealed that the most likely finger-pressing-the-button can be identified as rising of the atmospheric pressure at all three sits (92.62{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595

a88d1abe5} Sweden, 92.85{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} in the Pyrenees and 91,00{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} in Italy). Variations above 10 hPa in 75.80{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} of the peaks for the sector “36/24 h” and 76.19{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} for the sector “18 h” preceding the take-off. The global analysis of all the abiotic factors makes it possible to construct a Numbers of hypotheses for the interpretation of the “why” this happens. The sensory input which detects these variations of atmospheric pressure is identified as the Para-Tympanic Organ of Vitali, a possible “biological” barometer.

,.”In our second actual analysis (2015 -2021) we can report the following update concerning events and relative increase in atmospheric pressure 12-24-48 hours before:

Falsterbo (Sweden – transit’s site close to the origin areas)
• 2015(2 events) +17,+12 hPa
• 2016(3 events) +14,+28,+11
• 2017(4 events) +17,+13,+48,one negative
• 2018(1 event) + 15
• 2019(3 events) +23,+13,+19
• 2020 (2 events) +15 ,+18
• 2021 no special events (diluted migration flow without notable peaks)

Italy transit monitoring along Italian peninsula far to origin area)

-2015 (1 event) +11 hPa
-2016 (2 events) + 11 ,(+7)
-2017(2 events) +11,+12
-2018 (2 events) negative,negative
-2019(2 events) +11,+10
-2020 (3 events) + 12,+22,+10

-2021 (3 events) one negative ,+ 12 , + 15 (mass take-off)

Total events recorded/selected for the present update 7 years (2015.2021) : 25/29 increasing more than 10 hPa 12-48h before
Falsterbo 14/15 – 93,33{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}
Italy 11/ 14 – 78,57 {a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}
. From 1999 until today we can report the following update of a total of 89 events
Falsterbo Sweden total 63 events peaks /waves
Italy 26
In this update we have excluded the findings from France (Pyrenees) due to the reduction of registration sites in the last years

Concerning the “increasing” of the atmospheric pressure (more than 10 hPa) we have in the first analysis (1999-2013) positive 92.62{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} Sweden, 92.85{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} and 91,00{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5} in Italy and the present update (1998-2021) 94, 44{a6be835d09a84c463fa955f66368ad74671de57ffb293aa26834595a88d1abe5}.
We must strongly underline that the present data ,reported as a synthesis ,are documented in details in precedent papers published on-line year by year (references from 35 to 53 and updated 73)

In addition to these documentary data it seems useful to report
a special focus “ Mass movements”

The phenomena of takeoff “strip” of thousands and thousands of pigeons has been observed at many migration seasons : “ Strips” or “Tapes “ are long (more than 500-1000 meters/Kms) groups of Woodpigeons agglomerated in a unique or slightly fragmented mass- as a “cylinder” in the sky- in a long sequence of big flocks or unique flock flittering in a virtual corridor (probably isobaric) of the atmosphere (95),usually at quite important altitude (more of 500 m. over the ground or sea) always oriented on a well identified migration’line (from north-east to south-west or from east to west) .
To have better reported events of “ strips” we have a special list about the observations on the eastern site of Appenine mountains/hills (Monte della Chioda- by Raffaele Faccin) :
• 17 October 2012 (h.9,28) “Monte della Chioda” (check Googlearth) – 3km in 4 minutes continuing transit – +10hPa increase
• 18 October 2012 (h.9,08) as a “target” by continuing transit for 11 minutes on the same valley – +22 hPa increase
• 17 October 2019 (h.9,30) transit 3 minutes – + 10 hPa
• 26 October 2019 (h.9,23) large 3/4 km x long 7/8 km , 5 great flocks in sequence in 9 minutes + 10 hPa
• 10 November 2019 ,same area Romagna ,sequence of 50 flocks (size 2000-5000)
• 10 November 2019 , in Massa Fiscaglia (FE) a single “cylinder” of flocks in sequence for 30 minutes (from Mesola forest take-off) +10
Many of these events have been documented with videos and pictures

The basic atmospheric conditions in the areas of origin (mainly stop-overs) are difficult to catalog in detail in a global analysis of the area and its timing, but in particular and occasional observation conditions they can offer interesting elements aimed at interpreting – or how much less trying to interpret. – the behavior of populations in stop-over before deciding on migratory take-off. Even a single event – casual in multicentre documentary observation in a

large stop-over area – can offer elements of analysis and discussion :
• 26 October 2019 (h.9,23) large 3/4 km x long 7/8 km , 5 great flocks observed in Monte Chioda (Central Appenine on the Flyway from Adriatic coast Mesola-Ravenna) in sequence in 9 minutes and increasing Air Pressure + 10 hPa ,24h before in the stop-over origin take-off .

On 25 October 2019, preceding this observation of movement and mass transit in the stop-over area (88,89)directly connected to the Monte Chioda area, a singular behavior of large flocks (1000-10.000-30-000 birds) was detected in pasture on agricultural areas adjacent to the Mesola forest (Ferrara, Italy). In the early afternoon (h15.30-16) in distant pasture sites (1-20 km), in the absence of any disturbing factor and in full contemporaneity these flocks took off and continued vaulting over the site in bands of altitude 100-300 m from the ground. The phenomenon – which occurred simultaneously in distant areas – occurred in calm wind, temperatures 19-20 °, humidity 70-80, Atmospheric pressure slightly increased from 1017 hPa to 1020 hPa (previous 24h from 1014 hPa) – The phenomenon thus in simultaneous action was observed by expert hunters and documented on video (D. Bianchi – personal communication). Even if a single event has no scientific value, it can still be a starting point for interpretation: the wood pigeons in stop-over and in the feeding phase, sensing (94) the increase in atmospheric pressure, got up as if to test the isobaric conditions in altimetric corridors such as to guarantee a subsequent-after 12 h- migratory flight with energy saving and atmospheric stability free of turbulence

Another particular phenomenon and event – also repeated in various seasons – is that of the occurrence of the extreme migratory impulse simultaneously on populations of Wood pigeons with origins thousands of kilometers away from each other and in the presence of substantial photoperiod

differences (latitude, longitude) and of geo-orographic characteristics.

It happened recently to the day of 24 October 2021 – characterized by a large isobaric situation (https://www.ilcolombaccio.it/CMS/una-giornata-straordinaria/ Map) with an imposing large nucleus of very high atmospheric pressure (1021-1030 hPa from Scandinavia,East Europe,North Central Europe,Mediterranean area,West Europe) and on this basis (forecasted jump of Air Pressure 10-18 hPa 24.48 h before 24 October) the mass migration is expected well in advance – but in the geographical whole of Europe it offers the singular CONTEMPORANEITY of peaks or events documented in 4 geographic sites enormously distant from each other (Sweden, Eastern France, Pyrenees, Italy) : different origins, opens – in our opinion – questions that are worth trying to investigate. An interpretative hypothesis can be ventured: even on different genetic bases and different geographical conditions, a single "physical" abiotic factor (generalized increase spread over the whole continent and stable in atmospheric pressure) can trigger the migratory impulse over the whole West Paleartic.

We must note a particular aspect concerning the so-called pre-nuptial or spring migration with departures from the wintering quarters to the nesting areas. Our present work is based on documented detailed data obtained by hunter-detectors during the autumn migration when hunting is allowed in Italy. During the spring hunting is forbidden and therefore we only have occasional signs which are however significant.
In recent years, however, we have collected (2022)evidence of large masses from Sardinia(wintering area) and the Adriatic coast(transit area) coinciding with the atmospheric pressure rises 12-48h before the events. mass occurred in Sardeggna after an elevation of 10-15 hPa (and subsequent stabilization at 1030-1035 hPa) detected in the Cagliari airport archive 12-72 h before migration-observation as by

https://www.ilcolombaccio.it/bacheca/index.php/topic,4522.0.html

More in addition to the present item " wild birds" we have collected data on other avian species as in https://photos.google.com/share/AF1QipM79yvIsGsLOiiwU_wuU3evW2-Kpqk1jTfMZwQ6dw6zRUS44mmb0S2dA2uCXPn5Ag?key=QXFxeDMzVUV0WTcxbnNlRG43RlJhYjJOcXlRbnh3
and link Reference (….) abstract : On the basis of the preceding paper (Cavina, 2014) concerning Eurasian Woodpigeons' autumn migration, we analyzed abiotic factors on the origin Scandinavian-Russian breeding areas for four more bird species in addition to the Woodpigeon. We have selected 60 migratory mass peaks of transit of the Eurasian Siskin, the Chaffinch/Brambling, the Common Starling, the Common Woodpigeon and the Barnacle Goose. The detailed relationship between mass take-off and changes in Atmospheric Pressure (plus other abiotic factors) 48-12 hours before starting has been analyzed .
– (A) – 6 peaks not significant
– (B) – 6 peaks moderately significant (7-10 hPa difference)
– (C) – 48 peaks strongly significant (10 – 20 hPa difference)

Discussion – Conclusion
The aim of the present paper is to offer documented data concerning the interaction between " increasing of Air Pressure " (main abiotic factor) and " migration decision-making-mass-take-off" in wild birds (93.94) considering the possible role of PTO (73,86,88,89) .

Our data repeatedly published online (2014-2022 References) are based on direct observation of the migration in the field (1950-2022) and on detailed analysis of the findings in the online institutional literature and Archives on-line.
If it is true that scientific findings acquire veracity if verifiable and repeatable, our attempt at a scientific message

falls within these principles and adds another element “predictable and confirmed data” .
Concerning the “Organ of flight “ (73) we underline again that it is basic to say : “PTO is used daily by enormous number of living animals (200-300 billions of birds) but represents currently one of the major unsolved mysteries and challenges in sensory physiology of vertebrates “ (Giannessi F.,Ruffoli R., von Bartheld C.S. – (2013) – Giovanni Vitali: Discoverer of the Paratympanic Organ – Ann Anat. 2013 ;195(1) 10 – https://pubmed.ncbi.nlm.nih.gov/22999077/).

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