Updating Woodpigeon(Columba palumbus) autumn migration's "peaks/ waves-data" in Europe until 2019 : relationship with a single abiotic factor as Air Pressure'changes.

citation : Italian Journal Woodpigeon Research –IJWR-online –Vol.3-2020-18/01/2020

Updating Woodpigeon(*Columba palumbus*) autumn migration's "peaks/ waves-data" in Europe until 2019 : relationship with a single abiotic factor as Air Pressure's changes.

Enrico Cavina (*-**)Rinaldo Bucchi(**)Denis Bianchi (**)
(**)Club Italiano del Colombaccio
(*-**)https://enricocavina.academia.edu/
ecavinaster@gmail.com

SUMMARY

In the present report we udpate 2010-2019 the data of the precedent detailed analysis (2014) http://www.scienceheresy.com/-ornithologyheresy/Cavina2015.pdf , as by precedent abstract < *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 Italy), processing and reporting of their data..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- migration 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% Sweden, 92.85% in the Pyrenees and 91,00% in Italy). Variations above 10 hPa in 75.80% of the peaks for the sector "36/24 h" and 76.19% for the sector "18 h" preceding the take-off. The global analysis of all the abiotic factors makes it possible to construct a number 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>

The actual "evidence based" data cinfirm the result of 2014 http://www.scienceheresy.com/-ornithologyheresy/Cavina2015.pdf

Key words: Woodpigeon,migration,Air Pressure,peaks/waves,takeoff

INTRODUCTION (part as by <http://www.scienceheresy.com/-ornithologyheresy/Cavina2015.pdf>and links/bibliography)

The target of the present report is only the "one " : to put in evidence (data "evidence based") that exploring the "abiotic factors"'s influence on the birds' migration "decision making "(departure,mass take-off and transits) ,the most evident "abiotic factor" influencing the departures is the increasing (usually more than 10 hPa) of the Air Pressure 12-48h (and more) before the migration's departures from breeding,nesting,stop-over areas .It happened in more of 80% of the collected events in more than 20 years for many millions of migrating birds in Western Paleartic (Europe) also by special focus on *Columba palumbus* and Italy.

If the "Air Pressure's jump" could be considered as the "finger pushing the starting button " , it seems obvious to consider the importance of the sensitive ecology (inside the complexity of relationships of many "abiotic and biotic factors" with many anatomical structures) by focus on the Para Tympanic Organ of Vitali .

On the basic counts and analysis of peaks/waves (@)as reported in precedent papers (2014) and specifically in

<http://www.scienceheresy.com/ornithologyheresy/Cavina2015.-pdf> and in <http://www.wbwp-fund.eu/ring/-pdf/40/1_cavina%202018.pdf >we have updated some interesting data and variations (**abiotic factors**) concerning more recent migrations until 2019 (enclosed) in Europe and focusing in Italy .

Many factors [51] biological and abiotic factors affect the decision-making moment for many migratory birds to fly migration in autumn and spring. This moment of decision ("decision making") occurs as the first "take-off" from the areas of breeding (autumn) and from wintering areas (spring) and then always occurs along the migratory route until the arrival in the destination area (wintering areas, breeding areas) [3,25,40,44].

The phenomenon of "I decide to go, at this very present moment" occurs in different ways for all species of migratory animals, and to interpret it however we have to remember the complexity of the phenomenon of "Migration" (the mystery of migration) in various species of birds.

The "I decide to start now" is active in all migrating birds - migrants day and night, in the short or medium or long distance , migration alone or in group or mass (gregariousness) – who begin or continue after stop-over migration under the stimuli of different biological and abiotic
factors[1,2,3,4,30,57,77].

The ornithological literature is rich in studies of all of these various factors [44,51] and related integrations such as physiological, physical, genetic, ecological, ethological, biochemical etc., notably the work of M.S.Bowlin (2010) [51] "Grand Challenges in Migration Biology". However, in spite of the wealth of analysis and specific research on abiotic factors, it does not reveal many references and insights useful to identify the time and the precise motive of the "decision making " for the precise moment of take-off, namely the identification of the "finger pressing the button" to start the migratory flight, if it exists as such.

It is obvious that the biological condition (physiological, hormonal, metabolic, physical) [7,13,36] which has been maturing in the days before the migration ("zughunrue")[85], this is the basis on which the command will act to go . We

must always remember that among the abiotic factors, the length of daylight (photo-period) [8,37,40,60,72] is a prominent factor that affects the pineal gland and resulting various neural correlations . It is also obvious that the timing of optimal migration depends on other abiotic factors[2,3,86], just as the environmental conditions and mainly the status of the weather in place or expected. It is imperative – for the birds – to deal with the migratory flight in the best conditions in terms of safety and fatigue, vis-a-vis environmental conditions and the status of the real or expected weather .[12]
But the main question for the focus of our research is this: while considering the balance of decision making of all factors – biotic and abiotic – can we identify a factor that most of the other represents “the finger pressing the button” for the take-off of migratory flight ?. [16-34-35-39-45-48-60-67-71]
The ability of migratory birds to predict the weather is well-known and widely studied [38-44-51] and this also applies to the behavior of resident birds about the behavior (especially alimentary) in the area of residence. It is also known that the extemporaneous weather depend on several factors-atmospheric physical and first of all the atmospheric pressure (AP); as well as the climatic conditions of long period, mostly seasonal, depend on the temporal oscillation so-called “North Atlantic Oscillation” (and corresponding El Nino for the Pacific) characterized by cyclic fluctuation (fluctuation) of the differences of atmospheric pressure at sea level between two vast areas of land- ocean hemisphere: climatic condition acts strongly on biotic factors .[6-31-32-67-82-89]
In several scientific papers [38-44-51] aimed at studying the correlation between meteorological factors and migration, Atmospheric Pressure “lows” are almost always given greater prominence, the arrival of which would be perceived by the migrating birds as a harbinger of bad weather. Not a lot of importance has been given to the study quantitative variations of atmospheric pressure [39- 45] that occur just before the arrival of low atmospheric pressure and bad weather.
We should give importance and emphasize the supposed anatomical basis or “biological barometer” which is the Para-Tympanic Organ of Vitali that in addition to barometric

functions would also function as altimeter[17-18-20-21-22-23--24-29-80-83]. In previous notes published on the Web [74- 79] we had highlighted some important conclusions about the correlations between mass migration and elevations of the atmospheric pressure in the hours before the take-off both for Woodpigeons and for the Woodcock (Scolopax rusticola) [79-74-78].

MATERIALS and methods – **RESULTS** (updating data **2019**)

EUROPE

SWEDEN -as by <http://www.scienceheresy.com/-ornithologyheresy/Cavina2015.pdf> detailed data 2014

The present analysis as **preliminary report** is focused only on the changes (single Abiotic factor) of Air Pressure (*) happened 12-48h before mass take-off/ transits (ten years 2010-2019) in **Falsterbo (Sweden)** *(Falsterbofagelstation – Lennart Karlsson permission copyright 3rd sept.2014) .*

– 2010 (2 events) +10,+16 **hPa** growing up 12-48h before the transit

- 2011(2 events) +18 , one negative (no changes)
- 2912(2 events) +17,+10
- 2013(3 events) +29,+18,+15
- 2014(2 events) + 10,one negative
- 2015(2 events) +17,+12
- 2016(3 events) +14,+28,+11
- 2017(4 events) +17,+13,+48,one negative
- 2018(1 event) + 15
- 2019(3 events) +23,+13,+19

Total events 24 (peaks 18 / waves 6)

Air Pressure (*) changes growing up more than 10 hPa (minimum +10 hPa/Max 48 hPa) in 21/24 events **(87,5%)**

No changes in 3 events

2010-2019 : 5.495.000 Woodpigeons recorded (average 549.520/one year) and 2.938.300 (average 293.830 /one year) in 24 events and in 64 days (average 45.910 /one day) . The total in 24 events represent 53,47% of the Total recorded,

(*) by Russian Meteo Website (free) https://rp5.ru/ which offers full archives of all meteo data (hourly,daily,yearly) all over the World ,mostly by Meteo-stations of airports.

———-

http://www.scienceheresy.com/ornithologyheresy/Cavina2016.pdf
Appendix-Collaterally *a similar analysis has been performed on similar peaks/waves for* ***Barnacle Geese*** *in October ,as easily available (Falsterbo website " migration counts") for all the migratory Species (**)in Falsterbo (Sweden) .Meteo data on the Gotland island ,most important stop-over site on the Oriental flyway from North Arctic Russia (Arkangelo area).*

- *2010 : meteo data not available*
- *2011 : meteo data not available*
- *2012(1 event) + 10* ***hPa***
- *2013(2 events) + 15,one negative*
- *2014(1 event) + 10*
- *2015(3 events) +10,+12,one negative*
- *2016(2 events) +15,+12*
- *2017(3 events) +14,+10,one negative*
- *2018(2 events) +10,+10*
- *2019(4 events) +12,+16,+14,+12*

Total events 18
Air Pressure change more than 10 hPa : 15/18 ***(83,3%)***
(**)Other Species as in
The selected years –with mostly yearly transit – have been extracted from a list of 43 years recorded on the Falsterbo Archives from **1973 until 2015** . The abiotic factors listed in Weather History web-cards were analyzed in the "origin" (mostly breeding) areas 0 – 400 km North – North East from Falsterbo, and 2000 Km East (coasts of North Russia) regarding **Barnacle Geese** , considering in this case,supposed long distance flies after takeoff.
We have identified 60 peaks (one peak in one or more per day) summarised as following :
– 5 peaks Eurasian Siskin – Carduelis spinus – transit more than 10.000 x day
– 17 peaks Caffinch –Fringilla coelebs / Brambling –Fringilla montifringilla transit more 40.000 x day
– 8 peaks Common Starling –Sturnus vulgaris – more than 10.000 x day
– 15 peaks Common Woodpigeon Columba palumbus – transit more than 40.000 x day
– 15 peaks Barnacle Goose Branta leucops – transit more than

10.000 x day
RESULTS
The relationships between A.P.jumps (12-24-36-48 h. before takeoff) and the day (mostly first day) of the peak were :
– 6 not significant
– 6 moderately significant (7-10 hPa increases)
– 48 / 60 **(80%)** strongly significant (more than 10 hPa differences)

FRANCE
FRANCE (Pyrenees)
As by <http://www.scienceheresy.com/-ornithologyheresy/Cavina2015.pdf>.detailed data .
Everything overexposed (nesting area –Sweden- Falsterbo) may well be worth in the evolution of our research with retroactive now “focus” on the site of stop.over (France – Pirenees).
The method of collecting and analyzing data of “count” remains identical to that used for the analysis of the nesting area (first take-off).
The area of stop-over and subsequent transit now analyzed here is totally in French territory and observers to count steps on the mountains Pyrenees (400km – France-Spain border) are located to the east of Atlantic coastline extending over a total migratory face up to the Mediterranean coast, but most concentrated in the 70-100 km to the east edge of the Atlantic Ocean. [02-03-]
The counts made and stored on the site www.palombe.com and GIFS are all verifiable, and collect complete data from 1999 to 2013: This period of 15 years is therefore speculate the period of which we have reported in Sweden.
It should be borne in mind that the transit migrant populations from the Pyrenees collects more from various areas of origin and migration routes, and with the initial take-off from nesting areas temporally very different from those encountered and documented.The birds stay in front of very high mountains to be climbed over in a area where the weather and air pressure corridors could be very different , depending on the Atlantic Ocean atmospheric conditions on the West.
The area of stop-over – before the Pyrenees- and take-offs that we considered in our analysis in terms of retrospective

and / or post-dated research – good approximation extends to 300-500 km north of the Pyrenees (mostly Flavignac) and lies between latitude 48 ° 55 'north latitude and 43 ° 18' north, global area on which it was possible to collect meteorological data for 15 years from Weather History (WeatherUnderground*)* and now by https://rp5.ru/.

The area of take-off-after stop.over more or less short or very short – is well defined in the 300-500 km area to the north,from where at speed 50-70 km / h the woodpigeons can reach the Pyrenees . In the 15 years of the report 2014 , we have extrapolated 42 peaks (min.1g – max 5 days) migration for a total of 22,444,226 birds (average for peak 1: 534 386 birds) The records of maximum values are in 1999 with 2,374,712 birds, and the negative minimum with 816 101 birds in 2010. The record of the main peak was 26 to 27 October 1999 (2 days) with 1.172 million birds, which accounted for 73.39% of the whole year 1999.

In the 15 years we have also extracted 15 peaks (compared to 42 in total, 35.72%) with a higher amount of birds to the global average (about 42 peaks) of 534 384 birds per spike.The results 2014 are reported in the Tables – PYRENEES (FRANCE data collected in Archives of www.palombe com . as by permission of Olivier MAURY www.palombe com Email 9th Sept.2014 – Official Migration counts on PYRENEES (FRANCE) -27.345.388 woodpigeons counted 1999-2013 (15 years) – 42 peaks of migration.

ATMOSPHERIC PRESSURE: in 92,85% of the peaks there was increase (1-30 hPa) with variations above 10 hPa in 75.80% of the peaks for the sector "36/24 h" and 76.19% for the sector "18 h" before the take-off.

It should be noted therefore further confirms that the atmospheric pressure is the safety factor for the decision to takeoff to migration and realized more specifically in the afternoon / night before take-off: 90.47% of the peaks in the atmospheric pressure is higher than 1010 hPa and more sectorally in 50.70% (previous day) and 66% (Day of the take-off) is higher than the atmospheric pressure at 1020 hPa.

At present time all the counts -"1999-2019"- on Pyrenees are available at

https://www.palombe.com/migration/comptages.php

At present updating (2020) as by "Falsterbo" we have

investigated the last ten years with the following results considering Air Pressure changing on TWO areas : 1) Pyrenees area – 2) Flavignac continental area .
2010(2 events) negative, negative //(Flavignac) +11,+15 **hPa** growing up 12-48h before the transit
2011(3 events) negative,negative,+18 // negative,negative,+11
2012(3 events) +8,+20,+21 // +10,+20,+28
2013(1 event) +11. // +13
2014(2 events) negative,+7 // +13,+10
2015(4 events) +10,+13,negative,negative//+-10,+10,negat.,negat.
2016(2 events) negative,negative // negative,+20
2017(3 events) negative,negat.negat.//negative,negat.,negat.
2018(2 events) negative,negative// negative,+17
2019(1 event) negative // negative
hPa growing up 12-48h before the transit: 31,82% more than 7 (7-10) hPa ,54,55% more than 10 hPa in the Pyrenees area.

ITALY

The present analysis as **preliminary report** is focused only on the changes (single Abiotic factor) of Air Pressure (*) happened 12-48h before mass take-off/ transits (ten years 2010-2019) in **Italy** ,updating recorded data as by “. “ where from we extract data collected 1998-2007 (ten years) by “Progetto Colombaccio – Club Italiano del Colombaccio – Rinaldo Bucchi Head of the Team “ (published – April 2008 – Promo Service Ed. – Forlì IT – www.ilcolombaccio.it). In the period 1998-2007 (ten years) with the collaboration of 115 observers of the Italian Club of Woodpigeon , were surveyed in transit 4.83138 million birds (annual average 483 831) and have been identified 10 migratory PEAKS (min.1g. -max.6gg) in October and 10 peaks in November (November : here used 2) – TOTAL analyzed 12 PEAKS, where the analysis carried out here has been to relate the history of their peaks (specific dates of the first day of Peak) and the detailed analysis of the weather conditions corresponding to the areas of origin of migration flows (Central and Eastern Europe from “Door Morava “in Latitude 50 ° 15 ‘, the Balkans up to 43 ° 50’), also taking into account the coastal areas or for fledglings significant internal mass (Ungheria.Slovenia, Istria, Croatian coast) : four areas as “**long-medium-short distance-transit**

area " ,with the following results:

- – CHANGES: -in the long distance remote areas (more than 1500 km) the A.P. increased (78-48 h before transit in Italy) 67 %;
- -in the most remote and continental stop-over areas (medium and short distance) in the A.P. 48/36/24 h prior to takeoff and the day of detection of the peak (in **ITALIAN sites**) rises by **more than 10 hPa in 90 % of the Peaks**
- – The same: in the intermediate areas and closer to the coast (short distance – 24-12 h. before take.off) , the most significant of " takeoff of the day "(latitudes 47 ° 30 ', 46 ° 03', 45 ° 20 ', 41 ° 53'), **the increase is more than 90%.** *(reference at http://www.scienceheresy.-com/ornithologyheresy/Cavina2015.pdf)*

ITALY
1998-2007 12 peaks
1998-15 October (8 days)
1999-27 October (2 days) – 8 November(4 days)
2000-14 October (8 days)
2001-11 October (5 days)
2002-20 October (2 days)
2003-16 October (2 days)
2004-19 October (2 days)
2005-12 October (6 days)
2006-26 October (3 days) 4 November (3 days)
2007-15 October (2 days)
Updating (2019) the precedent results and focus on a single abiotic factor (Air Pressure changes) in transit area (Central Italy) we have collected the following results
-2008(2 events) +10,+11 **hPa** growing up 12-48h before the transit
-2009(2 events)+11,+13
-2010 (1 event) +15
-2011 (2 events) +15,+10
-2012 (1 event) +20
-2013 (2 events) +10,+11
-2014 (*) (1 event) +14

-2015 (1 event) +11
-2016 (2 events) + 11 ,(+7)
-2017(2 events) +11,+12
-2018 (2 events) negative,negative
-2019(2 events) +11,+10
17/19 **(89,47%)** Air Pressure increasing more than 10 hPa 12/24/48 h before the event

(*) 2014 – special focus – **Mass movements**

ITALY: the performance of the full migration (with "peaks") is characterized by differences in weather conditions between the Tyrrhenian Sea area (cyclonic vortex beginning of October) and the Adriatic Sea area (entrance from the Balkans – High Pressure permanent) with

– Early mass influx of October 7 to 9 on the side of the Adriatic Sea

– More late influx of mass 23 to 24 October on the Tyrrhenian side

Very important were the massive takeoffs observed directly (http://www.ilcolombaccio.it/):

– 19- October from the woods of St.Rossore (Pisa-Livorno) – +11 hPa

– October 20 forests in Adriatic area -PesaroUrbino + 8 hPa

– October 25, Mesóla forest (Ferrara) +14 hPa

– 25 to 27 October Monte Conero (Ancona) +10 hPa

– November 2 (flow) – Grosseto area Tirreno

The phenomena of takeoff "strip" of thousands and thousands of pigeons, at dawn, and S.Rossore Park

"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 ,usually at quite important altitude (more of 300 m. over the ground) ,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 –

- 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 – negative for increasing
- 26 October 2019 (h.9,23) large 3/4 km x long 7/8 km , 5 great flocks in sequence + 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 photographs.
All mass migration (**2014**) – as regards the abiotic factors – were characterized by gradual growth conditions (stability of high atmospheric pressure equal to or greater than 1020 hPa) or rapid increase of 36-12 h. prior to fly both on the Adriatic Sea both on the Tyrrhenian Sea
All mass takeoffs migration from the Italian stop-over areas were characterized by rapid increases in PA with changes (24-12 h) of more than 10 hPa.
It may be significant to note that a forecast “NOT APPLICABLE” because it was based on weather (https://www.metcheck.com/IT) very long-term forecast (60 days) written on September 4th, 2014, it was recognized RELIABLE: the rush of AP provided (4th Sept.) long-term Central and Eastern European areas on the October 3rd to 5th, has occurred and was combined perfectly with the mass migration of trans-Adriatic Sea which took place on the evening of October 7th until 9th October, which peak early migration and in combination with the full moon period.
The phenomena of “strips” is well drammatically documented in many video/Youtube by records in the Ornithological Station of Portland (UK)

DISCUSSION

In the precedent paper the analysis was conducted by various abiotic factors such as general Weather conditions (rain, clouds,fog, etc.), Temperature (Average, MIN.MAX.),

Visibility, winds (force, direction), length of daylight, humidity, moon phases and "%" of the Moon illuminated.
In the present report we have considered only Air Pressure changes.
In the precedent paper we have reported
"Here are the essential details to:
– Changes in atmospheric pressure (AP) 48/36/24 h prior to takeoff in the areas of origin – VALUES absolute core of the PA in the 12 h prior to takeoff in those areas.
In a recent (2019) paper [116] the Authors have commented our results as following ***<Cavina (2015) put an attention to the property of Wood Pigeon migration that the numbers of migrants fluctuate day by day very much. Generally, fluctuations of the passage intensity are commonly known to students of birds migration, but in this spe- cies they are really spectacular, varying from the zero individuals to several hundreds thousand pigeons per day. Cavina (op. cit.) connected this with observed changes of air pressure – the waves of migrants start soon after air pressure drops by around 10 hPa. The problem of waveness of migration was discussed by Cavina (2016) for other spe- cies of diurnal migrants (Siskin, Carduelis spinus, Chaffinch/Brambling, Fringilla sp., Starling, Sturnus vulgaris and Barnacle Goose, Branta leucopsis) in other paper. The air pressure changes seems to be direct stimulus for the starting decision of birds ready to move. From the other side, subsequent waves seems to be fixed to the "time- windows" during the season (e.g. for the Willow Warbler, Pylloscopus trochilus – Piotrkowska 1995, the Blackcap, Sylvia atricapilla – Busse 1996, Kopiec 1997>***
With the following results:
– CHANGES: -in the long distance remote areas (more than 1500 km) he A.P. increased (78-48 h before transit in Italy) 67 %;
-in the most remote and continental stop-over areas (Medium and short distance) in the A.P. 48/36/24 h prior totakeoff and the day of detection of the peak (in ITALIAN) rises by more than 10 hPa in 90 % of the Peaks
– The same: in the intermediate areas and closer to the coast (short distance – 24-12 h. before take.off) , the most significant of " takeoff of the day "(latitudes 47 ° 30 ', 46 ° 03', 45 ° 20 ', 41 ° 53'), the increase is more than 90%

-Values Absolute: in the most remote and interior the basic values of PA – 12 hours before – are higher than 1010 hPa in the 75-100%
– The same: in the intermediate areas the basic values greater than 1010 hPa are in the 50% -66% and in the areas closest coastal 83.33%
– Check-in (ITALY) the absolute values of the basis on the first day of the peak are higher than 10 hPa "
In the present report , where we have considered only the Air Pressure changes and only on the transit area (excluding Pyrenees) , the analysis could appear superficial , but all the data could be object of future updating and however seem significative . The methods of the present report should be extended for a comparative and statistical(scientifically statistical) analysis between all the main abiotic and biotic factors , considering the origins (we are trying in ITALY to do a radioisotopic research by the cooperation of Hobson [115]) of the various woodpigeons'populations at various longitudes/latitudes territories in various seasonal and migration-timing conditions . The complexity of so many items seems evident :the Research field is open ,and difficult.
The migration's ecology remain a complex phenomena and our results seem offer a little contribute for a better knowledge.
Probably the main interrogative is about the simultaneity of the decision-making : what happens in the sensitive systems and brains, so strong and simultaneous to be able for a mass command to fly to migrate ? How many other biotic and abiotic factors take part – between them well coordinated-
In the event of mass take-off from breeding areas (Sweden-Falsterbo) and/or stop-over sites (France,Italy) ,here where populations by different origins (North-North East- East geographic area) mixed themselves before continuing the Migration ?
We know well the importance of "Zugunrhue" and length of day-light , but what levels of the single abiotic factors are necessary to offer the "body" of birds ready for this mass decision-making and take-off ? How much is important prevalence of genetic command or gregarism or past-experiences of adults or hierarchy in the single families and population or single condition of the habitat's biodiversity and food-availability ? How much could be important the ability – if

yes or not – to forecast the climatologic and habitat conditions of the wintering area as target of the Migration ? How many possibility we have to explore more and more the ultrastructural – molecular – electophisiological status of the barometric sensitive organs , including the mechanoreceptors on the feathers-pluìmes ?
The mistery is ready to be investigated.

CONCLUSION

The conclusions are as by precedent paper

If you want to compare the data obtained in Sweden (area of first take-off) and France (take-off area after stop) and Italy (transit area after stop-over) prevails in a substantially similar effect (numerical and statistical) about the abiotic factors that may have influenced the decision of the take –off : no significant differences between the three areas about almost all factors considered .
As for the raising or "overhang" of the atmospheric pressure in the hours (36h / 24 / 18h) prior to the take-off, this increase is still a constant (Sweden 92.62% – 92.85% France) before a true peak migration and quantification of differences can only detect a higher percentage of increase in the hours further away (48-24 h) prior to take-off in France (73.80%) than in Sweden where at this time the remote 'incidence is only 27.65%, while in the two areas in the "18h" before takeoff , the incidence is 78.72% (Sweden) and 76.19% (France). Always interpreted in absolute terms of hypothesis would be the following : raising stimulates the take-off more powerfully and more quickly acclimated birds in a long time in the nest, while the stimulus is more long-term (1-2 days. before) the birds that have long been in migration and stop-over [86] .A regardless of this interpretation and assumptions, it is important to note that the increase is constant over 90% in the peak mass migration. [7-34-61]
The set of data – here in the form of simple raw numbers and percentages not elaborated in strictly statistical, and then ultimately understandable – suggests the desirability and / or the possibility of in-depth analysis designed to identify integrations (day a day / hour a hour) with other abiotic and biological factors (as algorithms, equations, formulas, statistics, mathematical indices of analysis and / or forecast) [32-51-66].

The extension of this method of analysis (ornithology – meteorology) to other areas of nesting and transit (possibly in the spring) may provide additional contributions to the understanding of the phenomenon of migration, deepening the analysis in climatological terms, so now present seasonal changes in the increasingly looming and influential on the environment. [69]
Verification "live" directly in the field in 2014, about migration in Europe and particularly in Italy – as expressed in the "Updating spatial and temporal Research" – gave full confirmation of the results obtained with the global search retroactive.
Finally, we emphasize that the sensor terminal of the changes in atmospheric pressure can be easily detected in the organ Para-Tympanic (PTO) Vitali [20-21], which studied for the first time by Vitali in Italy in the early decades of the last century, still the subject of extensive research morphological and functional [19- 24]: if "the finger pressing" can be discerned in the changes of atmospheric pressure (the "overhang"), "click" on which the press is probably the Paratympanic organ of Vitali, having to consider all the neuro-functional integration with the adjacent structures in the inner ear (Lagena, vestibular apparatus) until the centers of the Brain and Cerebellum.
To explain all that we have shown in this retrospective study is essential that there is a definite anatomical basis barometer understood as "organic". [83-84-87].
As conclusion 2020 we can affirm again that the target of the present report is only the "one " : to put in evidence (data "evidence based") that exploring the "abiotic factors"'s influence on the birds' migration "decision making "(departure,mass take-off and transits) ,the most evident "abiotic factor" influencing the departures is the increasing (usually more than 10 hPa) of the Air Pressure 12-48h (and more) before the migration's departures from breeding,nesting,stop-over areas .It happened in more of 80% of the collected events in more than 20 years for many millions of migrating birds in Western Paleartic (Europe) also by special focus on *Columba palumbus* and Italy.
The data 2020- here reported – are "evidence based" data .
If the "Air Pressure's jump" –as a warranty of no-turbolences

and stability in atmospheric isobaric corridors – could be considered as the “finger pushing the starting button ” , it seems obvious to consider the importance of the sensitive ecology (inside the complexity of relationships of many “abiotic and biotic factors” with many anatomical structures) by focus on the Para Tympanic Organ of Vitali

REFERENCES

[01] FALSTERBO Migrations counts’Archives Falsterbo Ornitholgic station Sweden . 2014 . Available from http://www.-falsterbofagelstation.se/index_e.html

[02] PYRENEES Migrations counts’ Archives over Pyrenees mountains France . 2014 Available from http://www.palombe.com/-migration/comptages.php and for GIFS from http://www.palombe.com/Etudes-et-ONCFS

[03] WUNDERGROUND Weather conditions’ Archives (Weather History) in Weather Underground 2014 Available from http://www.wunderground.com/history/

[1] Zehender S,Akesson S,Liechti F.et al. Nocturnal autumn bird migration at Falsterbo,South Sweden .J.Avian.Biol. 2001;32:239-248

[2] Richardson WJ. Timing and amount of bird migration in relation to weather : a review . Oikos 1978; 30:224-274 :

[3] Richardson WJ .Timing in bird migration in relation to weather :updated review . In : Gwinner E.(ed.) Bird Migration :Physiology and Eco-physiology . Springer-Verlag , Berlin 1990. pp.78-101

[4] Richardson WJ. Wind and orientation of migrating birds :A Review.- In Berthold P.(ed) Orientation in Birds . Bikhauser Verlag .Basel. 1991 . pp.226-249

[5] Birtsas P,Sokos C,Papaspyropoulos KG. et al. Abiotic factors and autumn migration phenology os Woodcock (Scolopax rusticola) in Mediterranean area . Italian J.of Zoology 2013 ; 80,3:392- 401

[6] Chambers LE,Beaumont LJ,Hudson IL Continental scale analysis of bird migration timing : influences of climate and life history traits – a generalized mixture model clustering and discriminant approach . Int.J.Biometeorol. 2013, on-line DOI.10.1007/s00484-013-0707-2

[7] Weber TP,Hedenstrom A. Optimal Stopover Decisions under Wind Influence : the Effects of Correlated Winds . J.Theoret.Biol. 2000; 205 (1):95-104

[8] Alerstam T. Flight by night or day ? Optimal daily timing of bird migration . J.Theoret.Biol. 2009; 258(4):530-536
[9] Schmaljohann H,Bruderer B,Liechti F . Sustained bird flights occur at temperatures far beyond expected limits . Animal Behaviour 2008 ; 76(4):1133-1138
[10] Sachs G. Speed stability in birds . Mathem.Bioscences 2009 ; 219(1):1-6
[11] Gronroos J,Green M,Alerstam T. To fly or not to fly depending on winds :shorebird migration in different seasonal winds regimes Animal Behaviour 2012 ; 83(6):1449-1457
[12] Hedenstrom A. Aerodynamics,evolution and ecology of avian flight (Review) Trend Ecol.& Evol.. 2002 ; 17(9):415-422
[13] Giardina B,Corda M,Pellegrini MG et al. Flight and heat dissipation in birds:A possible molecular mechanism FEBS letters 1990; 270 (1-2):173-176
[14] Klein W,Codd JR. Breathing and locomotion :Comparative anatomy , morphology and function . Resp.Phys.Neurobiol. 2010 ; 173 (Suppl.ICRS):S26-S32
[15] Danhardt J,Lindstrom A. Optimal departure decisions of songbirds from an experimental topover site and the significance of weather . Animal Behaviour 2001 ; 62(2): 235-243
[16] Kreithen MI,Keeton WT. Detection of changes in atmospheric pressure by the homing pigeon (Columbia livia) . J.Comp.Physiol. 1974 ; 89:73-82
[17] von Bartheld CS. Development and innervation of paratympanic organ (Vitali organ) in chick embryos . Brain Behav.Evol. 1990 ; 35: 1-15
[18] von Bartheld CS.Functional morphology of the paratympanic organ in the middle ear of birds . Brain Behav.Evol. 1994 ; 44:61-73
[19] von Bartheld CS,Giannessi F. The paratympanic organ : a barometer and altimeter in the middle ear of birds ? J.Exp.Zool.B:Mol.Dev.Evol. 2011 ; 316:402-408
[20] Vitali G. L’organo nervoso paratimpanico e la sua funzione . Riv.Biol. 1921 ;3:3012-316
[21] Benjamins CE . Y a-t-il une relation entre l’organe paratympanique de Vitali e le vol des oiseaux ? Arch.Neerl.Physiol. 1926 ; 11: 215-222
[22] Giannessi F,Fattori B . The ultrastructure of the sensory hair cells of the paratympanic organ receptor cells in

chicken . Anat.Embryiol. 1996 ; 193: 569-575
[23] Giannessi F,Fattori B,Ruffoli R et al . Homing experiments on pigeons subjected to bilateral destruction of the paratympanic organ . J.Exp.Biol. 1996 ; 199:2035-2039
1
[24] Giannessi F , Ruffoli R, von Bartheld CS. Giovanni Vitali : Discoverer of the paratympanic
organ . Ann Anat. 2013;195(1):5-10
[25] Gordo O. Why are bird migration dates shifting ? A review of weather and climate effect on
avian migratory phenology . Clin.Res. 2007 ; 35:37-58
[26] Respiration in Birds. (http://www.mhhe.com/biosci/-genbio/raven6b/graphics/raven06b/other/raven06_53.pdf)
How Animals Maximize the Rate of Diffusion:Atmospheric Pressure and Partial Pressures
Available from www.mhhe.com/biosci/genbio/…/raven06_53.pdf
[27] Scott GR . Elevated performance: the unique physiology of birds that fly at high altitudes.J.Exp.Biol. 2011 ; 214:2455-2462
[28] Frappel PB,Hinds DS,Boggs DF. Scaling of Respiratory Variables and the Breathing Pattern in Birds: An Allometric and Phylogenetic Approach . Physiological and Biochemical Zoology 2001; 74(1):75-89
[29] O'Neill P,Mak SS,Fritzsch B et al. The amniote paratympanic organ develops from a previously undiscovered sensory placode. Nat.Commun 2012 ; 3: 1041- Available from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3518548/
[30] Huppop O,Huppop K . Bird migration in Helgoland : the yeld from 100 years of research . J.Onithol. 2011 ; S1:25-40
[31] Jenni L,Kéry M. Timing of autumn bird migration under climate change : advances in long- distants migrants , delays in short-distance migrants . Proc.R.Soc.Lond B 2012 ; 270:1467- 1471
[32] Knudsen E,Lindén A, Both C et al. Challenging claims in the study of migratory birds and climate change . Biol.Rev. 2011 ; 86; 928-946
[33] Sapir N,Wikelski M,Avisar R et al. Timing and flight mode of departure in migrating European bee-eaters in relation to multi-scale meteorological processes. Behav. Ecol. Sociobiol. 2011 ; 65: 1353-1365
[34] Shamoun-Baranes J, van Loon E, Alon D. et al. Is there a

connection between weather at departure sites, onset of migration and timing of soaring-bird autumn migration in Israel ? Glob. Ecol. Biogeogr. 2006; 15: 541-552
[35] Newton I. Weather-related mass-mortality events in migrants . Ibis 2007; 149: 453-467
[36] Ramenofsky M,Wingfield JC . Regulation of migration . Bioscience 2007 ; 57:135-143
[37] Coppack T,Pulido F,Berthold P. Photoperiodic response to early hatching in a migratory bird species . Oecologia 2001 ; 128:181-186
[38] Duriez O,Bauer S,Destin A. et al. What decision rules might pink-footed geese use to depart on migration ? An individual-based model . Behav.Ecol. 2009 ; 20:560-569
[39] Ebird org/content . Understanding birds & weather : Fall birding basics . 2011 available from
http://ebird.org/content/ebird/news/fall-birding-basics/
[40] Encyclopaedia Britannica . Physiological stimulus of migration . 2014 . Available from
www.briattnica.com/migration/Physiological/
[41] Linderson MJ. Objective classification of atmospheric circulation over southern Scandinavia. Intern. J .Climatol. 2001 ; 21(2) : 155-169
[42] Racerocks.com ./ Pearson CollegeUWC . Abiotic factors Atmospheric Pressure (Diagrams) Available from http://www.racerocks.com/racerock/abiotic/barometric/-barometric.htm
[43] Zalakevixius M. , A study of mechanisms controlling migratory take-off of geese, thrushes and Wood Pigeon in spring and autumn: a radar study., ActaÂ Ornithologica Lithuanica, 1999; 7&8: 16 -25
[44] Avis-Ibis FES –Bibliography of Common Wood-pigeon (Columba palumbus) 2014 Available from http://avis.-indianbiodiversity.org/bibliography-of-columbiformes--columbidae-pigeons-and- doves/bibliography-of-common-wood--pigeon-columba-palumbus.html
[45] Stead N. Birds stock up as pressure drops J.Exp.Biol. 2013 ; 216: 10.1242-46
[46] Monarchnet .uga.edu . Monarch Biology . 2014 Available from
http://monarchnet.uga.edi/MonarchBiology
[47] Alerstam T,Ulfstrand S. A radar study of the autumn

migration of woodpigeons Columba palumbus in southern Scandinavia . Ibis 1974;116:522-542
[48] Breuner CW,Spraguel RS,Patterson SH.et al. Environment, behaviour and physiology : do birds use barometric pressure to predict storms ? J.Exp.Biol. 2013 ; 216:1982-1990
[49] Bankovics A. The migration of Wood Pigeon (Columba palumbus) and Turtle Dove (Streptopelia turtur) in Hungary . Naturzale 2001; 16:83-93
[50] BirdLife International (2014) Species factsheet:Columba palumbus . Available from http://www.birdlife.org
[51] Bowling MS,Bisson IA,Shamoun-Baranes J. et al. . Grand Challenges in Migration Biology . Integrat.Comparat.Biology 2010 ; 50(3): 261-279
[52] Akesson S,Hedenstrom A . How migrants get there: migratory performance and orientation. BioScience 2007;57:123-33.
[53] Åkesson S, Walinder G, Karlsson L.et al. Nocturnal migratory flight initiation in reed warblers Acrocephalus scirpaceus: effect of wind on orientation and timing of migration. J Avian Biol 2002;33:349-57
[54] Barta Z, Houston AI, Weber TP, et al. . Optimal moult strategies in migratory birds. Phil Trans R Soc B 2008;363:211-29
[55] Both C, Bouwhuis S, Lessells CM, et al. . Climate change and population declines in a long- distance migratory bird. Nature 2006;441:81-3.
[56] Bowlin MS, Bowlin MS. Pointed wings, low wingloading and calm air reduce migratory flight costs in songbirds. PLoS One 2008;3:e2154.
[57] Couzin ID, Krause J, Franks NR, et al. Effective leadership and decision-making in animal groups on the move. Nature 2005;433:513-6
[58] Drake VA, Farrow RA The influence of atmospheric structure and motions on insect migration. Ann Rev Entomol 1988;33:183-210.
[59] Gannes LZ . Comparative fuel use of migrating passerines: effects of fat stores, migration distance, and diet. Auk 2001;118:665-77.
[60] Gwinner E . Circannual rhythms in birds: their interaction with circadian rhythms and environmental photoperiod. J Reprod Fertil Suppl 1973;19:51-65.

[61] Klaasen RHG, Strandberg R, Hake M, Alerstam T. . Flexibility in daily travel routines causes regional variation in bird migration speed. Behav Ecol Sociobiol 2008;62:1427-32.
[62] Kunz TH, Aeroecology: probing and modeling the aerosphere. Integr Comp Biol 2008;48:1- 11.
[63] Liechti F. . Birds: blowin' by the wind? J Ornithol 2006;147:202-11.
[64] McNamara JM, Houston AI. Optimal annual routines: Behaviour in the context of physiology
and ecology. Phil Trans R Soc B 2008;363:301-19.
[65] McNamara JM, Houston AI.. The timing of migration within the context of an annual routine.
J Avian Biol 1998;29:416-23.
[66] Pennycuick CJ. . Towards an optimal strategy for bird flight research. J Avian Biol
1998;29:449-57.
[67] Pielke RA, . A comprehensive meteorological modeling system – RAMS. Meteorol Atmos
Phys 1992;49:69-91.
[68] Shamoun-Baranes J, van Loon E, Alon D, et al. Is there a connection between weather at departure sites, onset of migration and timing of soaring-bird autumn migration in Israel? Glob Ecol Biogeog 2006;15:541-52.
[69] Shamoun-Baranes J, Bouten W, van Loon E. . Integrating meteorological conditions into migration research . Proceedings of the 2010 Annual Society for Integrative and Comparative Biology Meeting. Seattle, Washington; 2010a
[70] Shamoun-Baranes J, Leyrer J, van Loon E, et al. Stochastic atmospheric assistance and the use of emergency staging sites by migrants. Proc R Soc B 2010b. published online (doi: 10.1098/rspb.2009
[71] Stokke BG, Møller AP, Saether BE, et al. . Weather in the breeding area and during migration affects the demography of a small long-distance passerine migrant. Auk 2005;122:637-47.
[72] Weber J-M. The physiology of long-distance migration: extending the limits of endurance metabolism. J Exp Biol 2009;212:593-7.
[73] La Beccaccia “Scientifica” (The “scientific” woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 23/10/2012 – ATLANTE fotografico

di ANATOMIA del COLOMBACCIO
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[74] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 12/05/2012 – Il "senso" barometrico per la Migrazione degli Uccelli
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[75] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 31/12/2012 – EDITORIALE – Nota di aggiornamento sulla MIGRAZIONE di BECCACCIA e Colombaccio
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[76] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 24/06/2013 – Isotopi e migrazioni : Colombaccio e Beccaccia
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[77] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 11/11/2013 – Picchi MIGRATORI e Meteo-previsione delle MIGRAZIONI : un MODELLO sperimentale
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[79] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 10/12/2013 – COLOMBACCIO Scientifico : estratti Available from http://www.-labeccacciascientifica.it/aggiornamenti.asp
[80] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 13/10/2012 – La Beccaccia ha un organo per prevedere il tempo ?
Available from http://www.labeccacciascientifica.it/-aggiornamenti.asp
[81] La Beccaccia "Scientifica" (The "scientific" woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI] 27/02/2011 – AERODINAMICA del VOLO

e MORFOLOGIA ANATOMICA Available from http://www.-labeccacciascientifica.it/aggiornamenti.asp
[82] La Beccaccia “Scientifica” (The “scientific” woodcock) 2008 [http://www.labeccacciascientifica.it] [updated 2010-2014 – AGGIORNAMENTI]
16/02/2010 – CAMBIAMENTI CLIMATICI e MIGRAZIONE “evidence based review” 2001-2010 Available from http://www.-labeccacciascientifica.it/aggiornamenti.asp
[83]P.T.O. Paratympanic Organo of Vitali in Woodpigeon (Columba palumbus)Legenda in Italian language 2011 – Images available from https://plus.google.com/-photos/103942035281038458760/albums/5952413426147196337
[84] Woodpigeon’s (Columba palumbus) Anatomy – 2011 – Images available from https://plus.google.com/-photos/103942035281038458760/albums/5802439903337176049
[85] Baudinette RV,Frappel PB,Butler PJ. The influence of locomotion on air-sac pressures in little penguins . J.Exp.Biol. 2001;204:3581-3586
[85] Helm B. Zugunruhe of migratory and non migratory birds in a circannual context . J.Avian Biol. 2006 , 37(6):533-540
[86] Eikenaar C,Schlafke JL. Size and accumulation of fuel reserve at stopover predict nocturnal restlessness in a migratory bird . Royal Soc.Publ. 2013; DOI : 10.1098/rsbl.2013.0712
[87] O’Neill P. Magnetoreception and baroreception in birds . Develop.Growth Differ . 2013 ; 55:188-197
[88] Koninklijk Nederlands Meteo.Institut – Weerkaarten archief Europa 2003-2014
http://www.knmi.nl/klimatologie/daggegevens/-weerkaarten/animate.cgi
[89] Thomas PJ, Labrosse AK,Pomeroy AC et al. Effects of Weather on Avian Migration at Proposed Ridgeline Wind Energy Sites . (Bibliography about Weather & Migration). J.Wildlife Management 2011 ; 75(4):805-815
[90] Van Belle, J., Shamoun-Baranes J, Van Loon E .. An operational model predicting autumn bird migration intensities for flight safety. Journal of Applied Ecology 2007; 44:864–874
[91] Shamoun-Baranes, J., Bouten W, Buurma L et al…. Avian information systems: developing Web-based bird avoidance models. Ecology and Society 2008 ;13(2): 38. [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art38/

[92] Kerlinger P,Moore FR. Atmospheric structure and avian migration . Current Ornithology , 1989; 6:109-142
[93] Club Italiano del Colombaccio – Rinaldo Bucchi et al. – Progetto Colombaccio "Giornate di Picco Massimo " pag.11 – Ed. Promo Service.Forlì Italy

Update of Bibliography (2020)

[94]Sato J, Inagaki H, Kusui M, Yokosuka M, Ushida T (2019) Lowering barometric pressure induces neuronal activation in the superior vestibular nucleus in mice. PLoS ONE 14(1): e0211297.
[95]Giannessi F.,Ruffoli R.,von Bartheld CS
Giovanni Vitali :Discoverer of the paratympanic organ
Ann Anat. 2013 Jan;195(1):5-10. doi: 10.1016/j.aanat.2012.06.005.
[96]Fusani L. – To stay or to go :decision-making at stopover sites
https://www.msn.unipi.it/wp-content/uploads/2017/06/libro_-degli_abstract_sie_2017.pdf
[97]Santos CD, Przybyzin S, Wikelski M, Dechmann DKN (2016) : Collective Decision-Making in Homing Pigeons: Larger Flocks Take Longer to Decide but Do Not Make Better Decisions. PLoS ONE 11
[98]Schaub M, Jenni L, Bairlein F (2008) Fuel stores, fuel accumulation, and the decision to depart from a migration stopover site. Behav Ecol 19: 657-666
[99]La Sorte FA, Hochachka WM, Farnsworth A, Sheldon D, Van Doren BM, Fink D, Kelling S. (2015 Seasonal changes in the altitudinal distribution of nocturnally migrating birds during autumn migration.

- Soc. open sci. 2: 150347. http://dx.doi.org/10.1098/-rsos.150347

[100] Becciu P. (2014)The effects of atmospheric conditions on the flight of soaring migrants
in Italy recorded by radar
Ornis italica, Rome (Italy)
http://www.enram.eu/wp-content/uploads/2014/02/STSM--report_Becciu.pdf

[101]Goymann V.,Fusani L.,Cardinale M.
Ecophysiology of bird migration and stop-over behavior.Project.
https://www.researchgate.net/project/Ecophysiology-of-bird--migration-and-stop-over-behavior
[102] A Review of Migratory Bird Flyways and Priorities for Management. 2014. UNEP/CMS Secretariat, Bonn, Germany. 164 pages.
CMS Technical Series No. 27 https://www.cms.int/sites/-default/files/publication/CMS_Flyways_Reviews_Web.pdf
[103] Knudsen E. and Co-authors . -Challenging claims in the study of migratory birds and climate
Biol. Rev. (2011), 86, pp. 928–946.
doi: 10.1111/j.1469-185X.2011.00179.x
[104] Ahola M. and co-authors (2004)
Variation in climate warming along the migration route
uncouples arrival and breeding dates
Global Change Biology (2004) 10, 1610–1617, doi: 10.1111/j.1365-2486.2004.00823.x
[105] Butkauskas, D., Švažas, S., Bea, A. *et al.* Designation of flyways and genetic structure of Woodpigeon *Columba palumbus* in Europe and Morocco. *Eur J Wildl Res* **65,** 91 (2019) doi:10.1007/s10344-019-1336-9
https://link.springer.com/article/10.1007/s10344-019-1336-9
[106] Butkauskas D, Švažas S, Sruoga A, Bea A, Grishanov G, Kozulin A, Olano I, Stanevičius V, Tubelytė V, Ragauskas A (2013) Genetic techniques for designation of main flyways of the woodpigeon (*Columba palumbus*) in Europe as a tool for control and prevention of pathogenic diseases. Vet Med Zoot 63:12–16
[107] Cohou V (2011) Monitoring of woodpigeon migrations and their spatial and temporal evolution. Results induced by new technologies. In: Puigcerver M, Rodriguez-Teijeiro JD, Buner F. (eds), Abstracts of the 30th IUGB Congress Barcelona, Spain. P. 238
[108] Kumar S, Stecher G, Li M, Knyaz C, Tamura K (2018) MEGA X: Molecular evolutionary genetics analysis across computing platforms. Mol Biol Evol 35:1547–1549
[109] Mischenko A, Fedosov V, Tilba P, Sukhanova O, Mezhnev A (2013) Numbers and ecology of Woodpigeon (*Columba palumbus*) in different regions of European Russia. Vest Ochot:167–176 (in

Russian)
[110] Bianchi D. (2019 – personal communication)
Present status of Woodpigeons (estimated 6-700.000 in total area) in stop-over at Mesola forest (Ferrara – Po river delta) -3 Nov.2019- Forecasted take-off 9-12 Nov. for definitive migration .
Estimated increasing respect average last 5 years : 300 %
https://youtu.be/wG_MT5qvS1A
https://youtu.be/A26A1wuL8Tg
[111] Finch, T., Pearce-Higgins, J.W., Leech, D.I. *et al.* Carry-over effects from passage regions are more important than breeding climate in determining the breeding phenology and performance of three avian migrants of conservation concern. *Biodivers Conserv* **23,** 2427–2444 (2014) doi:10.1007/s10531-014-0731-5
[112] Alerstam T. – (2011) Optimal bird migration revisited. Journal für Ornithologie = Journal of Ornithol- ogy, Springer Verlag, 2011, 152 (S1), pp.5-23. 10.1007/s10336-011-0694-1 . hal-00697238
[113]Weber TP, Hedenström A (2000) Optimal stopover decisions under wind influence:the effects of correlated winds. J theor Biol 205: 95-104
[114]Weber TP, Fransson T, Houston AI (1999b) Should I stay or should I go? Testing optimality models of stopover decisions in migrating birds. Behav Ecol Sociobiol 46: 280-286
[115] Keith A. Hobson ,Hervé Lormée ,Steven L. Van Wilgenburg, Leonard I. Wassenaar ,Jean Marie Boutin (2009)- Stable isotopes (δD) delineate the origins and migratory connectivity of harvested animals: the casa of European woodpigeons-**Journal of Applied Ecology**
Volume 46, Issue 3 –https://doi.org/10.1111/j.-1365-2664.2009.01651.x
[116] Justyna M. Machowina1 and Izabella Rz – (2019) – AUTUMN MIGRATION OF THE WOOD PIGEON, COLUMBA PALUMBUS, AT EASTERN PART OF THE POLISH BALTIC COAST *-THE RING 41 (2019) 10.1515/ring-2019-0003*
(117)** Italian Journal Woodpigeon Research – Journal on-line***
Editorials,papers,reports,news,reviews.
Vol.1-2-3 2017-2018-2019 –http://journal.ilcolombaccio.it/
(@) ***Peaks and waves*** *definition as by*

<http://www.wbwp-fund.eu/ring/pdf/40/1_cavina%202018.pdf>:

"In this paper, we define the term peak day as a day within which the number of observed birds exceeds 5% of the individuals observed within the season (all birds observed from the beginning to the end of the observation period = 100%). This means that if during a period of two, three or more consecutive days the share of birds each day is above 5% of the total number of observed birds, all these days will be called 'peak days'. For a more precise description, peak days with different values are designated as 'low peaks' – 5.1-10.0% of the yearly total, 'moderate peaks' – 10.1-15.0% and 'high peaks' – >15%. Still the term 'peak' refers to one day. When we use the percentage value of the share of the day in the entire study, calculation of the Similarity Index (SI – discussed below) is natural and easily understandable.
We use the term wave of migration to refer to a period of several days in sequence in 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"

AKNOWLEDGEMENTS – including all the Observers/Hunters (Club Italiano del Colombaccio) who has collected data on the field for more than 20 years , specifically for this report we thank Raffaele Faccin,Franco Gessi,Filippo Puntieri,Paolo Cenni, Renato Bianchi,Lorenzo Monesi,Roberto Valentini,Renzo Pausini for their essential contribute.
Corroispondence : ecavinaster&gmail.com