

Table S1. Raw data including general information on the subjects, acoustic and X-ray measurements. A- First series; B- Second series; C- Third series; D- Fourth series.

S1A-

| Individual | General information |        |            |             | Acoustic analysis |          | X-ray measurements       |                  |                  | Quality assessment |       |      |
|------------|---------------------|--------|------------|-------------|-------------------|----------|--------------------------|------------------|------------------|--------------------|-------|------|
|            | Sex                 | Series | Age (days) | Weight (Kg) | Formant1          | Formant2 | Skull (Prosthion-Basion) | Nasal tract (mm) | Vocal tract (mm) | Skull              | Nasal | Oral |
| Baldur     | Male                | 1      | 10         | 1.66        | 664.13            | 1758.26  | 83.646                   | 118.407          | 85.450           | 1                  | 1     | 1    |
| Barbarossa | Male                | 1      | 10         | 2.08        | 678.93            | 1674.67  | 70.370                   | 103.969          | 75.661           | 1                  | 2     | 2    |
| Belana     | Female              | 1      | 10         | 2.17        | 691.50            | 1848.78  | 87.075                   | 126.535          | 98.720           | 1                  | 1     | 1    |
| Bernadette | Female              | 1      | 10         | 2.21        | 712.28            | 1551.88  | 83.790                   | 113.029          | 87.138           | 1                  | 1     | 2    |
| Blossom    | Female              | 1      | 10         | 2.25        | 748.02            | 1673.72  | 69.322                   | 105.853          | 80.934           | 1                  | 2     | 1    |
| Bolero     | Male                | 1      | 10         | 2.145       | 668.20            | 1791.82  | 83.309                   | 116.864          | 89.742           | 1                  | 1     | 1    |
| Bruno      | Male                | 1      | 10         | 2.39        | 605.67            | 1422.14  | 88.168                   | 127.514          | 99.057           | 1                  | 1     | 1    |
| Zafran     | Male                | 1      | 10         | 2.37        | 797.26            | 1896.05  | 84.752                   | 122.310          | 92.816           | 1                  | 2     | 2    |
| Zardož     | Male                | 1      | 10         | 1.93        | 701.00            | 1775.36  | 80.920                   | 118.665          | 89.612           | 1                  | 2     | 2    |
| Zeppelin   | Male                | 1      | 10         | 2.4         | 790.74            | 2019.54  | 71.725                   | 101.736          | 74.171           | 1                  | 2     | 2    |
| Zeus       | Male                | 1      | 10         | 2.015       |                   |          | 84.767                   | 128.892          | 94.219           | 1                  | 1     | 2    |
| Zirbe      | Female              | 1      | 10         | 1.69        | 670.68            | 1606.16  | 78.266                   | 113.658          | 88.911           | 1                  | 2     | 1    |
| Zita       | Female              | 1      | 10         | 1.18        | 869.05            | 1897.06  | 72.303                   | 100.085          | 74.344           | 1                  | 2     | 1    |
| Zoltan     | Male                | 1      | 10         | 1.7         |                   |          | 83.518                   | 115.299          | 89.242           | 1                  | 2     | 1    |
| Radischen  | Female              | 1      | 8          | 1.413       | 819.39            | 1512.40  | 80.051                   | 111.853          | 84.004           | 1                  | 2     | 1    |
| Radomir    | Male                | 1      | 8          | 1.445       | 806.21            | 1613.57  | 81.159                   | 111.600          | 78.969           | 1                  | 2     | 1    |
| Raya       | Female              | 1      | 8          | 1.69        | 799.02            | 1940.02  | 80.327                   | 113.472          | 88.876           | 1                  | 2     | 1    |
| Ronon      | Male                | 1      | 8          | 1.21        |                   |          | 72.139                   | 103.986          | 73.246           | 1                  | 2     | 2    |
| Rosine     | Female              | 1      | 8          | 1.23        | 727.74            | 1848.02  | 71.444                   | 99.234           | 76.170           | 1                  | 1     | 1    |
| Rubina     | Female              | 1      | 8          | 1.42        | 833.53            | 1749.00  | 81.080                   | 113.958          | 86.511           | 1                  | 3     | 2    |

S1B-

| Individual | General information |        |            |             | Acoustic analysis |          | X-ray measurements       |                  |                  | Quality assessment |       |      |
|------------|---------------------|--------|------------|-------------|-------------------|----------|--------------------------|------------------|------------------|--------------------|-------|------|
|            | Sex                 | Series | Age (days) | Weight (Kg) | Formant1          | Formant2 | Skull (Prosthion-Basion) | Nasal tract (mm) | Vocal tract (mm) | Skull              | Nasal | Oral |
| Baldur     | Male                | 2      | 44         | 4.58        | 560.96            | 1486.08  | 91.435                   | 148.730          | 113.324          | 1                  | 3     | 2    |
| Barbarossa | Male                | 2      | 44         | 5.79        | 556.34            | 1381.19  | 98.059                   | 137.683          | 111.972          | 1                  | 1     | 1    |
| Belana     | Female              | 2      | 44         | 5.64        | 555.17            | 1447.78  | 92.622                   | 128.234          | 106.202          | 1                  | 2     | 1    |
| Bernadette | Female              | 2      | 44         | 6.35        | 566.69            | 1303.74  |                          |                  |                  |                    |       |      |
| Blossom    | Female              | 2      | 44         | 6.49        | 553.56            | 1378.20  |                          |                  |                  |                    |       |      |
| Bolero     | Male                | 2      | 44         | 7.03        | 503.05            | 1321.98  |                          |                  |                  |                    |       |      |
| Bruno      | Male                | 2      | 44         | 7.62        | 510.18            | 1340.08  |                          |                  |                  |                    |       |      |
| Zafran     | Male                | 2      | 44         | 6.88        | 521.85            | 1375.07  | 102.712                  | 134.194          | 115.952          | 2                  | 3     | 2    |
| Zardož     | Male                | 2      | 44         | 5.59        | 555.23            | 1481.89  | 98.692                   | 130.438          | 108.513          | 1                  | 2     | 1    |
| Zeppelin   | Male                | 2      | 44         | 6.07        | 551.17            | 1290.92  | 107.662                  | 139.401          | 119.893          | 1                  | 1     | 1    |
| Zeus       | Male                | 2      | 44         | 6.32        | 557.55            | 1347.55  |                          |                  |                  |                    |       |      |
| Zirbe      | Female              | 2      | 44         | 4.44        | 609.48            | 1494.06  |                          |                  |                  |                    |       |      |
| Zita       | Female              | 2      | 44         | 4.75        | 650.02            | 1426.11  | 83.325                   | 138.541          | 108.679          | 2                  | 3     | 3    |
| Zoltan     | Male                | 2      | 44         | 4.73        | 569.06            | 1542.14  |                          |                  |                  |                    |       |      |
| Radischen  | Female              | 2      | 42         | 5.94        | 626.76            | 1484.93  |                          |                  |                  |                    |       |      |
| Radomir    | Male                | 2      | 42         | 6.89        | 531.56            | 1257.17  |                          |                  |                  |                    |       |      |
| Raya       | Female              | 2      | 42         | 6.83        | 542.62            | 1397.85  |                          |                  |                  |                    |       |      |
| Ronon      | Male                | 2      | 42         | 6.03        | 614.86            | 1432.39  | 109.204                  | 145.293          | 121.290          | 1                  | 2     | 1    |
| Rosine     | Female              | 2      | 42         | 5.73        | 530.36            | 1399.55  | 98.896                   | 135.883          | 105.523          | 1                  | 1     | 2    |
| Rubina     | Female              | 2      | 42         | 5.87        | 621.42            | 1471.98  | 98.228                   | 133.135          | 107.981          | 1                  | 2     | 1    |

S1C-

| Individual | General information |        |            |             | Acoustic analysis |          | X-ray measurements       |                  |                  | Quality assessment |       |      |
|------------|---------------------|--------|------------|-------------|-------------------|----------|--------------------------|------------------|------------------|--------------------|-------|------|
|            | Sex                 | Series | Age (days) | Weight (Kg) | Formant1          | Formant2 | Skull (Prosthion-Basion) | Nasal tract (mm) | Vocal tract (mm) | Skull              | Nasal | Oral |
| Baldur     | Male                | 3      | 73         | 6.1         | 494.42            | 1289.94  |                          |                  |                  |                    |       |      |
| Barbarossa | Male                | 3      | 73         | 9           | 536.76            | 1106.86  |                          |                  |                  |                    |       |      |
| Belana     | Female              | 3      | 73         | 9.1         | 490.24            | 1207.15  |                          |                  |                  |                    |       |      |
| Bernadette | Female              | 3      | 73         | 9.9         | 493.73            | 1153.83  | 109.183                  | 147.655          | 115.642          | 1                  | 1     | 2    |
| Blossom    | Female              | 3      | 73         | 9.9         | 548.48            | 1198.46  | 110.630                  | 157.838          | 116.943          | 1                  | 2     | 2    |
| Bolero     | Male                | 3      | 73         | 10.9        | 482.02            | 1162.49  | 122.682                  | 171.397          | 137.686          | 3                  | 3     | 3    |
| Bruno      | Male                | 3      | 73         | 12.3        | 457.79            | 1208.22  | 122.216                  | 173.353          | 129.544          | 1                  | 2     | 2    |
| Zafran     | Male                | 3      | 73         | 10.5        | 454.94            | 1188.22  |                          |                  |                  |                    |       |      |
| Zardoz     | Male                | 3      | 73         | 8.3         | 493.64            | 1285.93  |                          |                  |                  |                    |       |      |
| Zeppelin   | Male                | 3      | 73         | 9.7         | 467.72            | 1117.74  |                          |                  |                  |                    |       |      |
| Zeus       | Male                | 3      | 73         | 10.9        | 480.74            | 1077.87  | 111.333                  | 163.997          | 133.015          | 1                  | 2     | 1    |
| Zirbe      | Female              | 3      | 73         | 6.5         | 532.97            | 1304.85  | 98.162                   | 138.069          | 119.632          | 1                  | 3     | 2    |
| Zita       | Female              | 3      | 73         | 7           | 524.78            | 1305.11  |                          |                  |                  |                    |       |      |
| Zoltan     | Male                | 3      | 73         | 7.9         | 493.51            | 1306.05  | 108.382                  | 150.513          | 130.552          | 1                  | 1     | 1    |
| Radischen  | Female              | 3      | 71         | 9.4         | 532.11            | 1266.10  | 116.832                  | 164.515          | 134.877          | 1                  | 2     | 1    |
| Radomir    | Male                | 3      | 71         | 12.6        | 443.96            | 1094.49  | 118.680                  | 161.182          | 135.940          | 1                  | 1     | 1    |
| Raya       | Female              | 3      | 71         | 10.1        | 441.40            | 1224.28  | 116.096                  | 155.489          | 133.885          | 1                  | 2     | 1    |
| Ronon      | Male                | 3      | 71         | 10.4        | 517.49            | 1247.94  |                          |                  |                  |                    |       |      |
| Rosine     | Female              | 3      | 71         | 9.8         | 457.27            | 1159.31  |                          |                  |                  |                    |       |      |
| Rubina     | Female              | 3      | 71         | 9.1         | 525.61            | 1204.32  |                          |                  |                  |                    |       |      |

S1D-

| Individual | General information |        |            |             | Acoustic analysis |          | X-ray measurements       |                  |                  | Quality assessment |       |      |
|------------|---------------------|--------|------------|-------------|-------------------|----------|--------------------------|------------------|------------------|--------------------|-------|------|
|            | Sex                 | Series | Age (days) | Weight (Kg) | Formant1          | Formant2 | Skull (Prosthion-Basion) | Nasal tract (mm) | Vocal tract (mm) | Skull              | Nasal | Oral |
| Baldur     | Male                | 4      | 131        | 11.4        | 408.56            | 1052.32  | 125.728                  | 171.480          | 150.461          | 1                  | 1     | 1    |
| Barbarossa | Male                | 4      | 131        | 14.1        | 392.93            | 942.50   | 133.951                  | 181.848          | 157.785          | 1                  | 2     | 2    |
| Belana     | Female              | 4      | 131        | 14.4        | 425.60            | 934.07   | 130.850                  | 181.462          | 157.357          | 1                  | 1     | 1    |
| Bernadette | Female              | 4      | 131        | 15.3        | 392.02            | 986.49   | 122.974                  | 176.080          | 142.707          | 2                  | 3     | 3    |
| Blossom    | Female              | 4      | 131        | 14.5        | 400.89            | 998.46   | 139.894                  | 188.397          | 159.600          | 1                  | 1     | 1    |
| Bolero     | Male                | 4      | 131        | 16.8        | 404.59            | 894.81   | 143.516                  | 193.793          | 164.872          | 1                  | 1     | 1    |
| Bruno      | Male                | 4      | 131        | 19.2        | 360.94            | 878.60   | 144.303                  | 205.770          | 172.869          | 1                  | 2     | 2    |
| Zafran     | Male                | 4      | 131        | 16.2        | 366.00            | 931.81   | 120.092                  | 171.646          | 142.473          | 3                  | 3     | 3    |
| Zardož     | Male                | 4      | 131        | 12.6        | 433.10            | 1016.43  | 134.348                  | 171.495          | 154.420          | 1                  | 1     | 1    |
| Zeppelin   | Male                | 4      | 131        | 15.3        | 371.46            | 890.85   | 142.507                  | 186.494          | 163.508          | 1                  | 1     | 1    |
| Zeus       | Male                | 4      | 131        | 17.8        | 360.02            | 891.22   | 151.286                  | 206.186          | 168.956          | 1                  | 2     | 2    |
| Zirbe      | Female              | 4      | 131        | 10.6        | 454.78            | 1016.59  | 112.709                  | 163.600          | 145.414          | 2                  | 1     | 1    |
| Zita       | Female              | 4      | 131        | 10.6        | 387.59            | 1017.10  | 104.430                  | 141.312          | 117.729          | 2                  | 3     | 3    |
| Zoltan     | Male                | 4      | 131        | 12.5        | 379.46            | 1032.51  | 124.723                  | 180.392          | 151.988          | 1                  | 1     | 1    |
| Radischen  | Female              | 4      | 129        | 14.6        | 406.22            | 969.82   | 141.477                  | 189.400          | 164.369          | 1                  | 1     | 1    |
| Radomir    | Male                | 4      | 129        | 18.7        | 345.89            | 833.80   | 146.427                  | 188.054          | 172.062          | 1                  | 2     | 1    |
| Raya       | Female              | 4      | 129        | 14.5        | 340.73            | 858.49   | 129.170                  | 169.083          | 148.241          | 1                  | 1     | 1    |
| Ronon      | Male                | 4      | 129        | 15.3        | 384.00            | 949.79   | 134.231                  | 184.834          | 162.115          | 1                  | 2     | 1    |
| Rosine     | Female              | 4      | 129        | 14.6        | 399.55            | 896.01   | 134.539                  | 180.046          | 161.344          | 1                  | 2     | 2    |
| Rubina     | Female              | 4      | 129        | 14.4        | 414.67            | 993.89   | 119.579                  | 172.965          | 146.201          | 2                  | 3     | 1    |

Table S2. Detailed composition of the initial models used in the analyses conducted on anatomical correlations, anatomical-acoustical correlations and acoustic allometry.

| <b>Analysis</b>                  | <b>Type</b> | <b>Predicted variable</b> | <b>Fixed effect</b>                     | <b>Random effect</b> | <b>Effect for which random slope is created</b> |
|----------------------------------|-------------|---------------------------|---|----------------------|---|
| Anatomical dependence            | LMM         | Vocal Tract Length (VTL)  | Weight (Log Wt) + Sex + Litter          | Individual + Series  | Weight (Log Wt)                                 |
| Anatomical-acoustical dependence | LMM         | Formant frequencies (Fn)  | Vocal tract length (VTL) + Sex + Litter | Individual + Series  | Vocal Tract Length (VTL)                        |
| Acoustic allometry               | LMM         | Formant frequencies (Fn)  | Weight (Log Wt) + Sex + Litter          | Individual + Series  | Weight (Log Wt)                                 |

Table S3. Difference between expected vocal tract length (based on first formant value) and measured (both corrected and non-corrected) nasal and oral tract length. A – First series; B – Second and third series; C – Fourth series.

S3A-

| Series | Individual  | F1 (Hz)       | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|--------|-------------|---------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 1      | Baldur      | 664.13        | 131.752                          | 118.407                          | 128.057                                    | 85.450                          | 93.722                                    | 13.345                           | 10.13                           | 3.695                                     | 2.80                                     | 46.302                          | 35.14                          | 38.030                                   | 28.87                                   |
| 1      | Barbarossa  | 678.93        | 128.880                          | 103.969                          | 112.442                                    | 75.661                          | 82.985                                    | 24.911                           | 19.33                           | 16.437                                    | 12.75                                    | 53.219                          | 41.29                          | 45.895                                   | 35.61                                   |
| 1      | Belana      | 691.50        | 126.537                          | 126.535                          | 136.848                                    | 98.720                          | 108.276                                   | 0.002                            | < 0.01                          | -10.311                                   | -8.15                                    | 27.817                          | 21.98                          | 18.261                                   | 14.43                                   |
| 1      | Bernadette  | 712.28        | 122.846                          | 113.029                          | 122.241                                    | 87.138                          | 95.573                                    | 9.817                            | 7.99                            | 0.605                                     | 0.49                                     | 35.708                          | 29.07                          | 27.273                                   | 22.20                                   |
| 1      | Blossom     | 748.02        | 116.975                          | 105.853                          | 114.480                                    | 80.934                          | 88.768                                    | 11.122                           | 9.51                            | 2.495                                     | 2.13                                     | 36.041                          | 30.81                          | 28.207                                   | 24.11                                   |
| 1      | Bolero      | 668.20        | 130.948                          | 116.864                          | 126.388                                    | 89.742                          | 98.429                                    | 14.084                           | 10.76                           | 4.560                                     | 3.48                                     | 41.206                          | 31.47                          | 32.519                                   | 24.83                                   |
| 1      | Bruno       | 605.67        | 144.468                          | 127.514                          | 137.906                                    | 99.057                          | 108.646                                   | 16.954                           | 11.74                           | 6.562                                     | 4.54                                     | 45.411                          | 31.43                          | 35.822                                   | 24.80                                   |
| 1      | Zafran      | 797.26        | 109.751                          | 122.310                          | 132.278                                    | 92.816                          | 101.801                                   | -12.559                          | -11.44                          | -22.528                                   | -20.53                                   | 16.935                          | 15.43                          | 7.950                                    | 7.24                                    |
| 1      | Zardož      | 701.00        | 124.822                          | 118.665                          | 128.336                                    | 89.612                          | 98.286                                    | 6.157                            | 4.93                            | -3.514                                    | -2.82                                    | 35.210                          | 28.21                          | 26.536                                   | 21.26                                   |
| 1      | Zeppelin    | 790.74        | 110.656                          | 101.736                          | 110.027                                    | 74.171                          | 81.351                                    | 8.920                            | 8.06                            | 0.629                                     | 0.57                                     | 36.485                          | 32.97                          | 29.306                                   | 26.48                                   |
| 1      | Zeus        |               |                                  | 128.892                          | 139.397                                    | 94.219                          | 103.339                                   |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Zirbe       | 670.68        | 130.465                          | 113.658                          | 122.921                                    | 88.911                          | 97.518                                    | 16.807                           | 12.88                           | 7.544                                     | 5.78                                     | 41.554                          | 31.85                          | 32.947                                   | 25.25                                   |
| 1      | Zita        | 869.05        | 100.685                          | 100.085                          | 108.242                                    | 74.344                          | 81.540                                    | 0.600                            | 0.60                            | -7.557                                    | -7.51                                    | 26.341                          | 26.16                          | 19.145                                   | 19.01                                   |
| 1      | Zoltan      |               |                                  | 115.299                          | 124.696                                    | 89.242                          | 97.881                                    |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Radischen   | 819.39        | 106.787                          | 111.853                          | 120.969                                    | 84.004                          | 92.136                                    | -5.066                           | -4.74                           | -14.182                                   | -13.28                                   | 22.783                          | 21.34                          | 14.652                                   | 13.72                                   |
| 1      | Radomir     | 806.21        | 108.532                          | 111.600                          | 120.695                                    | 78.969                          | 86.613                                    | -3.068                           | -2.83                           | -12.163                                   | -11.21                                   | 29.563                          | 27.24                          | 21.919                                   | 20.20                                   |
| 1      | Raya        | 799.02        | 109.509                          | 113.472                          | 122.720                                    | 88.876                          | 97.479                                    | -3.963                           | -3.62                           | -13.211                                   | -12.06                                   | 20.633                          | 18.84                          | 12.030                                   | 10.99                                   |
| 1      | Ronon       |               |                                  | 103.986                          | 112.461                                    | 73.246                          | 80.336                                    |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Rosine      | 727.74        | 120.236                          | 99.234                           | 107.322                                    | 76.170                          | 83.543                                    | 21.002                           | 17.47                           | 12.914                                    | 10.74                                    | 44.066                          | 36.65                          | 36.693                                   | 30.52                                   |
| 1      | Rubina      | 833.53        | 104.975                          | 113.958                          | 123.246                                    | 86.511                          | 94.885                                    | -8.983                           | -8.56                           | -18.271                                   | -17.40                                   | 18.464                          | 17.59                          | 10.090                                   | 9.61                                    |
|        | <b>Mean</b> | <b>740.20</b> | <b>119.343</b>                   | <b>113.346</b>                   | <b>122.584</b>                             | <b>85.390</b>                   | <b>93.655</b>                             | <b>6.475</b>                     | <b>5.14</b>                     | <b>-2.723</b>                             | <b>-2.92</b>                             | <b>33.985</b>                   | <b>28.09</b>                   | <b>25.722</b>                            | <b>21.13</b>                            |
|        | <b>SD</b>   | <b>74.07</b>  | <b>12.063</b>                    | <b>8.927</b>                     | <b>9.655</b>                               | <b>8.000</b>                    | <b>8.775</b>                              | <b>10.961</b>                    | <b>9.20</b>                     | <b>11.161</b>                             | <b>9.73</b>                              | <b>10.693</b>                   | <b>7.11</b>                    | <b>10.854</b>                            | <b>7.80</b>                             |
|        | <b>Min</b>  | <b>605.67</b> | <b>100.685</b>                   | <b>99.234</b>                    | <b>107.322</b>                             | <b>73.246</b>                   | <b>80.336</b>                             | <b>-12.559</b>                   | <b>-11.44</b>                   | <b>-22.528</b>                            | <b>-20.53</b>                            | <b>16.935</b>                   | <b>15.43</b>                   | <b>7.950</b>                             | <b>7.24</b>                             |
|        | <b>Max</b>  | <b>869.05</b> | <b>144.468</b>                   | <b>128.892</b>                   | <b>139.397</b>                             | <b>99.057</b>                   | <b>108.646</b>                            | <b>24.911</b>                    | <b>19.33</b>                    | <b>16.437</b>                             | <b>12.75</b>                             | <b>53.219</b>                   | <b>41.29</b>                   | <b>45.895</b>                            | <b>35.61</b>                            |

S3B-

| Series | Individual  | F1 (Hz)       | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|--------|-------------|---------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 2      | Baldur      | 560.96        | 155.982                          | 148.730                          | 160.851                                    | 113.324                         | 124.294                                   | 7.252                            | 4.65                            | -4.869                                    | -3.12                                    | 42.658                          | 27.35                          | 31.688                                   | 20.32                                   |
| 2      | Barbarossa  | 556.34        | 157.279                          | 137.683                          | 148.904                                    | 111.972                         | 122.811                                   | 19.596                           | 12.46                           | 8.375                                     | 5.32                                     | 45.307                          | 28.81                          | 34.468                                   | 21.92                                   |
| 2      | Belana      | 555.17        | 157.608                          | 128.234                          | 138.685                                    | 106.202                         | 116.482                                   | 29.374                           | 18.64                           | 18.923                                    | 12.01                                    | 51.406                          | 32.62                          | 41.126                                   | 26.09                                   |
| 2      | Zafran      | 521.85        | 167.672                          | 134.194                          | 145.131                                    | 115.952                         | 127.176                                   | 33.478                           | 19.97                           | 22.541                                    | 13.44                                    | 51.720                          | 30.85                          | 40.495                                   | 24.15                                   |
| 2      | Zardož      | 555.23        | 157.593                          | 130.438                          | 141.069                                    | 108.513                         | 119.017                                   | 27.155                           | 17.23                           | 16.525                                    | 10.49                                    | 49.080                          | 31.14                          | 38.576                                   | 24.48                                   |
| 2      | Zeppelin    | 551.17        | 158.753                          | 139.401                          | 150.762                                    | 119.893                         | 131.499                                   | 19.352                           | 12.19                           | 7.991                                     | 5.03                                     | 38.860                          | 24.48                          | 27.254                                   | 17.17                                   |
| 2      | Zita        | 650.02        | 134.612                          | 138.541                          | 149.832                                    | 108.679                         | 119.199                                   | -3.929                           | -2.92                           | -15.220                                   | -11.31                                   | 25.933                          | 19.27                          | 15.413                                   | 11.45                                   |
| 2      | Ronon       | 614.86        | 142.308                          | 145.293                          | 157.134                                    | 121.290                         | 133.031                                   | -2.985                           | -2.10                           | -14.827                                   | -10.42                                   | 21.018                          | 14.77                          | 9.277                                    | 6.52                                    |
| 2      | Rosine      | 530.36        | 164.981                          | 135.883                          | 146.957                                    | 105.523                         | 115.738                                   | 29.098                           | 17.64                           | 18.023                                    | 10.92                                    | 59.458                          | 36.04                          | 49.243                                   | 29.85                                   |
| 2      | Rubina      | 621.42        | 140.807                          | 133.135                          | 143.986                                    | 107.981                         | 118.434                                   | 7.672                            | 5.45                            | -3.179                                    | -2.26                                    | 32.826                          | 23.31                          | 22.373                                   | 15.89                                   |
|        | <b>Mean</b> | <b>571.74</b> | <b>153.759</b>                   | <b>137.153</b>                   | <b>148.331</b>                             | <b>111.933</b>                  | <b>122.768</b>                            | <b>16.606</b>                    | <b>10.32</b>                    | <b>5.428</b>                              | <b>3.01</b>                              | <b>41.827</b>                   | <b>26.86</b>                   | <b>30.991</b>                            | <b>19.78</b>                            |
|        | <b>SD</b>   | <b>42.14</b>  | <b>10.836</b>                    | <b>6.313</b>                     | <b>6.828</b>                               | <b>5.586</b>                    | <b>6.127</b>                              | <b>13.761</b>                    | <b>8.54</b>                     | <b>14.098</b>                             | <b>9.24</b>                              | <b>12.208</b>                   | <b>6.48</b>                    | <b>12.466</b>                            | <b>7.11</b>                             |
|        | <b>Min</b>  | <b>521.85</b> | <b>134.612</b>                   | <b>128.234</b>                   | <b>138.685</b>                             | <b>105.523</b>                  | <b>115.738</b>                            | <b>-3.929</b>                    | <b>-2.92</b>                    | <b>-15.220</b>                            | <b>-11.31</b>                            | <b>21.018</b>                   | <b>14.77</b>                   | <b>9.277</b>                             | <b>6.52</b>                             |
|        | <b>Max</b>  | <b>650.02</b> | <b>167.672</b>                   | <b>148.730</b>                   | <b>160.851</b>                             | <b>121.290</b>                  | <b>133.031</b>                            | <b>33.478</b>                    | <b>19.97</b>                    | <b>22.541</b>                             | <b>13.44</b>                             | <b>59.458</b>                   | <b>36.04</b>                   | <b>49.243</b>                            | <b>29.85</b>                            |
| 3      | Bernadette  | 493.73        | 177.223                          | 147.655                          | 159.689                                    | 115.642                         | 126.836                                   | 29.568                           | 16.68                           | 17.534                                    | 9.89                                     | 61.581                          | 34.75                          | 50.387                                   | 28.43                                   |
| 3      | Blossom     | 548.48        | 159.532                          | 157.838                          | 170.702                                    | 116.943                         | 128.263                                   | 1.694                            | 1.06                            | -11.170                                   | -7.00                                    | 42.589                          | 26.70                          | 31.269                                   | 19.60                                   |
| 3      | Bolero      | 482.02        | 181.528                          | 171.397                          | 185.366                                    | 137.686                         | 151.014                                   | 10.131                           | 5.58                            | -3.838                                    | -2.11                                    | 43.842                          | 24.15                          | 30.514                                   | 16.81                                   |
| 3      | Bruno       | 457.79        | 191.135                          | 173.353                          | 187.481                                    | 129.544                         | 142.084                                   | 17.782                           | 9.30                            | 3.654                                     | 1.91                                     | 61.591                          | 32.22                          | 49.051                                   | 25.66                                   |
| 3      | Zeus        | 480.74        | 182.010                          | 163.997                          | 177.363                                    | 133.015                         | 145.891                                   | 18.013                           | 9.90                            | 4.647                                     | 2.55                                     | 48.995                          | 26.92                          | 36.119                                   | 19.84                                   |
| 3      | Zirbe       | 532.97        | 164.174                          | 138.069                          | 149.322                                    | 119.632                         | 131.212                                   | 26.105                           | 15.90                           | 14.853                                    | 9.05                                     | 44.542                          | 27.13                          | 32.962                                   | 20.08                                   |
| 3      | Zoltan      | 493.51        | 177.301                          | 150.513                          | 162.780                                    | 130.552                         | 143.189                                   | 26.788                           | 15.11                           | 14.521                                    | 8.19                                     | 46.749                          | 26.37                          | 34.112                                   | 19.24                                   |
| 3      | Radischen   | 532.11        | 164.439                          | 164.515                          | 177.923                                    | 134.877                         | 147.933                                   | -0.076                           | -0.05                           | -13.484                                   | -8.20                                    | 29.562                          | 17.98                          | 16.506                                   | 10.04                                   |
| 3      | Radomir     | 443.96        | 197.091                          | 161.182                          | 174.318                                    | 135.940                         | 149.099                                   | 35.909                           | 18.22                           | 22.772                                    | 11.55                                    | 61.151                          | 31.03                          | 47.992                                   | 24.35                                   |
| 3      | Raya        | 441.40        | 198.234                          | 155.489                          | 168.161                                    | 133.885                         | 146.845                                   | 42.745                           | 21.56                           | 30.073                                    | 15.17                                    | 64.349                          | 32.46                          | 51.389                                   | 25.92                                   |
|        | <b>Mean</b> | <b>490.67</b> | <b>179.267</b>                   | <b>158.401</b>                   | <b>171.310</b>                             | <b>128.772</b>                  | <b>141.237</b>                            | <b>20.866</b>                    | <b>11.33</b>                    | <b>7.956</b>                              | <b>4.10</b>                              | <b>50.495</b>                   | <b>27.97</b>                   | <b>38.030</b>                            | <b>21.00</b>                            |
|        | <b>SD</b>   | <b>37.61</b>  | <b>13.647</b>                    | <b>10.897</b>                    | <b>11.785</b>                              | <b>8.245</b>                    | <b>9.044</b>                              | <b>14.072</b>                    | <b>7.38</b>                     | <b>14.473</b>                             | <b>7.98</b>                              | <b>11.295</b>                   | <b>4.88</b>                    | <b>11.363</b>                            | <b>5.35</b>                             |
|        | <b>Min</b>  | <b>441.40</b> | <b>159.532</b>                   | <b>138.069</b>                   | <b>149.322</b>                             | <b>115.642</b>                  | <b>126.836</b>                            | <b>-0.076</b>                    | <b>-0.05</b>                    | <b>-13.484</b>                            | <b>-8.20</b>                             | <b>29.562</b>                   | <b>17.98</b>                   | <b>16.506</b>                            | <b>10.04</b>                            |
|        | <b>Max</b>  | <b>548.48</b> | <b>198.234</b>                   | <b>173.353</b>                   | <b>187.481</b>                             | <b>137.686</b>                  | <b>151.014</b>                            | <b>42.745</b>                    | <b>21.56</b>                    | <b>30.073</b>                             | <b>15.17</b>                             | <b>64.349</b>                   | <b>34.75</b>                   | <b>51.389</b>                            | <b>28.43</b>                            |

S3C-

| Series            | Individual  | F1 (Hz)       | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|-------------------|-------------|---------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 4                 | Baldur      | 408.56        | 214.167                          | 171.480                          | 185.456                                    | 150.461                         | 165.026                                   | 42.687                           | 19.93                           | 28.712                                    | 13.41                                    | 63.706                          | 29.75                          | 49.142                                   | 22.95                                   |
| 4                 | Barbarossa  | 392.93        | 222.688                          | 181.848                          | 196.669                                    | 157.785                         | 173.059                                   | 40.840                           | 18.34                           | 26.019                                    | 11.68                                    | 64.903                          | 29.15                          | 49.629                                   | 22.29                                   |
| 4                 | Belana      | 425.60        | 205.590                          | 181.462                          | 196.251                                    | 157.357                         | 172.589                                   | 24.128                           | 11.74                           | 9.339                                     | 4.54                                     | 48.233                          | 23.46                          | 33.001                                   | 16.05                                   |
| 4                 | Bernadette  | 392.02        | 223.204                          | 176.080                          | 190.431                                    | 142.707                         | 156.521                                   | 47.124                           | 21.11                           | 32.773                                    | 14.68                                    | 80.497                          | 36.06                          | 66.683                                   | 29.88                                   |
| 4                 | Blossom     | 400.89        | 218.266                          | 188.397                          | 203.751                                    | 159.600                         | 175.049                                   | 29.869                           | 13.68                           | 14.515                                    | 6.65                                     | 58.666                          | 26.88                          | 43.217                                   | 19.80                                   |
| 4                 | Bolero      | 404.59        | 216.270                          | 193.793                          | 209.587                                    | 164.872                         | 180.832                                   | 22.477                           | 10.39                           | 6.682                                     | 3.09                                     | 51.398                          | 23.77                          | 35.438                                   | 16.39                                   |
| 4                 | Bruno       | 360.94        | 242.426                          | 205.770                          | 222.540                                    | 172.869                         | 189.603                                   | 36.656                           | 15.12                           | 19.885                                    | 8.20                                     | 69.557                          | 28.69                          | 52.823                                   | 21.79                                   |
| 4                 | Zafran      | 366.00        | 239.073                          | 171.646                          | 185.635                                    | 142.473                         | 156.264                                   | 67.427                           | 28.20                           | 53.438                                    | 22.35                                    | 96.600                          | 40.41                          | 82.809                                   | 34.64                                   |
| 4                 | Zardo       | 433.10        | 202.030                          | 171.495                          | 185.472                                    | 154.420                         | 169.368                                   | 30.535                           | 15.11                           | 16.558                                    | 8.20                                     | 47.610                          | 23.57                          | 32.662                                   | 16.17                                   |
| 4                 | Zeppelin    | 371.46        | 235.557                          | 186.494                          | 201.693                                    | 163.508                         | 179.336                                   | 49.063                           | 20.83                           | 33.863                                    | 14.38                                    | 72.049                          | 30.59                          | 56.221                                   | 23.87                                   |
| 4                 | Zeus        | 360.02        | 243.043                          | 206.186                          | 222.990                                    | 168.956                         | 185.311                                   | 36.857                           | 15.16                           | 20.053                                    | 8.25                                     | 74.087                          | 30.48                          | 57.732                                   | 23.75                                   |
| 4                 | Zirbe       | 454.78        | 192.402                          | 163.600                          | 176.933                                    | 145.414                         | 159.490                                   | 28.802                           | 14.97                           | 15.468                                    | 8.04                                     | 46.988                          | 24.42                          | 32.911                                   | 17.11                                   |
| 4                 | Zita        | 387.59        | 225.757                          | 141.312                          | 152.829                                    | 117.729                         | 129.125                                   | 84.445                           | 37.41                           | 72.928                                    | 32.30                                    | 108.028                         | 47.85                          | 96.631                                   | 42.80                                   |
| 4                 | Zoltan      | 379.46        | 230.593                          | 180.392                          | 195.094                                    | 151.988                         | 166.700                                   | 50.201                           | 21.77                           | 35.499                                    | 15.39                                    | 78.605                          | 34.09                          | 63.892                                   | 27.71                                   |
| 4                 | Radischen   | 406.22        | 215.402                          | 189.400                          | 204.836                                    | 164.369                         | 180.280                                   | 26.002                           | 12.07                           | 10.566                                    | 4.91                                     | 51.033                          | 23.69                          | 35.122                                   | 16.31                                   |
| 4                 | Radomir     | 345.89        | 252.967                          | 188.054                          | 203.380                                    | 172.062                         | 188.718                                   | 64.913                           | 25.66                           | 49.587                                    | 19.60                                    | 80.905                          | 31.98                          | 64.250                                   | 25.40                                   |
| 4                 | Raya        | 340.73        | 256.801                          | 169.083                          | 182.863                                    | 148.241                         | 162.591                                   | 87.718                           | 34.16                           | 73.938                                    | 28.79                                    | 108.560                         | 42.27                          | 94.210                                   | 36.69                                   |
| 4                 | Ronon       | 384.00        | 227.867                          | 184.834                          | 199.898                                    | 162.115                         | 177.808                                   | 43.033                           | 18.89                           | 27.969                                    | 12.27                                    | 65.752                          | 28.86                          | 50.060                                   | 21.97                                   |
| 4                 | Rosine      | 399.55        | 218.994                          | 180.046                          | 194.720                                    | 161.344                         | 176.962                                   | 38.948                           | 17.78                           | 24.274                                    | 11.08                                    | 57.650                          | 26.32                          | 42.032                                   | 19.19                                   |
| 4                 | Rubina      | 414.67        | 211.009                          | 172.965                          | 187.062                                    | 146.201                         | 160.353                                   | 38.044                           | 18.03                           | 23.948                                    | 11.35                                    | 64.808                          | 30.71                          | 50.656                                   | 24.01                                   |
|                   | <b>Mean</b> | <b>391.45</b> | <b>224.705</b>                   | <b>180.217</b>                   | <b>194.905</b>                             | <b>155.224</b>                  | <b>170.249</b>                            | <b>44.488</b>                    | <b>19.52</b>                    | <b>29.801</b>                             | <b>12.96</b>                             | <b>69.482</b>                   | <b>30.65</b>                   | <b>54.456</b>                            | <b>23.94</b>                            |
|                   | <b>SD</b>   | <b>29.13</b>  | <b>16.716</b>                    | <b>14.507</b>                    | <b>15.689</b>                              | <b>12.834</b>                   | <b>14.076</b>                             | <b>18.602</b>                    | <b>7.17</b>                     | <b>19.236</b>                             | <b>7.75</b>                              | <b>18.583</b>                   | <b>6.68</b>                    | <b>19.215</b>                            | <b>7.33</b>                             |
|                   | <b>Min</b>  | <b>340.73</b> | <b>192.402</b>                   | <b>141.312</b>                   | <b>152.829</b>                             | <b>117.729</b>                  | <b>129.125</b>                            | <b>22.477</b>                    | <b>10.39</b>                    | <b>6.682</b>                              | <b>3.09</b>                              | <b>46.988</b>                   | <b>23.46</b>                   | <b>32.662</b>                            | <b>16.05</b>                            |
|                   | <b>Max</b>  | <b>454.78</b> | <b>256.801</b>                   | <b>206.186</b>                   | <b>222.990</b>                             | <b>172.869</b>                  | <b>189.603</b>                            | <b>87.718</b>                    | <b>37.41</b>                    | <b>73.938</b>                             | <b>32.30</b>                             | <b>108.560</b>                  | <b>47.85</b>                   | <b>96.631</b>                            | <b>42.80</b>                            |
|                   | <b>Mean</b> | <b>544.50</b> | <b>172.863</b>                   | <b>147.113</b>                   | <b>159.103</b>                             | <b>120.322</b>                  | <b>131.969</b>                            | <b>24.115</b>                    | <b>12.30</b>                    | <b>11.992</b>                             | <b>4.92</b>                              | <b>50.712</b>                   | <b>28.75</b>                   | <b>38.888</b>                            | <b>21.85</b>                            |
| <b>All series</b> | <b>SD</b>   | <b>151.69</b> | <b>45.685</b>                    | <b>30.233</b>                    | <b>32.697</b>                              | <b>30.649</b>                   | <b>33.616</b>                             | <b>21.648</b>                    | <b>9.82</b>                     | <b>20.404</b>                             | <b>10.67</b>                             | <b>20.474</b>                   | <b>6.51</b>                    | <b>18.844</b>                            | <b>7.14</b>                             |
|                   | <b>Min</b>  | <b>340.73</b> | <b>100.685</b>                   | <b>99.234</b>                    | <b>107.322</b>                             | <b>73.246</b>                   | <b>80.336</b>                             | <b>-12.559</b>                   | <b>-11.44</b>                   | <b>-22.528</b>                            | <b>-20.53</b>                            | <b>16.935</b>                   | <b>14.77</b>                   | <b>7.950</b>                             | <b>6.52</b>                             |
|                   | <b>Max</b>  | <b>869.05</b> | <b>256.801</b>                   | <b>206.186</b>                   | <b>222.990</b>                             | <b>172.869</b>                  | <b>189.603</b>                            | <b>87.718</b>                    | <b>37.41</b>                    | <b>73.938</b>                             | <b>32.30</b>                             | <b>108.560</b>                  | <b>47.85</b>                   | <b>96.631</b>                            | <b>42.80</b>                            |



Table S4. Difference between expected vocal tract length (based on second formant value) and measured (both corrected and non-corrected) nasal and oral tract length. A – First series; B – Second and third series; C – Fourth series.

S4A-

| Series | Individual  | F2 (Hz)        | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|--------|-------------|----------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 1      | Baldur      | 1758.26        | 149.295                          | 118.407                          | 128.057                                    | 85.450                          | 93.722                                    | 30.888                           | 20.69                           | 21.238                                    | 14.23                                    | 63.845                          | 42.76                          | 55.574                                   | 37.22                                   |
| 1      | Barbarossa  | 1674.67        | 156.747                          | 103.969                          | 112.442                                    | 75.661                          | 82.985                                    | 52.778                           | 33.67                           | 44.305                                    | 28.27                                    | 81.086                          | 51.73                          | 73.762                                   | 47.06                                   |
| 1      | Belana      | 1848.78        | 141.986                          | 126.535                          | 136.848                                    | 98.720                          | 108.276                                   | 15.451                           | 10.88                           | 5.138                                     | 3.62                                     | 43.266                          | 30.47                          | 33.710                                   | 23.74                                   |
| 1      | Bernadette  | 1551.88        | 169.149                          | 113.029                          | 122.241                                    | 87.138                          | 95.573                                    | 56.120                           | 33.18                           | 46.909                                    | 27.73                                    | 82.011                          | 48.48                          | 73.576                                   | 43.50                                   |
| 1      | Blossom     | 1673.72        | 156.836                          | 105.853                          | 114.480                                    | 80.934                          | 88.768                                    | 50.983                           | 32.51                           | 42.356                                    | 27.01                                    | 75.902                          | 48.40                          | 68.068                                   | 43.40                                   |
| 1      | Bolero      | 1791.82        | 146.499                          | 116.864                          | 126.388                                    | 89.742                          | 98.429                                    | 29.635                           | 20.23                           | 20.111                                    | 13.73                                    | 56.757                          | 38.74                          | 48.070                                   | 32.81                                   |
| 1      | Bruno       | 1422.14        | 184.581                          | 127.514                          | 137.906                                    | 99.057                          | 108.646                                   | 57.067                           | 30.92                           | 46.674                                    | 25.29                                    | 85.524                          | 46.33                          | 75.935                                   | 41.14                                   |
| 1      | Zafran      | 1896.05        | 138.446                          | 122.310                          | 132.278                                    | 92.816                          | 101.801                                   | 16.136                           | 11.66                           | 6.168                                     | 4.45                                     | 45.630                          | 32.96                          | 36.645                                   | 26.47                                   |
| 1      | Zardo       | 1775.36        | 147.857                          | 118.665                          | 128.336                                    | 89.612                          | 98.286                                    | 29.192                           | 19.74                           | 19.521                                    | 13.20                                    | 58.245                          | 39.39                          | 49.571                                   | 33.53                                   |
| 1      | Zeppelin    | 2019.54        | 129.980                          | 101.736                          | 110.027                                    | 74.171                          | 81.351                                    | 28.244                           | 21.73                           | 19.953                                    | 15.35                                    | 55.809                          | 42.94                          | 48.629                                   | 37.41                                   |
| 1      | Zeus        |                |                                  | 128.892                          | 139.397                                    | 94.219                          | 103.339                                   |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Zirbe       | 1606.16        | 163.433                          | 113.658                          | 122.921                                    | 88.911                          | 97.518                                    | 49.775                           | 30.46                           | 40.512                                    | 24.79                                    | 74.522                          | 45.60                          | 65.916                                   | 40.33                                   |
| 1      | Zita        | 1897.06        | 138.372                          | 100.085                          | 108.242                                    | 74.344                          | 81.540                                    | 38.287                           | 27.67                           | 30.130                                    | 21.77                                    | 64.028                          | 46.27                          | 56.832                                   | 41.07                                   |
| 1      | Zoltan      |                |                                  |                                  |  |                                 |   |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Radischen   | 1512.40        | 173.566                          | 111.853                          | 120.969                                    | 84.004                          | 92.136                                    | 61.713                           | 35.56                           | 52.597                                    | 30.30                                    | 89.562                          | 51.60                          | 81.430                                   | 46.92                                   |
| 1      | Radomir     | 1613.57        | 162.683                          | 111.600                          | 120.695                                    | 78.969                          | 86.613                                    | 51.083                           | 31.40                           | 41.988                                    | 25.81                                    | 83.714                          | 51.46                          | 76.070                                   | 46.76                                   |
| 1      | Raya        | 1940.02        | 135.308                          | 113.472                          | 122.720                                    | 88.876                          | 97.479                                    | 21.836                           | 16.14                           | 12.588                                    | 9.30                                     | 46.432                          | 34.32                          | 37.829                                   | 27.96                                   |
| 1      | Ronon       |                |                                  |                                  |  |                                 |   |                                  |                                 |   |  |                                 |                                |  |   |
| 1      | Rosine      | 1848.02        | 142.044                          | 99.234                           | 107.322                                    | 76.170                          | 83.543                                    | 42.810                           | 30.14                           | 34.722                                    | 24.44                                    | 65.874                          | 46.38                          | 58.501                                   | 41.18                                   |
| 1      | Rubina      | 1749.00        | 150.086                          | 113.958                          | 123.246                                    | 86.511                          | 94.885                                    | 36.128                           | 24.07                           | 26.841                                    | 17.88                                    | 63.575                          | 42.36                          | 55.201                                   | 36.78                                   |
|        | <b>Mean</b> | <b>1739.91</b> | <b>152.169</b>                   | <b>113.757</b>                   | <b>123.029</b>                             | <b>85.850</b>                   | <b>94.161</b>                             | <b>39.302</b>                    | <b>25.33</b>                    | <b>30.103</b>                             | <b>19.25</b>                             | <b>66.811</b>                   | <b>43.54</b>                   | <b>58.548</b>                            | <b>38.08</b>                            |
|        | <b>SD</b>   | <b>163.13</b>  | <b>14.794</b>                    | <b>9.138</b>                     | <b>9.883</b>                               | <b>7.859</b>                    | <b>8.620</b>                              | <b>14.769</b>                    | <b>7.84</b>                     | <b>14.985</b>                             | <b>8.48</b>                              | <b>14.731</b>                   | <b>6.52</b>                    | <b>14.943</b>                            | <b>7.15</b>                             |
|        | <b>Min</b>  | <b>1422.14</b> | <b>129.980</b>                   | <b>99.234</b>                    | <b>107.322</b>                             | <b>74.171</b>                   | <b>81.351</b>                             | <b>15.451</b>                    | <b>10.88</b>                    | <b>5.138</b>                              | <b>3.62</b>                              | <b>43.266</b>                   | <b>30.47</b>                   | <b>33.710</b>                            | <b>23.74</b>                            |
|        | <b>Max</b>  | <b>2019.54</b> | <b>184.581</b>                   | <b>128.892</b>                   | <b>139.397</b>                             | <b>99.057</b>                   | <b>108.646</b>                            | <b>61.713</b>                    | <b>35.56</b>                    | <b>52.597</b>                             | <b>30.30</b>                             | <b>89.562</b>                   | <b>51.73</b>                   | <b>81.430</b>                            | <b>47.06</b>                            |

S4B-

| Series      | Individual | F2 (Hz)        | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|-------------|------------|----------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 2           | Baldur     | 1486.08        | 176.639                          | 148.730                          | 160.851                                    | 113.324                         | 124.294                                   | 27.909                           | 15.80                           | 15.788                                    | 8.94                                     | 63.315                          | 35.84                          | 52.346                                   | 29.63                                   |
| 2           | Barbarossa | 1381.19        | 190.054                          | 137.683                          | 148.904                                    | 111.972                         | 122.811                                   | 52.371                           | 27.56                           | 41.150                                    | 21.65                                    | 78.082                          | 41.08                          | 67.243                                   | 35.38                                   |
| 2           | Belana     | 1447.78        | 181.313                          | 128.234                          | 138.685                                    | 106.202                         | 116.482                                   | 53.079                           | 29.27                           | 42.627                                    | 23.51                                    | 75.111                          | 41.43                          | 64.830                                   | 35.76                                   |
| 2           | Zafran     | 1375.07        | 190.899                          | 134.194                          | 145.131                                    | 115.952                         | 127.176                                   | 56.705                           | 29.70                           | 45.768                                    | 23.98                                    | 74.947                          | 39.26                          | 63.723                                   | 33.38                                   |
| 2           | Zardoz     | 1481.89        | 177.139                          | 130.438                          | 141.069                                    | 108.513                         | 119.017                                   | 46.701                           | 26.36                           | 36.070                                    | 20.36                                    | 68.626                          | 38.74                          | 58.122                                   | 32.81                                   |
| 2           | Zeppelin   | 1290.92        | 203.343                          | 139.401                          | 150.762                                    | 119.893                         | 131.499                                   | 63.942                           | 31.45                           | 52.581                                    | 25.86                                    | 83.450                          | 41.04                          | 71.844                                   | 35.33                                   |
| 2           | Zita       | 1426.11        | 184.067                          | 138.541                          | 149.832                                    | 108.679                         | 119.199                                   | 45.526                           | 24.73                           | 34.235                                    | 18.60                                    | 75.388                          | 40.96                          | 64.868                                   | 35.24                                   |
| 2           | Ronon      | 1432.39        | 183.260                          | 145.293                          | 157.134                                    | 121.290                         | 133.031                                   | 37.967                           | 20.72                           | 26.125                                    | 14.26                                    | 61.970                          | 33.82                          | 50.229                                   | 27.41                                   |
| 2           | Rosine     | 1399.55        | 187.560                          | 135.883                          | 146.957                                    | 105.523                         | 115.738                                   | 51.677                           | 27.55                           | 40.603                                    | 21.65                                    | 82.037                          | 43.74                          | 71.823                                   | 38.29                                   |
| 2           | Rubina     | 1471.98        | 178.331                          | 133.135                          | 143.986                                    | 107.981                         | 118.434                                   | 45.196                           | 25.34                           | 34.346                                    | 19.26                                    | 70.350                          | 39.45                          | 59.898                                   | 33.59                                   |
| <b>Mean</b> |            | <b>1419.30</b> | <b>185.260</b>                   | <b>137.153</b>                   | <b>148.331</b>                             | <b>111.933</b>                  | <b>122.768</b>                            | <b>48.107</b>                    | <b>25.85</b>                    | <b>36.929</b>                             | <b>19.81</b>                             | <b>73.328</b>                   | <b>39.54</b>                   | <b>62.492</b>                            | <b>33.68</b>                            |
| <b>SD</b>   |            | <b>60.06</b>   | <b>8.140</b>                     | <b>6.313</b>                     | <b>6.828</b>                               | <b>5.586</b>                    | <b>6.127</b>                              | <b>10.045</b>                    | <b>4.63</b>                     | <b>10.356</b>                             | <b>5.01</b>                              | <b>7.236</b>                    | <b>2.89</b>                    | <b>7.370</b>                             | <b>3.17</b>                             |
| <b>Min</b>  |            | <b>1290.92</b> | <b>176.639</b>                   | <b>128.234</b>                   | <b>138.685</b>                             | <b>105.523</b>                  | <b>115.738</b>                            | <b>27.909</b>                    | <b>15.80</b>                    | <b>15.788</b>                             | <b>8.94</b>                              | <b>61.970</b>                   | <b>33.82</b>                   | <b>50.229</b>                            | <b>27.41</b>                            |
| <b>Max</b>  |            | <b>1486.08</b> | <b>203.343</b>                   | <b>148.730</b>                   | <b>160.851</b>                             | <b>121.290</b>                  | <b>133.031</b>                            | <b>63.942</b>                    | <b>31.45</b>                    | <b>52.581</b>                             | <b>25.86</b>                             | <b>83.450</b>                   | <b>43.74</b>                   | <b>71.844</b>                            | <b>38.29</b>                            |
| 3           | Bernadette | 1153.83        | 227.504                          | 147.655                          | 159.689                                    | 115.642                         | 126.836                                   | 79.849                           | 35.10                           | 67.815                                    | 29.81                                    | 111.862                         | 49.17                          | 100.668                                  | 44.25                                   |
| 3           | Blossom    | 1198.46        | 219.030                          | 157.838                          | 170.702                                    | 116.943                         | 128.263                                   | 61.192                           | 27.94                           | 48.328                                    | 22.06                                    | 102.087                         | 46.61                          | 90.767                                   | 41.44                                   |
| 3           | Bolero     | 1162.49        | 225.809                          | 171.397                          | 185.366                                    | 137.686                         | 151.014                                   | 54.412                           | 24.10                           | 40.443                                    | 17.91                                    | 88.123                          | 39.03                          | 74.795                                   | 33.12                                   |
| 3           | Bruno      | 1208.22        | 217.261                          | 173.353                          | 187.481                                    | 129.544                         | 142.084                                   | 43.908                           | 20.21                           | 29.780                                    | 13.71                                    | 87.717                          | 40.37                          | 75.177                                   | 34.60                                   |
| 3           | Zeus       | 1077.87        | 243.536                          | 163.997                          | 177.363                                    | 133.015                         | 145.891                                   | 79.539                           | 32.66                           | 66.173                                    | 27.17                                    | 110.521                         | 45.38                          | 97.645                                   | 40.09                                   |
| 3           | Zirbe      | 1304.85        | 201.172                          | 138.069                          | 149.322                                    | 119.632                         | 131.212                                   | 63.103                           | 31.37                           | 51.851                                    | 25.77                                    | 81.540                          | 40.53                          | 69.960                                   | 34.78                                   |
| 3           | Zoltan     | 1306.05        | 200.988                          | 150.513                          | 162.780                                    | 130.552                         | 143.189                                   | 50.475                           | 25.11                           | 38.208                                    | 19.01                                    | 70.436                          | 35.04                          | 57.798                                   | 28.76                                   |
| 3           | Radischen  | 1266.10        | 207.330                          | 164.515                          | 177.923                                    | 134.877                         | 147.933                                   | 42.815                           | 20.65                           | 29.407                                    | 14.18                                    | 72.453                          | 34.95                          | 59.397                                   | 28.65                                   |
| 3           | Radomir    | 1094.49        | 239.838                          | 161.182                          | 174.318                                    | 135.940                         | 149.099                                   | 78.656                           | 32.80                           | 65.519                                    | 27.32                                    | 103.898                         | 43.32                          | 90.739                                   | 37.83                                   |
| 3           | Raya       | 1224.28        | 214.411                          | 155.489                          | 168.161                                    | 133.885                         | 146.845                                   | 58.922                           | 27.48                           | 46.250                                    | 21.57                                    | 80.526                          | 37.56                          | 67.566                                   | 31.51                                   |
| <b>Mean</b> |            | <b>1199.66</b> | <b>219.688</b>                   | <b>158.401</b>                   | <b>171.310</b>                             | <b>128.772</b>                  | <b>141.237</b>                            | <b>61.287</b>                    | <b>27.74</b>                    | <b>48.378</b>                             | <b>21.85</b>                             | <b>90.916</b>                   | <b>41.20</b>                   | <b>78.451</b>                            | <b>35.50</b>                            |
| <b>SD</b>   |            | <b>79.48</b>   | <b>14.730</b>                    | <b>10.897</b>                    | <b>11.785</b>                              | <b>8.245</b>                    | <b>9.044</b>                              | <b>14.125</b>                    | <b>5.21</b>                     | <b>14.442</b>                             | <b>5.63</b>                              | <b>15.241</b>                   | <b>4.84</b>                    | <b>15.524</b>                            | <b>5.31</b>                             |
| <b>Min</b>  |            | <b>1077.87</b> | <b>200.988</b>                   | <b>138.069</b>                   | <b>149.322</b>                             | <b>115.642</b>                  | <b>126.836</b>                            | <b>42.815</b>                    | <b>20.21</b>                    | <b>29.407</b>                             | <b>13.71</b>                             | <b>70.436</b>                   | <b>34.95</b>                   | <b>57.798</b>                            | <b>28.65</b>                            |
| <b>Max</b>  |            | <b>1306.05</b> | <b>243.536</b>                   | <b>173.353</b>                   | <b>187.481</b>                             | <b>137.686</b>                  | <b>151.014</b>                            | <b>79.849</b>                    | <b>35.10</b>                    | <b>67.815</b>                             | <b>29.81</b>                             | <b>111.862</b>                  | <b>49.17</b>                   | <b>100.668</b>                           | <b>44.25</b>                            |

S4C-

| Series | Individual  | F2 (Hz)        | Expected vocal tract length (mm) | Measured Nasal tract length (mm) | Corrected (+8.15%) Nasal tract length (mm) | Measured Oral tract length (mm) | Corrected (+9.68%) Oral tract length (mm) | Difference Nasal / Expected (mm) | Difference Nasal / Expected (%) | Difference Corrected Nasal/ Expected (mm) | Difference Corrected Nasal/ Expected (%) | Difference Oral / Expected (mm) | Difference Oral / Expected (%) | Difference Corrected Oral/ Expected (mm) | Difference Corrected Oral/ Expected (%) |
|--------|-------------|----------------|----------------------------------|----------------------------------|--|---------------------------------|---|----------------------------------|---------------------------------|---|--|---------------------------------|--------------------------------|--|---|
| 4      | Baldur      | 1052.32        | 249.450                          | 171.480                          | 185.456                                    | 150.461                         | 165.026                                   | 77.970                           | 31.26                           | 63.994                                    | 25.65                                    | 98.989                          | 39.68                          | 84.424                                   | 33.84                                   |
| 4      | Barbarossa  | 942.50         | 278.514                          | 181.848                          | 196.669                                    | 157.785                         | 173.059                                   | 96.666                           | 34.71                           | 81.846                                    | 29.39                                    | 120.729                         | 43.35                          | 105.456                                  | 37.86                                   |
| 4      | Belana      | 934.07         | 281.029                          | 181.462                          | 196.251                                    | 157.357                         | 172.589                                   | 99.567                           | 35.43                           | 84.778                                    | 30.17                                    | 123.672                         | 44.01                          | 108.440                                  | 38.59                                   |
| 4      | Bernadette  | 986.49         | 266.094                          | 176.080                          | 190.431                                    | 142.707                         | 156.521                                   | 90.014                           | 33.83                           | 75.663                                    | 28.43                                    | 123.387                         | 46.37                          | 109.573                                  | 41.18                                   |
| 4      | Blossom     | 998.46         | 262.904                          | 188.397                          | 203.751                                    | 159.600                         | 175.049                                   | 74.507                           | 28.34                           | 59.152                                    | 22.50                                    | 103.304                         | 39.29                          | 87.855                                   | 33.42                                   |
| 4      | Bolero      | 894.81         | 293.358                          | 193.793                          | 209.587                                    | 164.872                         | 180.832                                   | 99.565                           | 33.94                           | 83.771                                    | 28.56                                    | 128.486                         | 43.80                          | 112.526                                  | 38.36                                   |
| 4      | Bruno       | 878.60         | 298.771                          | 205.770                          | 222.540                                    | 172.869                         | 189.603                                   | 93.001                           | 31.13                           | 76.231                                    | 25.51                                    | 125.902                         | 42.14                          | 109.168                                  | 36.54                                   |
| 4      | Zafran      | 931.81         | 281.711                          | 171.646                          | 185.635                                    | 142.473                         | 156.264                                   | 110.065                          | 39.07                           | 96.075                                    | 34.10                                    | 139.238                         | 49.43                          | 125.446                                  | 44.53                                   |
| 4      | Zardo       | 1016.43        | 258.256                          | 171.495                          | 185.472                                    | 154.420                         | 169.368                                   | 86.761                           | 33.59                           | 72.784                                    | 28.18                                    | 103.836                         | 40.21                          | 88.888                                   | 34.42                                   |
| 4      | Zeppelin    | 890.85         | 294.662                          | 186.494                          | 201.693                                    | 163.508                         | 179.336                                   | 108.168                          | 36.71                           | 92.969                                    | 31.55                                    | 131.154                         | 44.51                          | 115.327                                  | 39.14                                   |
| 4      | Zeus        | 891.22         | 294.540                          | 206.186                          | 222.990                                    | 168.956                         | 185.311                                   | 88.354                           | 30.00                           | 71.549                                    | 24.29                                    | 125.584                         | 42.64                          | 109.229                                  | 37.08                                   |
| 4      | Zirbe       | 1016.59        | 258.215                          | 163.600                          | 176.933                                    | 145.414                         | 159.490                                   | 94.615                           | 36.64                           | 81.282                                    | 31.48                                    | 112.801                         | 43.68                          | 98.725                                   | 38.23                                   |
| 4      | Zita        | 1017.10        | 258.086                          | 141.312                          | 152.829                                    | 117.729                         | 129.125                                   | 116.774                          | 45.25                           | 105.257                                   | 40.78                                    | 140.357                         | 54.38                          | 128.960                                  | 49.97                                   |
| 4      | Zoltan      | 1032.51        | 254.234                          | 180.392                          | 195.094                                    | 151.988                         | 166.700                                   | 73.842                           | 29.04                           | 59.140                                    | 23.26                                    | 102.246                         | 40.22                          | 87.534                                   | 34.43                                   |
| 4      | Radischen   | 969.82         | 270.668                          | 189.400                          | 204.836                                    | 164.369                         | 180.280                                   | 81.268                           | 30.03                           | 65.832                                    | 24.32                                    | 106.299                         | 39.27                          | 90.388                                   | 33.39                                   |
| 4      | Radomir     | 833.80         | 314.825                          | 188.054                          | 203.380                                    | 172.062                         | 188.718                                   | 126.771                          | 40.27                           | 111.445                                   | 35.40                                    | 142.763                         | 45.35                          | 126.108                                  | 40.06                                   |
| 4      | Raya        | 858.49         | 305.771                          | 169.083                          | 182.863                                    | 148.241                         | 162.591                                   | 136.688                          | 44.70                           | 122.907                                   | 40.20                                    | 157.530                         | 51.52                          | 143.180                                  | 46.83                                   |
| 4      | Ronon       | 949.79         | 276.378                          | 184.834                          | 199.898                                    | 162.115                         | 177.808                                   | 91.544                           | 33.12                           | 76.480                                    | 27.67                                    | 114.263                         | 41.34                          | 98.570                                   | 35.67                                   |
| 4      | Rosine      | 896.01         | 292.966                          | 180.046                          | 194.720                                    | 161.344                         | 176.962                                   | 112.920                          | 38.54                           | 98.246                                    | 33.53                                    | 131.622                         | 44.93                          | 116.004                                  | 39.60                                   |
| 4      | Rubina      | 993.89         | 264.115                          | 172.965                          | 187.062                                    | 146.201                         | 160.353                                   | 91.150                           | 34.51                           | 77.053                                    | 29.17                                    | 117.914                         | 44.64                          | 103.761                                  | 39.29                                   |
|        | <b>Mean</b> | <b>949.28</b>  | <b>277.727</b>                   | <b>180.217</b>                   | <b>194.905</b>                             | <b>155.224</b>                  | <b>170.249</b>                            | <b>97.510</b>                    | <b>35.01</b>                    | <b>82.823</b>                             | <b>29.71</b>                             | <b>122.504</b>                  | <b>44.04</b>                   | <b>107.478</b>                           | <b>38.62</b>                            |
|        | <b>SD</b>   | <b>63.72</b>   | <b>18.874</b>                    | <b>14.507</b>                    | <b>15.689</b>                              | <b>12.834</b>                   | <b>14.076</b>                             | <b>16.820</b>                    | <b>4.75</b>                     | <b>17.190</b>                             | <b>5.14</b>                              | <b>15.530</b>                   | <b>4.02</b>                    | <b>15.733</b>                            | <b>4.41</b>                             |
|        | <b>Min</b>  | <b>833.80</b>  | <b>249.450</b>                   | <b>141.312</b>                   | <b>152.829</b>                             | <b>117.729</b>                  | <b>129.125</b>                            | <b>73.842</b>                    | <b>28.34</b>                    | <b>59.140</b>                             | <b>22.50</b>                             | <b>98.989</b>                   | <b>39.27</b>                   | <b>84.424</b>                            | <b>33.39</b>                            |
|        | <b>Max</b>  | <b>1052.32</b> | <b>314.825</b>                   | <b>206.186</b>                   | <b>222.990</b>                             | <b>172.869</b>                  | <b>189.603</b>                            | <b>136.688</b>                   | <b>45.25</b>                    | <b>122.907</b>                            | <b>40.78</b>                             | <b>157.530</b>                  | <b>54.38</b>                   | <b>143.180</b>                           | <b>49.97</b>                            |
|        | <b>Mean</b> | <b>1311.47</b> | <b>213.875</b>                   | <b>148.405</b>                   | <b>160.500</b>                             | <b>121.669</b>                  | <b>133.447</b>                            | <b>65.128</b>                    | <b>29.24</b>                    | <b>53.005</b>                             | <b>23.47</b>                             | <b>91.725</b>                   | <b>42.60</b>                   | <b>79.900</b>                            | <b>37.04</b>                            |
|        | <b>SD</b>   | <b>342.72</b>  | <b>54.710</b>                    | <b>29.900</b>                    | <b>32.337</b>                              | <b>30.244</b>                   | <b>33.171</b>                             | <b>28.947</b>                    | <b>7.21</b>                     | <b>27.238</b>                             | <b>7.80</b>                              | <b>27.873</b>                   | <b>5.08</b>                    | <b>25.686</b>                            | <b>5.57</b>                             |
|        | <b>Min</b>  | <b>833.80</b>  | <b>129.980</b>                   | <b>99.234</b>                    | <b>107.322</b>                             | <b>74.171</b>                   | <b>81.351</b>                             | <b>15.451</b>                    | <b>10.88</b>                    | <b>5.138</b>                              | <b>3.62</b>                              | <b>43.266</b>                   | <b>30.47</b>                   | <b>33.710</b>                            | <b>23.74</b>                            |
|        | <b>Max</b>  | <b>2019.54</b> | <b>314.825</b>                   | <b>206.186</b>                   | <b>222.990</b>                             | <b>172.869</b>                  | <b>189.603</b>                            | <b>136.688</b>                   | <b>45.25</b>                    | <b>122.907</b>                            | <b>40.78</b>                             | <b>157.530</b>                  | <b>54.38</b>                   | <b>143.180</b>                           | <b>49.97</b>                            |