|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Supplement 2 to: |  |  |  |  |  |  |  |  |
| Authors: Eugen Belskii, Andrey Lyakhov |  |  |  |  |  |  |
| Title: Improved breeding parameters in the pied flycatcher with reduced pollutant emissions from a copper smelter |
|  |  |  |  |  |  |  |  |  |  |
| Pollution source: Middle Ural copper smelter (Revda, Sverdlovsk region of Russia, 56°51'N, 59°53'E) |
| Zone: 1 - impact (heavy pollution); 2 - buffer (moderate pollution); 3 - background (control unpolluted) |
| Habitat: 1 - deciduous (aspen/birch) forest; 2 - coniferous (spruce/fir) forest  |  |  |
| Breeding parameters of the pied flycatcher Ficedula hypoleuca |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Laying date (May 1st = 1)** |  |  |  |  |  |  |
| **Number of nests** |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 13 | 13 |
| 1990 |  |  |  |  |  |  |  | 22 | 22 |
| 1991 |  | 4 | 4 |  | 4 | 4 |  | 31 | 31 |
| 1992 | 8 | 2 | 10 |  | 6 | 6 |  | 23 | 23 |
| 1993 | 3 | 3 | 6 | 6 | 8 | 14 |  | 21 | 21 |
| 1994 | 2 | 2 | 4 | 6 | 5 | 11 |  | 12 | 12 |
| 1995 | 4 | 6 | 10 | 1 | 4 | 5 |  | 12 | 12 |
| 1996 | 4 | 1 | 5 |  | 5 | 5 | 24 | 13 | 37 |
| 1997 | 6 | 4 | 10 | 7 | 8 | 15 | 31 | 16 | 47 |
| 1998 | 6 | 4 | 10 | 4 | 6 | 10 | 30 | 22 | 52 |
| 1999 | 8 | 5 | 13 | 20 | 11 | 31 | 34 | 20 | 54 |
| 2000 | 4 | 5 | 9 | 14 | 12 | 26 | 37 | 30 | 67 |
| 2001 | 6 | 7 | 13 | 21 | 13 | 34 | 40 | 24 | 64 |
| 2002 | 6 | 13 | 19 | 20 | 12 | 32 | 48 | 23 | 71 |
| 2003 | 9 | 9 | 18 | 17 | 7 | 24 | 42 | 9 | 51 |
| 2004 | 9 | 8 | 17 | 21 | 10 | 31 | 63 | 14 | 77 |
| 2005 | 6 | 3 | 9 | 19 | 6 | 25 | 100 | 15 | 115 |
| 2006 | 4 | 5 | 9 | 19 | 8 | 27 | 95 | 21 | 116 |
| 2007 | 8 | 4 | 12 | 21 | 10 | 31 | 62 | 17 | 79 |
| 2008 | 17 | 5 | 22 | 19 | 7 | 26 | 54 | 17 | 71 |
| 2009 | 5 | 3 | 8 | 6 | 6 | 12 | 24 | 18 | 42 |
| 2010 | 3 | 5 | 8 | 10 | 6 | 16 | 41 | 15 | 56 |
| 2011 | 7 | 7 | 14 | 12 | 6 | 18 | 64 | 19 | 83 |
| 2012 | 14 | 6 | 20 | 12 | 5 | 17 | 69 | 25 | 94 |
| 2013 | 18 | 9 | 27 | 12 | 7 | 19 | 81 | 29 | 110 |
| 2014 | 26 | 14 | 40 | 7 | 7 | 14 | 88 | 34 | 122 |
| 2015 | 25 | 15 | 40 | 8 | 3 | 11 | 84 | 21 | 105 |
| 2016 | 18 | 15 | 33 | 7 | 3 | 10 | 54 | 18 | 72 |
| 2017 | 39 | 13 | 52 | 6 | 2 | 8 | 64 | 21 | 85 |
| 2018 | 27 | 7 | 34 | 3 | 3 | 6 | 51 | 16 | 67 |
| 2019 | 23 | 7 | 30 | 5 | 4 | 9 | 55 | 12 | 67 |
| 2020 | 22 | 6 | 28 | 6 | 5 | 11 | 49 | 11 | 60 |
| 2021 | 18 | 5 | 23 | 4 | 7 | 11 | 43 | 13 | 56 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Mean** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 28.38462 | 28.38462 |
| 1990 |  |  |  |  |  |  |  | 29.31818 | 29.31818 |
| 1991 |  | 33 | 33 |  | 21.25 | 21.25 |  | 21.93548 | 21.93548 |
| 1992 | 42.875 | 42 | 42.7 |  | 42.16667 | 42.16667 |  | 32.86957 | 32.86957 |
| 1993 | 39.33333 | 34 | 36.66667 | 33.83333 | 34.5 | 34.21429 |  | 31.57143 | 31.57143 |
| 1994 | 28.5 | 34 | 31.25 | 30 | 28.6 | 29.36364 |  | 28.75 | 28.75 |
| 1995 | 33.5 | 25.33333 | 28.6 | 21 | 28 | 26.6 |  | 25.5 | 25.5 |
| 1996 | 33.5 | 33 | 33.4 |  | 32 | 32 | 31.75 | 30.61538 | 31.35135 |
| 1997 | 32.83333 | 36.25 | 34.2 | 36 | 31.875 | 33.8 | 30.16129 | 29.9375 | 30.08511 |
| 1998 | 39.66667 | 33.5 | 37.2 | 26.25 | 32.66667 | 30.1 | 27.53333 | 31.90909 | 29.38462 |
| 1999 | 38.625 | 33.6 | 36.69231 | 38.75 | 35.09091 | 37.45161 | 30.82353 | 33.4 | 31.77778 |
| 2000 | 38.75 | 34.2 | 36.22222 | 28.85714 | 30.33333 | 29.53846 | 30.94595 | 29.8 | 30.43284 |
| 2001 | 32.16667 | 35.71429 | 34.07692 | 25.28571 | 28 | 26.32353 | 24.45 | 26.125 | 25.07813 |
| 2002 | 40.83333 | 38.30769 | 39.10526 | 32.35 | 34.16667 | 33.03125 | 33.91667 | 35.69565 | 34.49296 |
| 2003 | 38.11111 | 36.11111 | 37.11111 | 28.70588 | 24.42857 | 27.45833 | 29.21429 | 25.44444 | 28.54902 |
| 2004 | 33.44444 | 35.125 | 34.23529 | 23.38095 | 24.8 | 23.83871 | 22.66667 | 23.92857 | 22.8961 |
| 2005 | 30.16667 | 27.66667 | 29.33333 | 22 | 24 | 22.48 | 23.26 | 21.13333 | 22.98261 |
| 2006 | 36.25 | 29.8 | 32.66667 | 26.68421 | 25.875 | 26.44444 | 26.48421 | 26.90476 | 26.56034 |
| 2007 | 32.75 | 34.5 | 33.33333 | 27.66667 | 28.7 | 28 | 28.1129 | 27.52941 | 27.98734 |
| 2008 | 38.05882 | 30.4 | 36.31818 | 28.47368 | 25.71429 | 27.73077 | 23.90741 | 26.88235 | 24.61972 |
| 2009 | 34.8 | 31.33333 | 33.5 | 28.16667 | 37 | 32.58333 | 28.45833 | 27.27778 | 27.95238 |
| 2010 | 31 | 31.2 | 31.125 | 25.5 | 29.33333 | 26.9375 | 23.97561 | 23 | 23.71429 |
| 2011 | 38.14286 | 41 | 39.57143 | 30.08333 | 33 | 31.05556 | 28.1875 | 30.78947 | 28.78313 |
| 2012 | 23.64286 | 20.83333 | 22.8 | 22.83333 | 19.4 | 21.82353 | 19.11594 | 20.12 | 19.38298 |
| 2013 | 29.38889 | 29.33333 | 29.37037 | 27.83333 | 23.42857 | 26.21053 | 25.20988 | 24.17241 | 24.93636 |
| 2014 | 30.80769 | 29 | 30.175 | 23.71429 | 27.42857 | 25.57143 | 20.96591 | 21.94118 | 21.2377 |
| 2015 | 34.52 | 35.13333 | 34.75 | 23.625 | 23.33333 | 23.54545 | 24.95238 | 27.33333 | 25.42857 |
| 2016 | 24.38889 | 27.26667 | 25.69697 | 20.85714 | 20.33333 | 20.7 | 18.59259 | 20.61111 | 19.09722 |
| 2017 | 31.79487 | 29.84615 | 31.30769 | 44.33333 | 22.5 | 38.875 | 26.4375 | 28.2381 | 26.88235 |
| 2018 | 32.03704 | 34.57143 | 32.55882 | 22 | 30.33333 | 26.16667 | 29.47059 | 31.625 | 29.98507 |
| 2019 | 25.13043 | 32.42857 | 26.83333 | 32 | 26.25 | 29.44444 | 19.94545 | 21.66667 | 20.25373 |
| 2020 | 20.68182 | 20 | 20.53571 | 26.5 | 20 | 23.54545 | 18.65306 | 20.81818 | 19.05 |
| 2021 | 21.83333 | 27.6 | 23.08696 | 21.25 | 22.14286 | 21.81818 | 19.34884 | 20.92308 | 19.71429 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **SD** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 6.752018 | 6.752018 |
| 1990 |  |  |  |  |  |  |  | 5.167539 | 5.167539 |
| 1991 |  | 5.887841 | 5.887841 |  | 1.707825 | 1.707825 |  | 4.9392 | 4.9392 |
| 1992 | 5.514591 | 2.828427 | 4.967673 |  | 6.145459 | 6.145459 |  | 5.98714 | 5.98714 |
| 1993 | 3.785939 | 2.645751 | 4.131182 | 5.56477 | 4.898979 | 4.995052 |  | 2.248809 | 2.248809 |
| 1994 | 4.949747 | 2.828427 | 4.573474 | 1.095445 | 2.073644 | 1.68954 |  | 3.91094 | 3.91094 |
| 1995 | 6.608076 | 4.131182 | 6.46701 |  | 4.546061 | 5.029911 |  | 4.011348 | 4.011348 |
| 1996 | 2.886751 | #ДЕЛ/0! | 2.50998 |  | 2.54951 | 2.54951 | 7.041801 | 4.752867 | 6.285858 |
| 1997 | 2.786874 | 4.645787 | 3.823901 | 9.273618 | 5.24915 | 7.427747 | 6.083293 | 7.827036 | 6.642517 |
| 1998 | 7.501111 | 7.767453 | 7.842902 | 2.362908 | 9.223159 | 7.752419 | 4.232333 | 8.755456 | 6.820252 |
| 1999 | 7.726346 | 3.209361 | 6.688107 | 10.9298 | 6.847694 | 9.718843 | 4.549196 | 7.714648 | 5.983205 |
| 2000 | 6.020797 | 4.438468 | 5.403188 | 1.83375 | 5.72607 | 4.091266 | 4.684169 | 1.710011 | 3.68545 |
| 2001 | 6.145459 | 11.22073 | 9.059632 | 9.935506 | 7.83156 | 9.16092 | 7.712627 | 9.405422 | 8.353888 |
| 2002 | 10.88883 | 8.479236 | 9.073127 | 6.158221 | 5.749835 | 5.981069 | 6.952218 | 7.510204 | 7.133168 |
| 2003 | 7.912718 | 7.720823 | 7.653441 | 12.18485 | 3.047247 | 10.47141 | 9.771875 | 4.901814 | 9.178919 |
| 2004 | 11.14799 | 9.789754 | 10.23798 | 3.707778 | 7.269418 | 5.04709 | 8.568509 | 7.7704 | 8.394209 |
| 2005 | 11.07098 | 5.507571 | 9.26013 | 7.94425 | 5.585696 | 7.38873 | 8.04736 | 3.292126 | 7.62151 |
| 2006 | 12.68529 | 6.016644 | 9.486833 | 4.282427 | 3.181981 | 3.945137 | 6.042162 | 4.603311 | 5.792482 |
| 2007 | 4.652188 | 11.61895 | 7.164728 | 8.816651 | 9.21412 | 8.805301 | 7.930239 | 6.226131 | 7.562549 |
| 2008 | 7.47053 | 4.615192 | 7.574307 | 8.720145 | 5.437962 | 7.962702 | 6.525042 | 7.49902 | 6.83555 |
| 2009 | 6.418723 | 3.05505 | 5.424811 | 5.307228 | 12.18195 | 10.0766 | 6.446969 | 2.696524 | 5.165327 |
| 2010 | 7 | 7.224957 | 6.621124 | 9.288583 | 8.477421 | 8.910434 | 6.234933 | 4.407785 | 5.779947 |
| 2011 | 11.21648 | 8.717798 | 9.764254 | 8.928589 | 6.418723 | 8.105715 | 6.356786 | 8.297114 | 6.882371 |
| 2012 | 6.058778 | 1.722401 | 5.257576 | 8.451286 | 7.668116 | 8.14889 | 8.825991 | 7.473955 | 8.460034 |
| 2013 | 7.747021 | 6.264982 | 7.163734 | 8.299325 | 4.429339 | 7.30737 | 8.966209 | 4.01843 | 7.960081 |
| 2014 | 10.09166 | 8.494342 | 9.491933 | 5.765249 | 12.06727 | 9.287827 | 6.023801 | 6.31948 | 6.097084 |
| 2015 | 9.009809 | 8.279637 | 8.640246 | 5.449443 | 4.618802 | 5.007267 | 6.742966 | 6.126445 | 6.664858 |
| 2016 | 7.022141 | 8.145697 | 7.572503 | 8.47405 | 5.859465 | 7.454305 | 4.311102 | 5.991552 | 4.821197 |
| 2017 | 7.726167 | 7.904072 | 7.739733 | 12.4043 | 2.12132 | 14.58412 | 8.481305 | 7.154752 | 8.169939 |
| 2018 | 7.460055 | 12.17726 | 8.478819 | 0 | 4.50925 | 5.382069 | 9.016325 | 9.945686 | 9.215423 |
| 2019 | 7.393513 | 13.52599 | 9.443419 | 11.7686 | 7.228416 | 9.900898 | 7.694197 | 5.449493 | 7.336797 |
| 2020 | 7.006027 | 4.939636 | 6.540371 | 10.21274 | 7.483315 | 9.277539 | 4.772102 | 9.400193 | 5.849598 |
| 2021 | 3.698171 | 6.188699 | 4.842173 | 6.5 | 5.113009 | 5.344496 | 2.999077 | 6.157131 | 3.948368 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Supplement to: |  |  |  |  |  |  |  |  |
| Authors: Eugen Belskii, Andrey Lyakhov |  |  |  |  |  |  |
| Title: Improved breeding parameters in the pied flycatcher with reduced pollutant emissions from a copper smelter |
|  |  |  |  |  |  |  |  |  |  |
| Pollution source: Middle Ural copper smelter (Revda, Sverdlovsk region of Russia, 56°51'N, 59°53'E) |
| Zone: 1 - impact (heavy pollution); 2 - buffer (moderate pollution); 3 - background (control unpolluted) |
| Habitat: 1 - deciduous (aspen/birch) forest; 2 - coniferous (spruce/fir) forest  |  |  |
| Breeding parameters of the pied flycatcher Ficedula hypoleuca |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Clutch size** |  |  |  |  |  |  |  |  |
| **Number of nests** |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 13 | 13 |
| 1990 |  |  |  |  | 3 | 3 |  | 22 | 22 |
| 1991 |  | 4 | 4 |  | 4 | 4 |  | 30 | 30 |
| 1992 | 7 | 2 | 9 |  | 5 | 5 |  | 20 | 20 |
| 1993 | 3 | 3 | 6 | 6 | 8 | 14 |  | 22 | 22 |
| 1994 | 2 |  | 2 | 6 | 5 | 11 |  | 11 | 11 |
| 1995 | 4 | 6 | 10 | 1 | 6 | 7 |  | 12 | 12 |
| 1996 | 4 | 1 | 5 |  | 7 | 7 | 23 | 13 | 36 |
| 1997 | 6 | 4 | 10 | 6 | 8 | 14 | 31 | 16 | 47 |
| 1998 | 4 | 4 | 8 | 4 | 6 | 10 | 31 | 22 | 53 |
| 1999 | 7 | 7 | 14 | 19 | 8 | 27 | 34 | 22 | 56 |
| 2000 | 3 | 5 | 8 | 16 | 11 | 27 | 37 | 30 | 67 |
| 2001 | 6 | 8 | 14 | 19 | 13 | 32 | 41 | 24 | 65 |
| 2002 | 5 | 14 | 19 | 20 | 12 | 32 | 43 | 19 | 62 |
| 2003 | 10 | 7 | 17 | 19 | 7 | 26 | 41 | 8 | 49 |
| 2004 | 7 | 6 | 13 | 21 | 10 | 31 | 63 | 14 | 77 |
| 2005 | 8 | 3 | 11 | 20 | 6 | 26 | 101 | 15 | 116 |
| 2006 | 4 | 5 | 9 | 20 | 10 | 30 | 91 | 20 | 111 |
| 2007 | 6 | 3 | 9 | 16 | 12 | 28 | 61 | 15 | 76 |
| 2008 | 9 | 5 | 14 | 18 | 7 | 25 | 51 | 17 | 68 |
| 2009 | 5 | 3 | 8 | 9 | 5 | 14 | 36 | 18 | 54 |
| 2010 | 3 | 5 | 8 | 10 | 6 | 16 | 40 | 15 | 55 |
| 2011 | 7 | 6 | 13 | 12 | 7 | 19 | 63 | 19 | 82 |
| 2012 | 15 | 6 | 21 | 13 | 6 | 19 | 68 | 25 | 93 |
| 2013 | 14 | 10 | 24 | 12 | 7 | 19 | 76 | 29 | 105 |
| 2014 | 23 | 14 | 37 | 7 | 7 | 14 | 88 | 34 | 122 |
| 2015 | 23 | 15 | 38 | 8 | 3 | 11 | 83 | 20 | 103 |
| 2016 | 16 | 12 | 28 | 7 | 3 | 10 | 53 | 18 | 71 |
| 2017 | 34 | 11 | 45 | 8 | 2 | 10 | 64 | 19 | 83 |
| 2018 | 25 | 7 | 32 | 3 | 3 | 6 | 49 | 13 | 62 |
| 2019 | 24 | 7 | 31 | 5 | 4 | 9 | 52 | 12 | 64 |
| 2020 | 22 | 6 | 28 | 6 | 5 | 11 | 50 | 11 | 61 |
| 2021 | 18 | 5 | 23 | 4 | 7 | 11 | 43 | 12 | 55 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Mean** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 6.384615 | 6.384615 |
| 1990 |  |  |  |  | 4.666667 | 4.666667 |  | 6.363636 | 6.363636 |
| 1991 |  | 6 | 6 |  | 7.25 | 7.25 |  | 6.9 | 6.9 |
| 1992 | 3.857143 | 4.5 | 4 |  | 5.2 | 5.2 |  | 6.35 | 6.35 |
| 1993 | 2.666667 | 6.333333 | 4.5 | 5.833333 | 6.25 | 6.071429 |  | 6.590909 | 6.590909 |
| 1994 | 4 |  | 4 | 6.666667 | 6 | 6.363636 |  | 6.272727 | 6.272727 |
| 1995 | 4.25 | 6.166667 | 5.4 | 7 | 6.166667 | 6.285714 |  | 6.25 | 6.25 |
| 1996 | 3.5 | 3 | 3.4 |  | 5.857143 | 5.857143 | 6.608696 | 6 | 6.388889 |
| 1997 | 4 | 4 | 4 | 5 | 6.125 | 5.642857 | 6.354839 | 6.375 | 6.361702 |
| 1998 | 3.75 | 5 | 4.375 | 6 | 5.666667 | 5.8 | 6.354839 | 6.272727 | 6.320755 |
| 1999 | 4.714286 | 4.571429 | 4.642857 | 5.894737 | 5.875 | 5.888889 | 6.441176 | 6.318182 | 6.392857 |
| 2000 | 4.666667 | 4 | 4.25 | 6.3125 | 6.545455 | 6.407407 | 6.135135 | 6.666667 | 6.373134 |
| 2001 | 4 | 4.5 | 4.285714 | 6.315789 | 6.230769 | 6.28125 | 6.390244 | 6.666667 | 6.492308 |
| 2002 | 3.8 | 4.214286 | 4.105263 | 5.95 | 6 | 5.96875 | 6.27907 | 6.526316 | 6.354839 |
| 2003 | 3.4 | 4.571429 | 3.882353 | 6.421053 | 6.571429 | 6.461538 | 5.95122 | 7.125 | 6.142857 |
| 2004 | 2.857143 | 4.333333 | 3.538462 | 6.190476 | 6.5 | 6.290323 | 6.238095 | 6.428571 | 6.272727 |
| 2005 | 3.75 | 5.333333 | 4.181818 | 6.95 | 7 | 6.961538 | 6.50495 | 6.866667 | 6.551724 |
| 2006 | 5.75 | 4.2 | 4.888889 | 6.95 | 6.9 | 6.933333 | 6.527473 | 6.65 | 6.54955 |
| 2007 | 4.833333 | 4 | 4.555556 | 6.4375 | 6.25 | 6.357143 | 6.163934 | 6.733333 | 6.276316 |
| 2008 | 3.222222 | 5.2 | 3.928571 | 6.166667 | 6.714286 | 6.32 | 6.666667 | 6.647059 | 6.661765 |
| 2009 | 4.4 | 6.333333 | 5.125 | 5.444444 | 5.6 | 5.5 | 6.472222 | 6.611111 | 6.518519 |
| 2010 | 3.333333 | 4.8 | 4.25 | 6.3 | 6.5 | 6.375 | 6.475 | 6.6 | 6.509091 |
| 2011 | 3.857143 | 4.333333 | 4.076923 | 5.916667 | 6.142857 | 6 | 6.238095 | 6.157895 | 6.219512 |
| 2012 | 4.933333 | 5.666667 | 5.142857 | 6.769231 | 7 | 6.842105 | 6.764706 | 7.08 | 6.849462 |
| 2013 | 4.357143 | 4.7 | 4.5 | 6.416667 | 7.142857 | 6.684211 | 6.5 | 6.482759 | 6.495238 |
| 2014 | 5 | 5.071429 | 5.027027 | 6.428571 | 6.428571 | 6.428571 | 6.568182 | 6.588235 | 6.57377 |
| 2015 | 5.217391 | 5.466667 | 5.315789 | 6.125 | 6.666667 | 6.272727 | 6.457831 | 6.5 | 6.466019 |
| 2016 | 5.875 | 5.083333 | 5.535714 | 6.857143 | 7.333333 | 7 | 7 | 7 | 7 |
| 2017 | 5 | 6.090909 | 5.266667 | 5.75 | 6 | 5.8 | 6.53125 | 6.526316 | 6.53012 |
| 2018 | 5.08 | 5.857143 | 5.25 | 6.666667 | 6 | 6.333333 | 6.693878 | 6.076923 | 6.564516 |
| 2019 | 5.291667 | 6.142857 | 5.483871 | 6.2 | 6.75 | 6.444444 | 6.980769 | 6.5 | 6.890625 |
| 2020 | 6.136364 | 6.5 | 6.214286 | 5.833333 | 6.6 | 6.181818 | 6.58 | 6.454545 | 6.557377 |
| 2021 | 5.611111 | 4.4 | 5.347826 | 6.75 | 6.571429 | 6.636364 | 6.697674 | 6.666667 | 6.690909 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **SD** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 0.869718 | 0.957427 |
| 1990 |  |  |  |  | 2.309401 | 2.309401 |  | 0.726731 | 0.726731 |
| 1991 |  | 0.816497 | 0.816497 |  | 0.5 | 0.5 |  | 0.711967 | 0.711967 |
| 1992 | 0.899735 | 0.707107 | 0.866025 |  | 1.48324 | 1.48324 |  | 1.136708 | 1.136708 |
| 1993 | 1.154701 | 0.57735 | 2.167948 | 0.408248 | 1.164965 | 0.916875 |  | 0.908116 | 0.908116 |
| 1994 | 1.414214 |  | 1.414214 | 0.816497 | 1 | 0.924416 |  | 1.00905 | 1.00905 |
| 1995 | 0.957427 | 0.983192 | 1.349897 |  | 0.752773 | 0.755929 |  | 1.864745 | 1.864745 |
| 1996 | 0.57735 |  | 0.547723 |  | 1.46385 | 1.46385 | 1.437774 | 1.080123 | 1.3369 |
| 1997 | 0.632456 | 1.414214 | 0.942809 | 0.894427 | 1.125992 | 1.150728 | 0.914636 | 0.957427 | 0.919015 |
| 1998 | 0.957427 | 1.414214 | 1.30247 | 0 | 1.21106 | 0.918937 | 0.608188 | 0.984732 | 0.778894 |
| 1999 | 1.380131 | 1.511858 | 1.392681 | 1.196975 | 0.64087 | 1.050031 | 0.704581 | 0.893701 | 0.778777 |
| 2000 | 1.154701 | 1 | 1.035098 | 0.60208 | 0.687552 | 0.636049 | 0.855121 | 0.758098 | 0.849881 |
| 2001 | 1.414214 | 1.603567 | 1.489893 | 0.945905 | 0.725011 | 0.851351 | 1.069534 | 0.868115 | 1.001921 |
| 2002 | 1.788854 | 1.423893 | 1.486784 | 1.050063 | 1.128152 | 1.062085 | 1.57851 | 1.020263 | 1.426871 |
| 2003 | 1.264911 | 1.272418 | 1.363926 | 0.837708 | 0.534522 | 0.760567 | 1.116943 | 0.353553 | 1.118034 |
| 2004 | 1.573592 | 1.032796 | 1.506397 | 1.077917 | 0.707107 | 0.972747 | 1.058213 | 1.157868 | 1.071599 |
| 2005 | 1.669046 | 1.154701 | 1.662419 | 0.887041 | 0.632456 | 0.823688 | 0.934064 | 0.915475 | 0.935715 |
| 2006 | 1.5 | 1.788854 | 1.763834 | 0.998683 | 0.567646 | 0.868345 | 0.935006 | 0.74516 | 0.901904 |
| 2007 | 1.722401 | 2 | 1.740051 | 1.152895 | 0.965307 | 1.061595 | 0.820169 | 0.593617 | 0.809917 |
| 2008 | 0.971825 | 1.923538 | 1.63915 | 1.098127 | 0.755929 | 1.029563 | 0.864099 | 0.701888 | 0.821544 |
| 2009 | 1.140175 | 0.57735 | 1.356203 | 1.666667 | 0.547723 | 1.344504 | 1.027789 | 0.777544 | 0.946508 |
| 2010 | 1.154701 | 2.387467 | 2.052873 | 1.05935 | 0.83666 | 0.957427 | 1.131994 | 0.985611 | 1.086495 |
| 2011 | 2.035401 | 1.505545 | 1.754116 | 0.900337 | 0.690066 | 0.816497 | 0.755929 | 0.898342 | 0.786057 |
| 2012 | 1.533747 | 1.505545 | 1.525966 | 1.165751 | 0.632456 | 1.014515 | 1.052611 | 0.953939 | 1.031527 |
| 2013 | 1.549548 | 1.636392 | 1.560379 | 1.443376 | 0.377964 | 1.204281 | 0.972968 | 0.828971 | 0.931539 |
| 2014 | 1.314257 | 1.491735 | 1.36395 | 0.534522 | 1.133893 | 0.851631 | 0.691416 | 0.783065 | 0.714872 |
| 2015 | 1.832944 | 1.302013 | 1.629214 | 0.64087 | 0.57735 | 0.64667 | 0.720792 | 0.888523 | 0.751672 |
| 2016 | 1.310216 | 1.729862 | 1.527092 | 0.377964 | 0.57735 | 0.471405 | 0.784465 | 1.084652 | 0.861892 |
| 2017 | 1.61433 | 0.94388 | 1.543314 | 1.28174 | 0 | 1.135292 | 1.023048 | 0.904828 | 0.991886 |
| 2018 | 1.800926 | 1.345185 | 1.722714 | 0.57735 | 0 | 0.516398 | 1.193805 | 1.38212 | 1.249537 |
| 2019 | 1.428869 | 0.899735 | 1.363108 | 1.788854 | 0.5 | 1.333333 | 0.91802 | 0.797724 | 0.910559 |
| 2020 | 1.037187 | 0.83666 | 0.994695 | 1.169045 | 0.547723 | 0.98165 | 0.835195 | 0.687552 | 0.806734 |
| 2021 | 2.226548 | 1.67332 | 2.144945 | 0.5 | 0.534522 | 0.504525 | 0.741134 | 0.984732 | 0.790516 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Supplement to: |  |  |  |  |  |  |  |  |
| Authors: Eugen Belskii, Andrey Lyakhov |  |  |  |  |  |  |
| Title: Improved breeding parameters in the pied flycatcher with reduced pollutant emissions from a copper smelter |
|  |  |  |  |  |  |  |  |  |  |
| Pollution source: Middle Ural copper smelter (Revda, Sverdlovsk region of Russia, 56°51'N, 59°53'E) |
| Zone: 1 - impact (heavy pollution); 2 - buffer (moderate pollution); 3 - background (control unpolluted) |
| Habitat: 1 - deciduous (aspen/birch) forest; 2 - coniferous (spruce/fir) forest  |  |  |
| Breeding parameters of the pied flycatcher Ficedula hypoleuca |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Number of fledglings per incubated clutch** |  |  |  |  |
| **Number of nests** |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 12 | 12 |
| 1990 |  |  |  |  | 3 | 3 |  | 18 | 18 |
| 1991 |  | 4 | 4 |  | 4 | 4 |  | 25 | 25 |
| 1992 | 7 | 2 | 9 |  | 4 | 4 |  | 15 | 15 |
| 1993 | 3 | 3 | 6 | 5 | 7 | 12 |  | 15 | 15 |
| 1994 | 2 | 2 | 4 | 3 | 2 | 5 |  | 10 | 10 |
| 1995 | 4 | 5 | 9 | 1 | 5 | 6 |  | 12 | 12 |
| 1996 | 4 | 1 | 5 |  | 4 | 4 | 22 | 13 | 35 |
| 1997 | 6 | 3 | 9 | 5 | 8 | 13 | 26 | 9 | 35 |
| 1998 | 4 | 4 | 8 | 1 | 3 | 4 | 29 | 18 | 47 |
| 1999 | 7 | 5 | 12 | 15 | 7 | 22 | 33 | 13 | 46 |
| 2000 | 3 | 5 | 8 | 14 | 11 | 25 | 37 | 26 | 63 |
| 2001 | 5 | 8 | 13 | 19 | 11 | 30 | 38 | 21 | 59 |
| 2002 | 4 | 14 | 18 | 19 | 12 | 31 | 42 | 17 | 59 |
| 2003 | 10 | 7 | 17 | 16 | 7 | 23 | 40 | 8 | 48 |
| 2004 | 7 | 6 | 13 | 21 | 9 | 30 | 50 | 14 | 64 |
| 2005 | 8 | 2 | 10 | 20 | 5 | 25 | 92 | 15 | 107 |
| 2006 | 4 | 5 | 9 | 9 | 6 | 15 | 81 | 19 | 100 |
| 2007 | 6 | 3 | 9 | 9 | 7 | 16 | 45 | 6 | 51 |
| 2008 | 9 | 5 | 14 | 14 | 7 | 21 | 47 | 17 | 64 |
| 2009 | 5 | 3 | 8 | 4 | 2 | 6 | 24 | 17 | 41 |
| 2010 | 3 | 5 | 8 | 9 | 5 | 14 | 38 | 15 | 53 |
| 2011 | 7 | 4 | 11 | 11 | 6 | 17 | 56 | 18 | 74 |
| 2012 | 14 | 6 | 20 | 10 | 4 | 14 | 63 | 25 | 88 |
| 2013 | 12 | 9 | 21 | 11 | 7 | 18 | 72 | 26 | 98 |
| 2014 | 23 | 14 | 37 | 7 | 7 | 14 | 85 | 32 | 117 |
| 2015 | 23 | 15 | 38 | 8 | 3 | 11 | 77 | 19 | 96 |
| 2016 | 9 | 7 | 16 | 7 | 3 | 10 | 40 | 11 | 51 |
| 2017 | 34 | 9 | 43 | 6 | 2 | 8 | 50 | 17 | 67 |
| 2018 | 25 | 6 | 31 | 3 | 3 | 6 | 45 | 13 | 58 |
| 2019 | 24 | 7 | 31 | 5 | 2 | 7 | 48 | 12 | 60 |
| 2020 | 22 | 6 | 28 | 6 | 5 | 11 | 48 | 10 | 58 |
| 2021 | 17 | 5 | 22 | 4 | 7 | 11 | 41 | 12 | 53 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Mean** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 6 | 6 |
| 1990 |  |  |  |  | 3.333333 | 3.333333 |  | 4.888889 | 4.888889 |
| 1991 |  | 2 | 2 |  | 5.25 | 5.25 |  | 5.8 | 5.8 |
| 1992 | 2 | 2.5 | 2.111111 |  | 3 | 3 |  | 3.533333 | 3.533333 |
| 1993 | 1.333333 | 3 | 2.166667 | 5.4 | 5.714286 | 5.583333 |  | 5.8 | 5.8 |
| 1994 | 2.5 | 2.5 | 2.5 | 6.333333 | 5.5 | 6 |  | 5.1 | 5.1 |
| 1995 | 3.5 | 4 | 3.777778 | 6 | 4 | 4.333333 |  | 5.666667 | 5.666667 |
| 1996 | 2.25 | 2 | 2.2 |  | 4.75 | 4.75 | 5.727273 | 5.307692 | 5.571429 |
| 1997 | 2.5 | 1.333333 | 2.111111 | 3.2 | 5.25 | 4.461538 | 5.076923 | 5.888889 | 5.285714 |
| 1998 | 2.5 | 4.25 | 3.375 | 5 | 4.333333 | 4.5 | 5.482759 | 5.277778 | 5.404255 |
| 1999 | 3 | 2.6 | 2.833333 | 4.4 | 4.571429 | 4.454545 | 5.393939 | 5.384615 | 5.391304 |
| 2000 | 3 | 2.6 | 2.75 | 5.357143 | 6 | 5.64 | 5 | 5.846154 | 5.349206 |
| 2001 | 2.8 | 2.25 | 2.461538 | 5.578947 | 4.272727 | 5.1 | 5.236842 | 5.761905 | 5.423729 |
| 2002 | 2 | 1.714286 | 1.777778 | 4.736842 | 4.416667 | 4.612903 | 5.309524 | 5.588235 | 5.389831 |
| 2003 | 1.7 | 3.285714 | 2.352941 | 5.4375 | 5.857143 | 5.565217 | 5.3 | 7 | 5.583333 |
| 2004 | 0.857143 | 2.166667 | 1.461538 | 5.47619 | 6 | 5.633333 | 5.62 | 5.785714 | 5.65625 |
| 2005 | 2 | 4 | 2.4 | 5.25 | 5.2 | 5.24 | 5.358696 | 6.4 | 5.504673 |
| 2006 | 2.25 | 0.6 | 1.333333 | 6.444444 | 6 | 6.266667 | 5.555556 | 6 | 5.64 |
| 2007 | 3.5 | 2.333333 | 3.111111 | 6 | 5.142857 | 5.625 | 4.177778 | 6.166667 | 4.411765 |
| 2008 | 1.111111 | 1.8 | 1.357143 | 5.214286 | 5.285714 | 5.238095 | 5.085106 | 5.647059 | 5.234375 |
| 2009 | 3.2 | 4.333333 | 3.625 | 6 | 6 | 6 | 5.416667 | 5.882353 | 5.609756 |
| 2010 | 1.666667 | 4 | 3.125 | 4.888889 | 6.2 | 5.357143 | 5.421053 | 5.6 | 5.471698 |
| 2011 | 2.714286 | 2.75 | 2.727273 | 5 | 5.666667 | 5.235294 | 5.339286 | 5.277778 | 5.324324 |
| 2012 | 3.642857 | 5.166667 | 4.1 | 5.7 | 5.75 | 5.714286 | 6.349206 | 6.32 | 6.340909 |
| 2013 | 3.5 | 3 | 3.285714 | 5.818182 | 5.571429 | 5.722222 | 4.847222 | 5.615385 | 5.05102 |
| 2014 | 3.434783 | 2.571429 | 3.108108 | 5.285714 | 5.428571 | 5.357143 | 5.670588 | 4.78125 | 5.42735 |
| 2015 | 3.217391 | 4 | 3.526316 | 5.5 | 6 | 5.636364 | 5.194805 | 5.263158 | 5.208333 |
| 2016 | 3.222222 | 3.428571 | 3.3125 | 6.428571 | 7 | 6.6 | 6.1 | 5.818182 | 6.039216 |
| 2017 | 3.205882 | 4.555556 | 3.488372 | 3.333333 | 5 | 3.75 | 5 | 4.764706 | 4.940299 |
| 2018 | 3.12 | 3.833333 | 3.258065 | 6 | 4 | 5 | 5.244444 | 4.230769 | 5.017241 |
| 2019 | 3.791667 | 4.428571 | 3.935484 | 4.8 | 6 | 5.142857 | 5.708333 | 6 | 5.766667 |
| 2020 | 3.363636 | 4.5 | 3.607143 | 3.5 | 6 | 4.636364 | 4.5625 | 4.2 | 4.5 |
| 2021 | 4.352941 | 4 | 4.272727 | 6.25 | 6.142857 | 6.181818 | 6.292683 | 6 | 6.226415 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **SD** |  |  |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 0.738549 | 0.738549 |
| 1990 |  |  |  |  | 3.05505 | 3.05505 |  | 2.025975 | 2.025975 |
| 1991 |  | 1.414214 | 1.414214 |  | 0.5 | 0.5 |  | 1.154701 | 1.154701 |
| 1992 | 1.290994 | 0.707107 | 1.166667 |  | 2 | 2 |  | 2.16685 | 2.16685 |
| 1993 | 1.527525 | 2.645751 | 2.136976 | 0.894427 | 0.95119 | 0.900337 |  | 1.264911 | 1.264911 |
| 1994 | 0.707107 | 0.707107 | 0.57735 | 1.527525 | 0.707107 | 1.224745 |  | 1.37032 | 1.37032 |
| 1995 | 1.732051 | 1.581139 | 1.563472 |  | 2.44949 | 2.33809 |  | 2.015095 | 2.015095 |
| 1996 | 0.957427 |  | 0.83666 |  | 2.629956 | 2.629956 | 1.38639 | 1.031553 | 1.266903 |
| 1997 | 1.516575 | 1.527525 | 1.536591 | 2.387467 | 1.669046 | 2.145359 | 1.998461 | 1.054093 | 1.824207 |
| 1998 | 1 | 2.217356 | 1.846812 |  | 0.57735 | 0.57735 | 1.595097 | 1.840894 | 1.676689 |
| 1999 | 1.290994 | 1.140175 | 1.193416 | 2.261479 | 1.618347 | 2.040711 | 1.818987 | 1.502135 | 1.718892 |
| 2000 | 2.645751 | 1.516575 | 1.832251 | 1.215739 | 1 | 1.150362 | 1.825742 | 1.488417 | 1.733528 |
| 2001 | 2.167948 | 1.752549 | 1.853617 | 1.894899 | 1.3484 | 1.807074 | 1.792389 | 1.757975 | 1.783095 |
| 2002 | 1.825742 | 1.266647 | 1.352799 | 1.557851 | 2.065224 | 1.745039 | 1.773629 | 1.277636 | 1.640195 |
| 2003 | 1.636392 | 1.380131 | 1.693413 | 1.8246 | 0.899735 | 1.590486 | 1.435806 | 0.534522 | 1.470755 |
| 2004 | 1.214986 | 0.983192 | 1.265924 | 1.435933 | 0.866025 | 1.299425 | 1.398104 | 1.888368 | 1.503633 |
| 2005 | 1.927248 | 0 | 1.897367 | 1.802776 | 2.949576 | 2.005825 | 1.837231 | 1.502379 | 1.824228 |
| 2006 | 2.872281 | 0.894427 | 2.061553 | 1.509231 | 0.894427 | 1.279881 | 1.903943 | 1.943651 | 1.909678 |
| 2007 | 1.643168 | 3.21455 | 2.14735 | 0.866025 | 1.46385 | 1.204159 | 2.308964 | 0.983192 | 2.281898 |
| 2008 | 1.166667 | 3.49285 | 2.169975 | 1.968153 | 2.058663 | 1.946915 | 2.114441 | 1.366619 | 1.949702 |
| 2009 | 1.788854 | 2.081666 | 1.846812 | 1.154701 | 0 | 0.894427 | 1.316011 | 1.69124 | 1.481183 |
| 2010 | 0.57735 | 2.915476 | 2.531939 | 2.204793 | 0.83666 | 1.905746 | 1.749619 | 1.549193 | 1.682532 |
| 2011 | 2.13809 | 3.40343 | 2.493628 | 1.264911 | 1.032796 | 1.20049 | 1.417768 | 1.22741 | 1.366007 |
| 2012 | 2.09788 | 2.228602 | 2.198085 | 1.702939 | 0.5 | 1.437336 | 1.381429 | 1.651262 | 1.453386 |
| 2013 | 1.623688 | 1.936492 | 1.73617 | 2.040499 | 1.618347 | 1.840894 | 2.657224 | 1.6267 | 2.44263 |
| 2014 | 2.018687 | 2.17377 | 2.092099 | 2.058663 | 2.699206 | 2.307418 | 1.748389 | 2.498185 | 2.009959 |
| 2015 | 2.194135 | 2.070197 | 2.152771 | 1.069045 | 1.732051 | 1.206045 | 1.987057 | 1.820931 | 1.946206 |
| 2016 | 1.641476 | 1.98806 | 1.74045 | 0.786796 | 1 | 0.843274 | 1.918867 | 2.358736 | 1.999608 |
| 2017 | 2.15715 | 1.666667 | 2.119884 | 1.505545 | 1.414214 | 1.581139 | 1.829464 | 1.953504 | 1.849493 |
| 2018 | 1.985783 | 2.483277 | 2.06507 | 0 | 1.732051 | 1.549193 | 1.978929 | 2.047513 | 2.021736 |
| 2019 | 2.08471 | 1.133893 | 1.913731 | 3.271085 | 0 | 2.734262 | 1.890157 | 1.044466 | 1.750222 |
| 2020 | 1.7333 | 2.345208 | 1.892271 | 2.738613 | 1 | 2.419617 | 2.296216 | 2.936362 | 2.393339 |
| 2021 | 1.902011 | 2.12132 | 1.906925 | 0.957427 | 0.690066 | 0.750757 | 0.813754 | 1.477098 | 0.993082 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Supplement to: |  |  |  |  |  |  |  |  |
| Authors: Eugen Belskii, Andrey Lyakhov |  |  |  |  |  |  |
| Title: Improved breeding parameters in the pied flycatcher with reduced pollutant emissions from a copper smelter |
|  |  |  |  |  |  |  |  |  |  |
| Pollution source: Middle Ural copper smelter (Revda, Sverdlovsk region of Russia, 56°51'N, 59°53'E) |
| Zone: 1 - impact (heavy pollution); 2 - buffer (moderate pollution); 3 - background (control unpolluted) |
| Habitat: 1 - deciduous (aspen/birch) forest; 2 - coniferous (spruce/fir) forest  |  |  |
| Breeding parameters of the pied flycatcher Ficedula hypoleuca |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Frequency of nests with unhatched eggs (0 = all eggs in a clutch hatched vs. 1 = at least one egg did not hatch)** |
| **Total number of nests** |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 12 | 12 |
| 1990 |  |  |  |  | 3 | 3 |  | 20 | 20 |
| 1991 |  | 4 | 4 |  | 4 | 4 |  | 29 | 29 |
| 1992 | 7 | 2 | 9 |  | 5 | 5 |  | 11 | 11 |
| 1993 | 3 | 3 | 6 | 5 | 6 | 11 |  | 19 | 19 |
| 1994 | 2 |  | 2 | 3 | 2 | 5 |  | 7 | 7 |
| 1995 | 4 | 3 | 7 |  | 5 | 5 |  | 12 | 12 |
| 1996 | 4 | 1 | 5 |  | 4 | 4 | 23 | 13 | 36 |
| 1997 | 6 | 4 | 10 | 5 | 8 | 13 | 30 | 16 | 46 |
| 1998 | 4 | 4 | 8 |  | 3 | 3 | 29 | 19 | 48 |
| 1999 | 6 | 4 | 10 | 17 | 5 | 22 | 32 | 13 | 45 |
| 2000 | 3 | 5 | 8 | 14 | 11 | 25 | 37 | 25 | 62 |
| 2001 | 5 | 8 | 13 | 19 | 10 | 29 | 39 | 21 | 60 |
| 2002 | 5 | 14 | 19 | 19 | 12 | 31 | 43 | 18 | 61 |
| 2003 | 10 | 7 | 17 | 17 | 7 | 24 | 41 | 8 | 49 |
| 2004 | 7 | 6 | 13 | 21 | 10 | 31 | 59 | 14 | 73 |
| 2005 | 8 | 2 | 10 | 19 | 5 | 24 | 95 | 15 | 110 |
| 2006 | 4 | 5 | 9 | 17 | 6 | 23 | 84 | 20 | 104 |
| 2007 | 6 | 3 | 9 | 13 | 9 | 22 | 47 | 7 | 54 |
| 2008 | 9 | 5 | 14 | 16 | 4 | 20 | 48 | 16 | 64 |
| 2009 | 5 | 3 | 8 | 6 | 4 | 10 | 23 | 18 | 41 |
| 2010 | 3 | 5 | 8 | 8 | 5 | 13 | 36 | 15 | 51 |
| 2011 | 7 | 4 | 11 | 11 | 5 | 16 | 55 | 19 | 74 |
| 2012 | 14 | 6 | 20 | 11 | 6 | 17 | 67 | 25 | 92 |
| 2013 | 14 | 10 | 24 | 12 | 7 | 19 | 74 | 28 | 102 |
| 2014 | 23 | 14 | 37 | 7 | 7 | 14 | 88 | 34 | 122 |
| 2015 | 23 | 15 | 38 | 8 | 3 | 11 | 82 | 20 | 102 |
| 2016 | 16 | 12 | 28 | 7 | 3 | 10 | 53 | 18 | 71 |
| 2017 | 34 | 7 | 41 | 6 | 2 | 8 | 57 | 17 | 74 |
| 2018 | 25 | 7 | 32 | 3 | 3 | 6 | 47 | 13 | 60 |
| 2019 | 24 | 7 | 31 | 5 | 2 | 7 | 51 | 12 | 63 |
| 2020 | 22 | 6 | 28 | 6 | 5 | 11 | 50 | 7 | 57 |
| 2021 | 17 | 5 | 22 | 4 | 7 | 11 | 39 | 12 | 51 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Number of nests with unhatched eggs** |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 3 | 3 |
| 1990 |  |  |  |  | 1 | 1 |  | 11 | 11 |
| 1991 |  | 2 | 2 |  | 3 | 3 |  | 8 | 8 |
| 1992 | 6 | 1 | 7 |  | 5 | 5 |  | 7 | 7 |
| 1993 | 3 | 2 | 5 | 1 | 2 | 3 |  | 6 | 6 |
| 1994 | 2 |  | 2 | 0 | 0 | 0 |  | 3 | 3 |
| 1995 | 2 | 2 | 4 |  | 3 | 3 |  | 5 | 5 |
| 1996 | 3 | 1 | 4 |  | 2 | 2 | 11 | 5 | 16 |
| 1997 | 4 | 2 | 6 | 1 | 3 | 4 | 11 | 6 | 17 |
| 1998 | 4 | 1 | 5 |  | 2 | 2 | 5 | 3 | 8 |
| 1999 | 4 | 2 | 6 | 7 | 2 | 9 | 9 | 6 | 15 |
| 2000 | 2 | 3 | 5 | 5 | 3 | 8 | 15 | 6 | 21 |
| 2001 | 3 | 7 | 10 | 7 | 7 | 14 | 16 | 7 | 23 |
| 2002 | 3 | 13 | 16 | 13 | 8 | 21 | 22 | 6 | 28 |
| 2003 | 8 | 5 | 13 | 6 | 3 | 9 | 15 | 1 | 16 |
| 2004 | 6 | 5 | 11 | 10 | 2 | 12 | 12 | 5 | 17 |
| 2005 | 6 | 1 | 7 | 11 | 0 | 11 | 27 | 2 | 29 |
| 2006 | 4 | 4 | 8 | 7 | 1 | 8 | 25 | 5 | 30 |
| 2007 | 3 | 2 | 5 | 7 | 3 | 10 | 20 | 3 | 23 |
| 2008 | 7 | 4 | 11 | 4 | 0 | 4 | 16 | 9 | 25 |
| 2009 | 3 | 1 | 4 | 2 | 1 | 3 | 11 | 6 | 17 |
| 2010 | 3 | 3 | 6 | 4 | 1 | 5 | 17 | 6 | 23 |
| 2011 | 6 | 1 | 7 | 6 | 2 | 8 | 22 | 9 | 31 |
| 2012 | 9 | 2 | 11 | 7 | 1 | 8 | 21 | 8 | 29 |
| 2013 | 6 | 7 | 13 | 1 | 2 | 3 | 17 | 10 | 27 |
| 2014 | 10 | 10 | 20 | 1 | 1 | 2 | 16 | 12 | 28 |
| 2015 | 14 | 6 | 20 | 2 | 0 | 2 | 22 | 8 | 30 |
| 2016 | 11 | 6 | 17 | 1 | 1 | 2 | 16 | 3 | 19 |
| 2017 | 23 | 4 | 27 | 5 | 1 | 6 | 15 | 8 | 23 |
| 2018 | 21 | 4 | 25 | 1 | 2 | 3 | 21 | 5 | 26 |
| 2019 | 16 | 2 | 18 | 2 | 0 | 2 | 25 | 3 | 28 |
| 2020 | 16 | 3 | 19 | 1 | 1 | 2 | 14 | 1 | 15 |
| 2021 | 10 | 2 | 12 | 1 | 2 | 3 | 8 | 3 | 11 |

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| Supplement to: |  |  |  |  |  |  |  |  |
| Authors: Eugen Belskii, Andrey Lyakhov |  |  |  |  |  |  |
| Title: Improved breeding parameters in the pied flycatcher with reduced pollutant emissions from a copper smelter |
|  |  |  |  |  |  |  |  |  |  |
| Pollution source: Middle Ural copper smelter (Revda, Sverdlovsk region of Russia, 56°51'N, 59°53'E) |
| Zone: 1 - impact (heavy pollution); 2 - buffer (moderate pollution); 3 - background (control unpolluted) |
| Habitat: 1 - deciduous (aspen/birch) forest; 2 - coniferous (spruce/fir) forest  |  |  |
| Breeding parameters of the pied flycatcher Ficedula hypoleuca |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Frequency of nests with perished chicks (0 = all chicks in a brood survived until fledging vs. 1 = at least one nestling died)**  |
| **Total number of nests** |  |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 12 | 12 |
| 1990 |  |  |  |  |  |  |  | 18 | 18 |
| 1991 |  | 4 | 4 |  | 4 | 4 |  | 25 | 25 |
| 1992 | 6 | 2 | 8 |  | 3 | 3 |  | 11 | 11 |
| 1993 | 2 | 3 | 5 | 5 | 6 | 11 |  | 15 | 15 |
| 1994 | 2 | 1 | 3 | 4 | 2 | 6 |  | 7 | 7 |
| 1995 | 4 | 3 | 7 |  | 3 | 3 |  | 11 | 11 |
| 1996 | 4 | 1 | 5 |  | 4 | 4 | 23 | 13 | 36 |
| 1997 | 6 | 2 | 8 | 5 | 8 | 13 | 27 | 9 | 36 |
| 1998 | 4 | 4 | 8 |  | 3 | 3 | 27 | 18 | 45 |
| 1999 | 6 | 4 | 10 | 14 | 5 | 19 | 31 | 11 | 42 |
| 2000 | 3 | 4 | 7 | 14 | 11 | 25 | 36 | 25 | 61 |
| 2001 | 5 | 7 | 12 | 19 | 9 | 28 | 38 | 20 | 58 |
| 2002 | 4 | 11 | 15 | 19 | 11 | 30 | 41 | 16 | 57 |
| 2003 | 8 | 7 | 15 | 16 | 7 | 23 | 40 | 8 | 48 |
| 2004 | 5 | 6 | 11 | 21 | 9 | 30 | 50 | 13 | 63 |
| 2005 | 5 | 2 | 7 | 18 | 5 | 23 | 91 | 15 | 106 |
| 2006 | 4 | 3 | 7 | 9 | 6 | 15 | 77 | 20 | 97 |
| 2007 | 6 | 3 | 9 | 8 | 7 | 15 | 44 | 6 | 50 |
| 2008 | 7 | 5 | 12 | 12 | 3 | 15 | 46 | 16 | 62 |
| 2009 | 5 | 3 | 8 | 4 | 2 | 6 | 21 | 17 | 38 |
| 2010 | 3 | 4 | 7 | 7 | 5 | 12 | 36 | 15 | 51 |
| 2011 | 6 | 3 | 9 | 10 | 5 | 15 | 54 | 18 | 72 |
| 2012 | 13 | 6 | 19 | 9 | 4 | 13 | 62 | 24 | 86 |
| 2013 | 12 | 8 | 20 | 11 | 7 | 18 | 72 | 26 | 98 |
| 2014 | 22 | 13 | 35 | 7 | 6 | 13 | 85 | 32 | 117 |
| 2015 | 22 | 15 | 37 | 8 | 3 | 11 | 76 | 19 | 95 |
| 2016 | 15 | 11 | 26 | 7 | 3 | 10 | 52 | 18 | 70 |
| 2017 | 29 | 7 | 36 | 6 | 2 | 8 | 50 | 17 | 67 |
| 2018 | 22 | 6 | 28 | 3 | 3 | 6 | 43 | 10 | 53 |
| 2019 | 21 | 7 | 28 | 5 | 2 | 7 | 45 | 12 | 57 |
| 2020 | 22 | 6 | 28 | 6 | 5 | 11 | 47 | 8 | 55 |
| 2021 | 17 | 5 | 22 | 4 | 7 | 11 | 39 | 12 | 51 |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| **Number of nests with perished chicks** |  |  |  |  |  |  |
| Zone | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| Habitat | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined | 1 | 2 | 1+2 combined |
| Year |  |  |  |  |  |  |  |  |  |
| 1989 |  |  |  |  |  |  |  | 2 | 2 |
| 1990 |  |  |  |  |  |  |  | 2 | 2 |
| 1991 |  | 4 | 4 |  | 1 | 1 |  | 10 | 10 |
| 1992 | 0 | 1 | 1 |  | 0 | 0 |  | 3 | 3 |
| 1993 | 0 | 2 | 2 | 1 | 1 | 2 |  | 3 | 3 |
| 1994 | 0 | 0 | 0 | 2 | 0 | 2 |  | 2 | 2 |
| 1995 | 0 | 2 | 2 |  | 0 | 0 |  | 2 | 2 |
| 1996 | 0 | 0 | 0 |  | 0 | 0 | 1 | 2 | 3 |
| 1997 | 1 | 0 | 1 | 2 | 1 | 3 | 3 | 0 | 3 |
| 1998 | 0 | 1 | 1 |  | 0 | 0 | 7 | 5 | 12 |
| 1999 | 1 | 3 | 4 | 5 | 3 | 8 | 7 | 3 | 10 |
| 2000 | 1 | 2 | 3 | 4 | 1 | 5 | 6 | 4 | 10 |
| 2001 | 0 | 3 | 3 | 2 | 3 | 5 | 11 | 5 | 16 |
| 2002 | 1 | 2 | 3 | 1 | 0 | 1 | 6 | 3 | 9 |
| 2003 | 2 | 3 | 5 | 4 | 2 | 6 | 4 | 0 | 4 |
| 2004 | 3 | 1 | 4 | 1 | 2 | 3 | 10 | 2 | 12 |
| 2005 | 0 | 1 | 1 | 3 | 2 | 5 | 23 | 2 | 25 |
| 2006 | 2 | 2 | 4 | 1 | 2 | 3 | 16 | 2 | 18 |
| 2007 | 3 | 1 | 4 | 1 | 2 | 3 | 18 | 0 | 18 |
| 2008 | 3 | 3 | 6 | 3 | 0 | 3 | 17 | 2 | 19 |
| 2009 | 1 | 2 | 3 | 0 | 0 | 0 | 5 | 1 | 6 |
| 2010 | 1 | 0 | 1 | 3 | 2 | 5 | 8 | 3 | 11 |
| 2011 | 0 | 1 | 1 | 3 | 0 | 3 | 9 | 0 | 9 |
| 2012 | 3 | 0 | 3 | 1 | 2 | 3 | 5 | 4 | 9 |
| 2013 | 2 | 1 | 3 | 5 | 4 | 9 | 24 | 5 | 29 |
| 2014 | 10 | 7 | 17 | 3 | 2 | 5 | 24 | 12 | 36 |
| 2015 | 12 | 8 | 20 | 3 | 1 | 4 | 29 | 6 | 35 |
| 2016 | 0 | 0 | 0 | 2 | 0 | 2 | 8 | 3 | 11 |
| 2017 | 7 | 2 | 9 | 3 | 1 | 4 | 22 | 4 | 26 |
| 2018 | 5 | 2 | 7 | 1 | 2 | 3 | 12 | 3 | 15 |
| 2019 | 1 | 5 | 6 | 2 | 1 | 3 | 10 | 2 | 12 |
| 2020 | 11 | 3 | 14 | 3 | 1 | 4 | 19 | 4 | 23 |
| 2021 | 4 | 0 | 4 | 0 | 1 | 1 | 4 | 3 | 7 |