

---

---

## Inter- and intra-annual frequency variations of large-whale calls in the southern Indian ocean.

---

---

### Reference

Leroy, E. C., Royer, J.-Y., Samaran, F. & Bonnel, J., 2017. Long-range impact of iceberg generated sounds on large-whale song frequency (submitted in Sept. 2017).

### File descriptions

=== [daily\\_average\\_frequency\\_Z-call.csv](#)

This file provides the daily average frequency of automatically detected Z-calls for all sites (except RAMA, no Z-calls are detected) and available years of the DEFOLOHYDRO (2007) and OHASISBIO (2010 to 2015) data sets. The call frequency is measured at the maximum of amplitude of the Z-call unit A (i.e. first tonal unit, near 27 Hz), with an accuracy of 0.035 Hz.

- Frequencies are given per day :
  - Columns 1 to 4 : year, julian day (since January 1st), month, week of year.
  - Columns 5 to 10: Z-call frequency (in Hz) averaged per day at, resp., MAD, SSEIR, NEAMS, NCRO, WKER and SWAMS sites.
- NaN indicate unavailable measurements due to data gaps or days without detections.

=== [weekly\\_average\\_frequency\\_MadagascarPBW\\_35Hzunit.csv](#)

This file provides the peak frequency of the ~35 Hz tonal unit of the Madagascan pygmy blue whale call type for each year (2007 and 2010 to 2015) and each site where the call type in found (i.e. MAD, SSEIR, NCRO, WKER, SWAMS). This frequency is extracted from daily averaged Power Spectral Density (PSD) in a frequency range bracketing the unit of interest (see table below), and calculated for each file over 300s-windows, 50% overlap and a frequency resolution of 0.01 Hz.

- For each recording file, the frequency value was kept only when the ratio between the signal power in the frequency range of interest and the mean noise-level in bracketing bandwidths (see table below) was above a certain threshold (1 dB for the Madagascan pygmy blue whale call type). The remaining values were then averaged per week.
  - Columns 1 to 2: year, week of year
  - Columns 3 to 7: weekly averaged frequency at MAD, SSEIR, NCRO, WKER, SWAMS
  - NaN indicate missing data or values below the given threshold.

=== [weekly\\_average\\_frequency\\_AustralianPBW\\_70Hzunit.csv](#)

This file provides the peak frequency of the ~70 Hz harmonic of the Australian pygmy blue whale call type for each year (2007 and 2010 to 2015) and each site where the call type in found (i.e. SSEIR and SWAMS). This value is extracted from daily averaged Power Spectral Density (PSD) in a frequency range bracketing the unit of interest (see table below), and calculated for each file over 300s-windows, 50% overlap and a frequency resolution of 0.01 Hz.

- For each recording file, the frequency value was kept only when the ratio between the signal power in the frequency range of interest and the mean noise level in bracketing bandwidths (see table below) was above a certain threshold (0.7 dB for the Australian pygmy blue whale call type). The remaining values were then averaged per week.
  - Columns 1 to 2: year, week of year
  - Columns 3 to 4: weekly averaged frequency at SSEIR, SWAMS
  - NaN indicate missing data or values below the given threshold.

### === [weekly\\_average\\_frequency\\_SriLankanPBW\\_105Hzunit.csv](#)

This file provides the peak frequency of the ~105 Hz tonal unit of the Sri Lankan pygmy blue whale call type for each year (2007 and 2010 to 2015) and each site where the call type in found (i.e. only NEAMS). Since the call type presence is weak, its frequency was extracted from weekly averaged PSD in a frequency range bracketing the unit of interest (see table below), and calculated over 300s-windows, 50% overlap and a frequency resolution of 0.01 Hz.

- For each recording file, the frequency value was kept only if the ratio between the signal power in the frequency range of interest and the noise level in a bandwidth above this range (see table below) was above a certain threshold (1.0 to 1.5 dB for the Sri Lanka pygmy blue whale call).
  - Columns 1 to 2: year, week of year
  - Column 3: weekly averaged frequency at NEAMS
  - NaN indicate missing data or values below the given threshold.

### === [weekly\\_average\\_frequency\\_finwhale\\_100Hzpulse.csv](#)

This file provides the peak frequency of the ~100 Hz-pulse of the fin whale for each year (2007 and 2010 to 2015) and each site where the call type in found (i.e. all sites : MAD, SSEIR, NEAMS, NCRO, WKER, SWAMS). This frequency is extracted from daily averaged Power Spectral Density (PSD) in a frequency range bracketing the unit of interest (see table below), and calculated for each file over 300s-windows, 50% overlap and a frequency resolution of 0.01 Hz.

- For each recording file, the frequency value was kept only when the ratio between the signal power in the frequency range of interest and the mean noise level in bracketing bandwidths (see table below) was above a certain threshold (0.6 dB for the fin whale call). The remaining values were then averaged per week.
  - Columns 1 to 2: year, week of year
  - Columns 3 to 8: weekly averaged frequency at MAD, SSEIR, NEAMS, NCRO, WKER, SWAMS
  - NaN indicate missing data or values below the given threshold.

### === [daily\\_average\\_ambient\\_noise\\_10to13Hz.csv](#)

This file provides the ambient noise-level (in dB re  $1\mu\text{Pa}^2/\text{Hz}$ ) in the 10-13 Hz bandwidth, estimated over 300s-windows in 0.0018 Hz-bins, averaged per julian day for each site and each year from 2010 to 2015 (OHASISBIO data set).

- Noise-levels are given per day:
  - Columns 1 to 4: year, julian day (since January 1st), month, week of year.
  - Columns 5 to 10: noise-levels averaged per day at, resp., MAD, SSEIR, NEAMS, NCRO, WKER and SWAMS sites.
- NaN indicate unavailable measurements due to data gaps.

Note that due to uncertainties in the hydrophone calibration in 2007 (DEFLOHYDRO data), the noise level was not computed for this year of data.

### === [daily\\_average\\_ambient\\_noise\\_30to33Hz.csv](#)

This file provides the ambient noise-level (in dB re  $1\mu\text{Pa}^2/\text{Hz}$ ) in the 30-33 Hz bandwidth, estimated over 300s-windows in 0.0018 Hz-bins, averaged per julian day for each site and each year from 2010 to 2015 (OHASISBIO data).

- Noise-levels are given per day:
  - Columns 1 to 4: year, julian day (since January 1st), month, week of year.
  - Columns 5 to 10: noise-levels averaged per day at, resp., MAD, SSEIR, NEAMS, NCRO, WKER and SWAMS sites.
- NaN indicate unavailable measurements due to data gaps.

Note that due to uncertainties in the hydrophone calibration in 2007 (DEFLOHYDRO data), the noise level was not computed for this year of data.

=== [daily\\_average\\_ambient\\_noise\\_64to66Hz\\_and\\_71to73Hz.csv](#)

This file provides the average ambient noise-level (in dB re  $1\mu\text{Pa}^2/\text{Hz}$ ) in the 64-66 Hz and 71-73 Hz bandwidths, estimated over 300s-windows in 0.0018 Hz-bins, and averaged per julian day for all sites and years from 2010 to 2015 (OHASISBIO data).

- Noise-levels are given per day:
  - Columns 1 to 4: year, julian day (since January 1st), month, week of year.
  - Columns 5 to 10: noise-levels averaged per day at, resp., MAD, SSEIR, NEAMS, NCRO, WKER and SWAMS sites.
- NaN indicate unavailable measurements due to data gaps.

Note that due to uncertainties in the hydrophone calibration in 2007 (DEFLOHYDRO data), the noise level was not computed for this year of data.

=== [daily\\_average\\_ambient\\_noise\\_91to93Hz\\_and\\_99to101Hz.csv](#)

This file provides the average ambient noise-level (in dB re  $1\mu\text{Pa}^2/\text{Hz}$ ) in the 91-93 Hz and 99-101 Hz bandwidths, estimated over 300s-windows in 0.0018 Hz-bins, and averaged per julian day for all sites and years from 2010 to 2015 (OHASISBIO data).

- Noise-levels are given per day:
  - Columns 1 to 4: year, julian day (since January 1st), month, week of year.
  - Columns 5 to 10: noise-levels averaged per day at, resp., MAD, SSEIR, NEAMS, NCRO, WKER and SWAMS sites.
- NaN indicate unavailable measurements due to data gaps.

Note that due to uncertainties in the hydrophone calibration in 2007 (DEFLOHYDRO data), the noise level was not computed for this year of data.

### Units

All sound levels, given in dB/Hz re  $1\text{ microPa}^2$ , are corrected for the hydrophone sensitivity and gain.

| Call of interest (see Fig. 2)               | Call-unit frequency band - 2007 | Call-unit frequency band - 2010-2015 |
|---------------------------------------------|---------------------------------|--------------------------------------|
| Madagascar pygmy blue whale (35 Hz-unit)    | [34.0 – 35.0 Hz]                | [33.5 – 34.5 Hz]                     |
| Australia pygmy blue whale (70 Hz-harmonic) | [69.0 – 71.0 Hz]                | [67.1 – 70.0 Hz]                     |
| Sri Lanka pygmy blue whale (105 Hz-unit)    | [102.4 – 105.0 Hz]              | [98.9 – 102.1 Hz]                    |
| Fin whale (100 Hz-pulse)                    | [96.0 – 99.0 Hz]                | [95.2 – 97.8 Hz]                     |

| Call of interest (see Fig. 2)               | Lower Noise window | Upper Noise window |
|---------------------------------------------|--------------------|--------------------|
| Madagascar pygmy blue whale (35 Hz-unit)    | [30 -32 Hz]        | [36 - 38 Hz]       |
| Australia pygmy blue whale (70 Hz-harmonic) | [64 - 66 Hz]       | [71 - 73 Hz]       |
| Sri Lanka pygmy blue whale (105 Hz-unit)    | N/A                | [102 - 106 Hz]     |
| Fin whale (100 Hz-pulse)                    | [91 - 93 Hz]       | [99 - 101 Hz]      |