HAF- OG VATNARANNSÓKNIR

MARINE AND FRESHWATER RESEARCH IN ICELAND

A catalogue of pulsed calls produced by killer whales (*Orcinus orca*) in Iceland 2008 - 2016
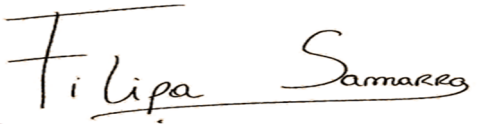
Selbmann A, Deecke VB, Fedutin ID, Filatova OA, Miller PJO and Samarra FIP

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Haf- og vatnarannsóknir

Marine and Freshwater Research in Iceland

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Titill: A catalogue of pulsed calls produced by killer whales (*Orcinus orca*) in Iceland 2008-2016		
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Abstract

Killer whales have been shown to produce stereotyped pulsed calls that can be classified into types with repertoires of call types varying between different social groups, populations and ecotypes. Closely related groups share part of their call type repertoire, thus, describing and comparing repertoires of killer whale calls from different groups and populations can provide important insight into their relatedness. Killer whales have long been known to occur in the coastal waters of Iceland, often found in large aggregations in herring grounds in the winter and summer. However, relatively few descriptions of call types have been conducted in this region. Here, we present a call type catalogue, based on recordings collected through dedicated research in Icelandic coastal waters that includes calls recorded from killer whales between 2008 and 2016. The catalogue aims to provide the first detailed description of the Icelandic killer whale call repertoire to provide insights into the acoustic behaviour of this population.

Lykilorð: Killer whale, Orca, Acoustic communication, Behaviour, Háhyrningur, killer, whale, orca, acoustic, behaviour, háhyrningur

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ICELANDIC ORCA PROJECT

A catalogue of pulsed calls produced by killer whales (*Orcinus orca*) in Iceland

2008-2016

A catalogue of pulsed calls produced by killer whales (*Orcinus orca*) in Iceland 2008-2016

Compiled by
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Introduction

Killer whales (*Orcinus orca*) spend the majority of their life underwater, only coming to the surface briefly to breathe. Light does not reach far underwater as it is absorbed quickly. However, sound propagates very fast and over long distances in water, making it an ideal means of communication for marine organisms. Like many other cetaceans, killer whales produce a variety of sounds to navigate, communicate and forage.

Killer whale sounds are usually divided into three types: clicks, whistles and pulsed calls (hereafter calls) (**Figure 1**). Clicks are short pulses of sound with a wide frequency bandwidth that are used in echolocation. Whistles are tonal sounds of high frequency and are thought to be used in close range communication and social interactions. Calls are the most common sounds of killer whales and have been studied in most detail. They are burst pulse sounds that consist of rapidly repeated pulses. They can contain two independently modulated frequency contours, a low frequency contour (LFC) and a high frequency contour (HFC). Calls with two frequency components are referred to as two-voiced or biphonic calls, as opposed to single-voiced or monophonic calls, which only have one frequency contour. Calls often have several parts, which are separated by distinct shifts in frequency (**Figure 2**).
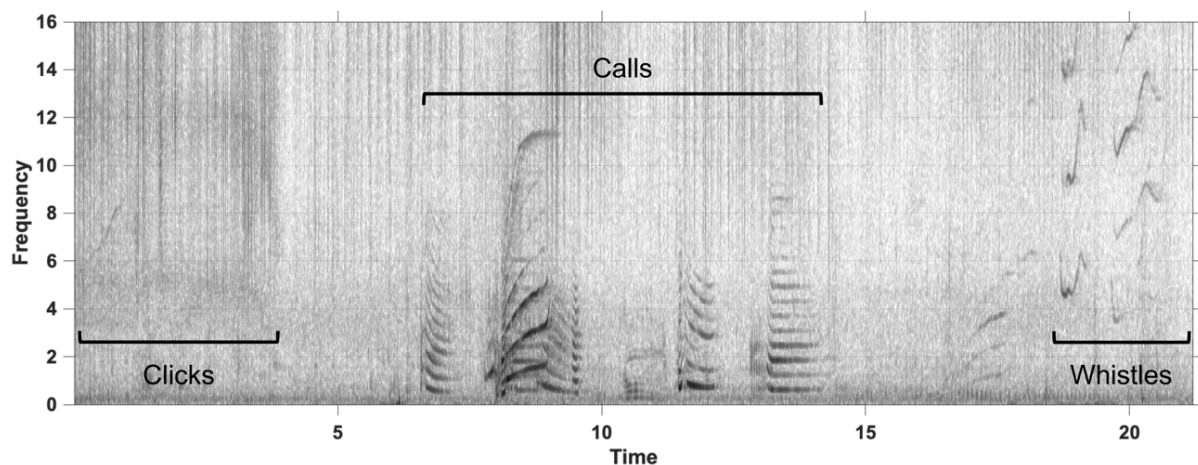

Figure 1. Example of a spectrogram showing different types of killer whale sounds.

The majority of killer whale calls have a distinctive structure and are stereotyped. Therefore, they can be placed into different categories referred to as call types. Not all killer whales use the same call types. Different social groups and populations of killer whales may have different repertoires of call types but closely related groups

may share some call types between them. Therefore, describing and comparing repertoires of killer whale calls from different groups and populations can provide important insights into their relatedness. Much of our knowledge on killer whale calls stems from the Northeast Pacific, where Dr. John Ford and colleagues pioneered the study of killer whale sounds from the 1970s onwards. They described group-specific repertoires of the local killer whale populations. Some call types are shared with other matrilines and all matrilines that share calls are referred to as clans. In this highly structured social system, call repertoires provide a measure of relatedness between killer whales.
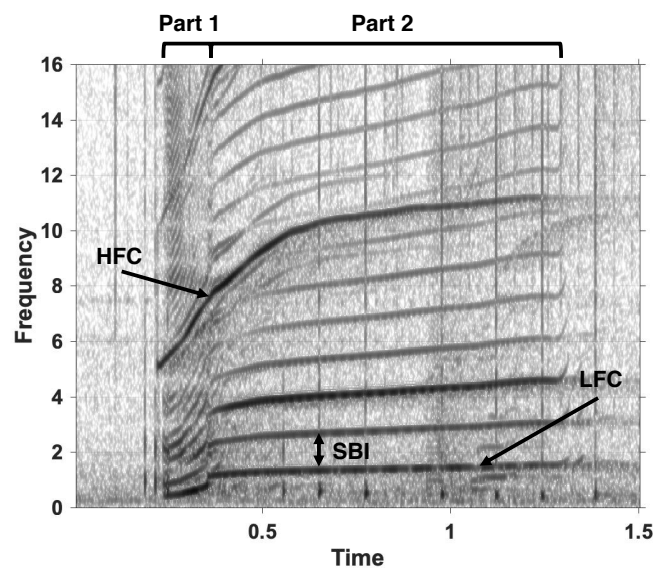

Figure 2. Spectrogram of a killer whale pulsed call. The low frequency contour (LFC), high frequency contour (HFC) and sideband interval (SBI) of the LFC are indicated by arrows. The different parts of the call are shown above the image.

Killer whales have been observed in coastal herring grounds in Iceland for decades, often in the winter and summer months when the herring overwinter and spawn. As a result, killer whales have been long thought to specialize on herring and follow its migration year-round. It was in the herring overwintering grounds of East Iceland that the Marine Research Institute (now Marine and Freshwater Research Institute) instigated research on this population in the 1980s. The primary purpose was to use photo-identification to provide an assessment of population size and structure, but early research also delved into their acoustic behaviour (see Further Reading section for a list of publications on acoustic research in Iceland). These early studies collected a few recordings of different aggregations of whales that pointed to the possible existence of group specific call repertoires in Icelandic killer whales. However, because killer whales in Iceland often occur in aggregations where it is

difficult to acoustically isolate family groups, there is little knowledge to date on the acoustic repertoire of different individuals, social groups or an overall overview of call types produced by killer whales encountered in Icelandic waters.

The Icelandic Orca Project began in 2008 and has now become the largest long-term study of killer whales in Icelandic waters. The aim of this project is to monitor the population, as well as investigate its social, foraging and acoustic behaviours. Between 2008 and 2016, 671 hours of acoustic recordings were collected and this catalogue provides a detailed description of the overall call repertoire of Icelandic killer whales from these recordings.
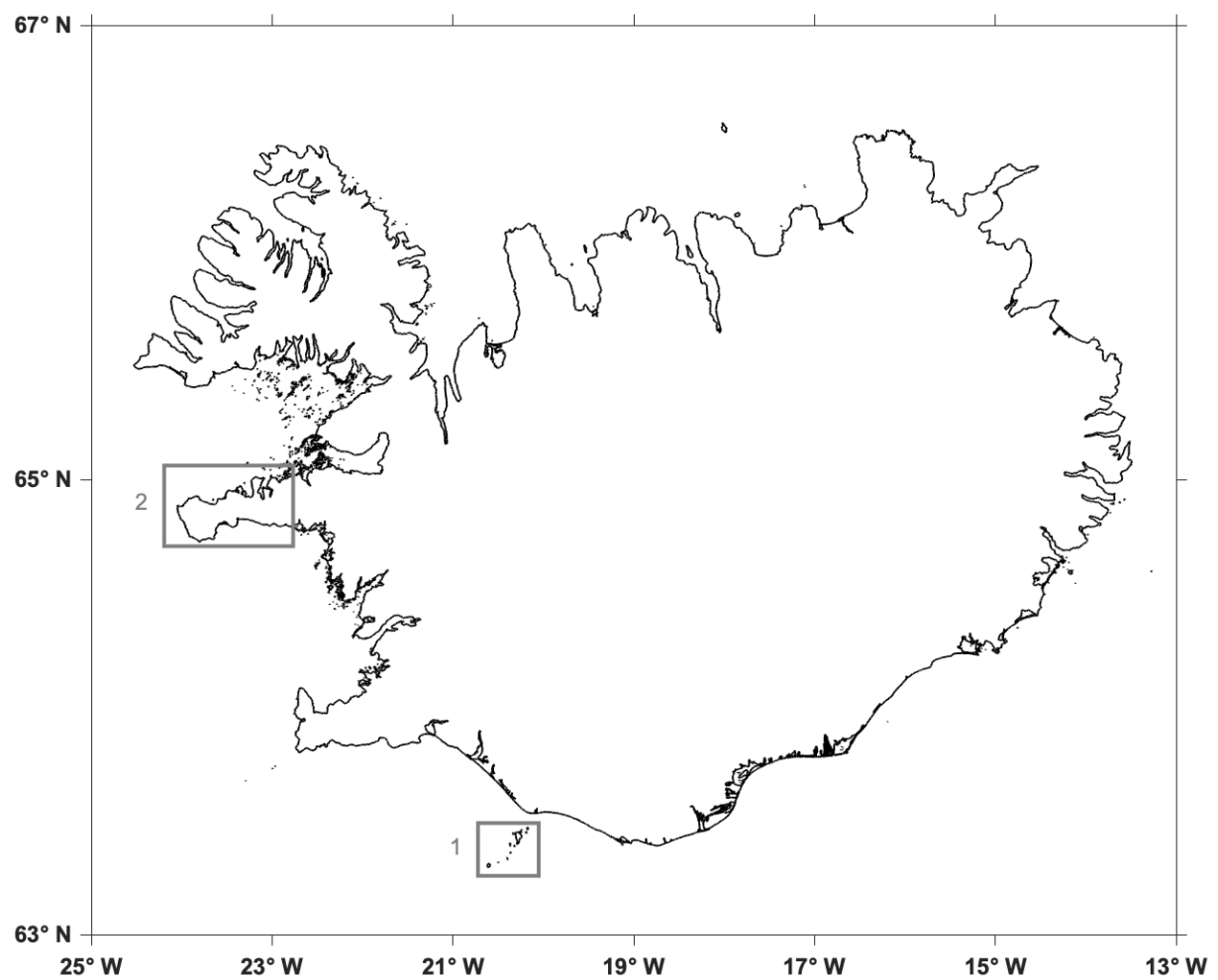
Sampling regions

Figure 3. Map of locations where acoustic recordings were collected.

Methodology

Sampling regions

This catalogue includes calls recorded from killer whales in the coastal waters of Iceland between 2008 and 2016. The catalogue is based on recordings from dedicated research of the Icelandic Orca Project taking place in the summer in Vestmannaeyjar (region 1, Figure 3) and in the winters of 2013 and 2014 in Grundarfjörður and Kolgrafafjörður (West Iceland, region 2, Figure 3). A total of 671 hours of recordings were collected, which resulted in 8011 high quality calls used in the classification presented below. Recording methods varied and included single hydrophones, towed and vertical hydrophone arrays, moored hydrophones and Dtags (archival tags that are attached to the whales using suction cups, see Johnson & Tyack, 2003)

Acoustic analysis

All recordings were manually analysed by visual and aural examination of spectrograms. Only high quality calls (high signal-to-noise ratio, majority of contour clearly visible and audible) were used for classification into call types. Calls were classified based on the structural characteristics and aural qualities (Ford, 1987). At least three separate instances of a call were required to define a new type or subtype.

The only published classification of calls from Iceland was conducted by Moore et al. (1988), who classified 24 call types based on a few hours of recordings from East Iceland. This was followed by a description of call type I36, the 'herding call' by Simon et al. (2006). Comparisons to the Moore et al. (1988) catalogue were made whenever possible and call types that could not be compared or that were different from previously described calls were labelled I37 onwards.

Catalogue format

For each call type presented, example spectrograms are followed by a table summarising parameter measurements and text providing a short description of that type. Each call type and subtype is presented on a separate page. A larger spectrogram shows a typical example of the call type/subtype and the two smaller spectrograms show differing variants that exemplify the variation within the call type. Frequencies are given in kHz and time in seconds. Spectrograms were created using a Hann window and FFT sizes of 1,024 for 48 kHz sampling rates, 2,048 for 64 and 96 kHz sampling rates, 4,096 for 192 kHz sampling rates and 5,120 for 240 kHz sampling rates, with 87.5% overlap.

Measurements of the overall duration and the frequency at the start, end, mid, maximum and minimum were taken from any calls with sufficient signal-to-noise ratio (Figure 4). They are shown in the table below the spectrograms. Calls were not divided into parts but considered over their entire duration. This meant that in some call types where a short pause separates two parts of a call, the pause was included in the measurements (e.g. I44). Further details on measurements for individual call types are provided in the text segment for each call type.
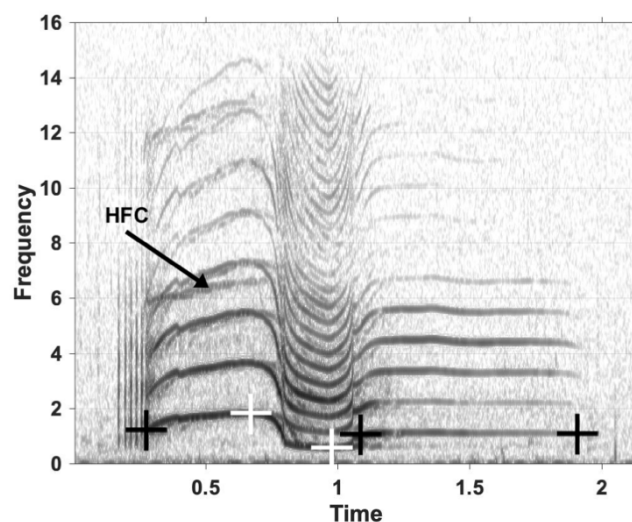

Figure 4. Measurements taken from killer whale calls. Measurements were taken of the start, mid and end frequency (black crosses) and of the maximum and minimum frequency (white crosses). The timing of the start and end frequency provided the duration. The high frequency component (HFC) was not measured.

Due to variations in call quality, not all parameters were measured from all calls. It was also not always possible to take measurements of all parameters. Sample sizes are indicated in the measurements table. In calls composed of both a LFC and HFC, measurements were taken only of the low frequency contour.

Abbreviations

N = Number of samples

CV = Coefficient of variation (Standard deviation/mean x 100)

Min = Minimum value measured

Max = Maximum value measured

LFC = Low frequency component

HFC = High frequency component

Acknowledgements

Catalogue

Overview of call types
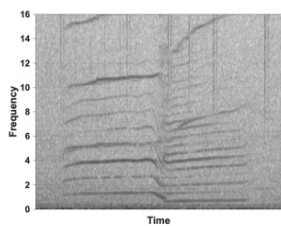
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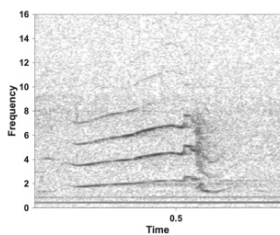
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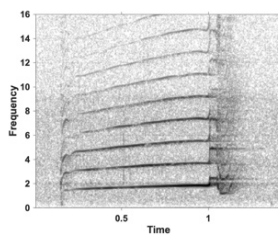
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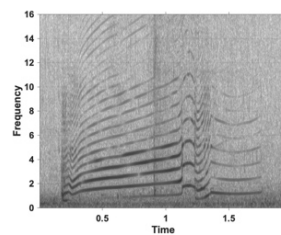
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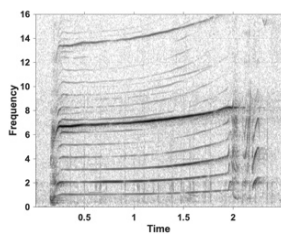
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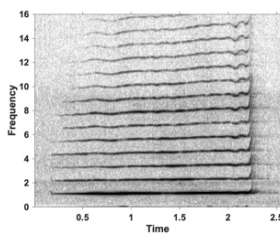
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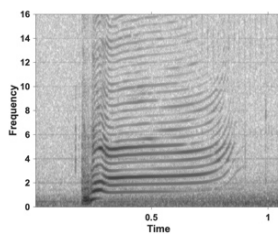
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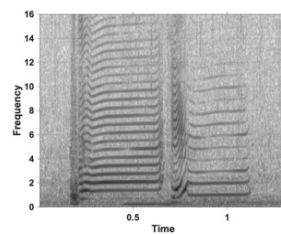
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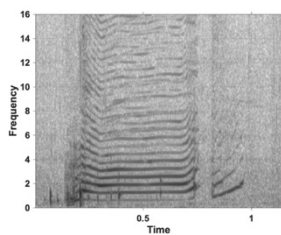
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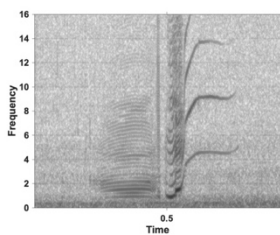
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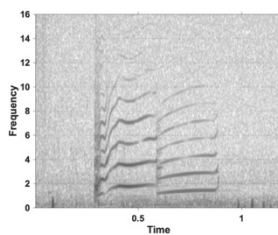
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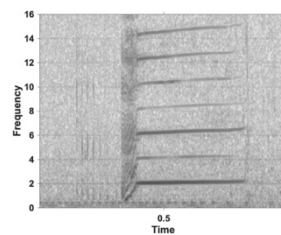
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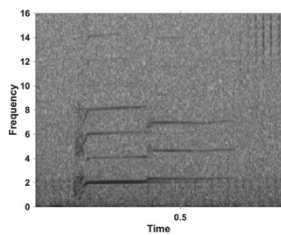
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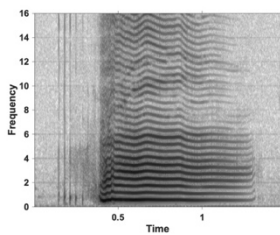
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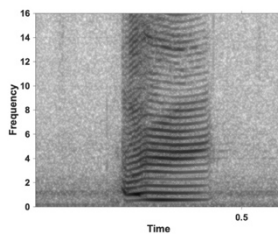
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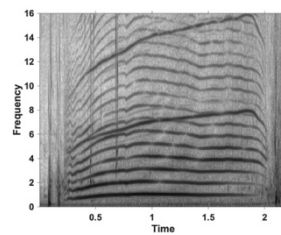
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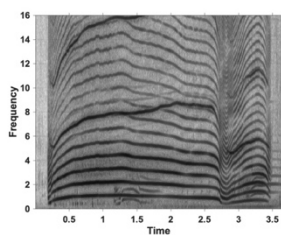
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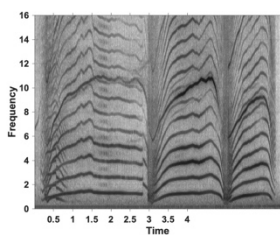
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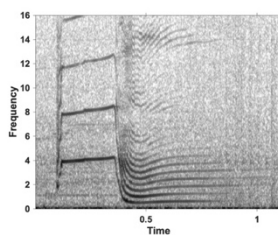
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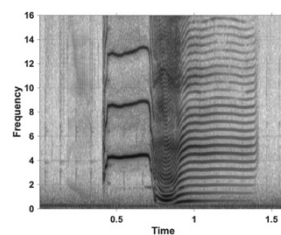
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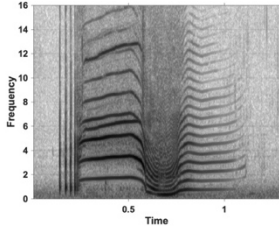
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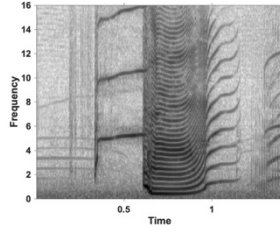
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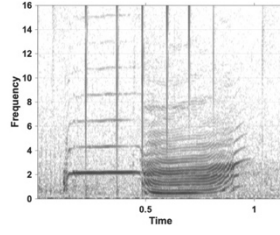
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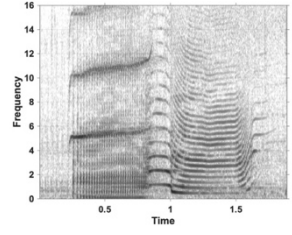
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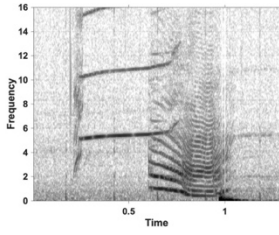
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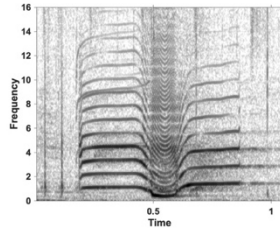
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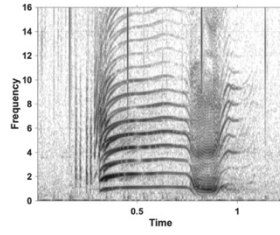
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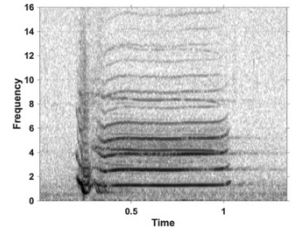
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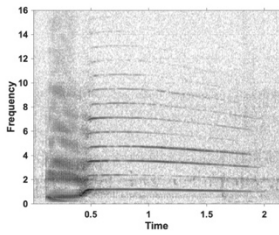
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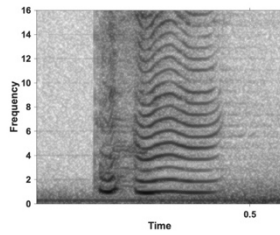
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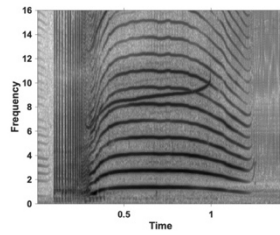
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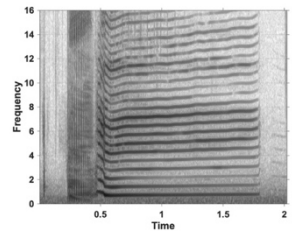
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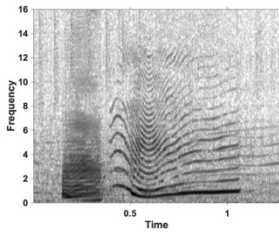
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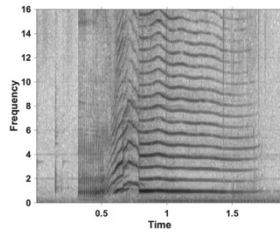
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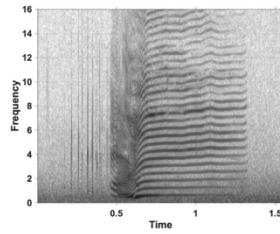
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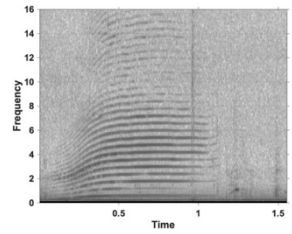
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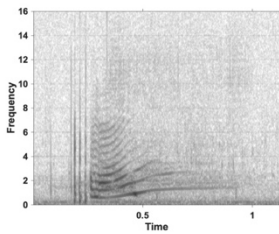
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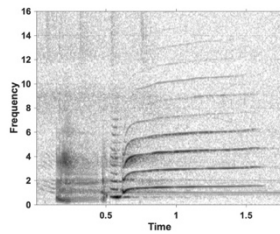
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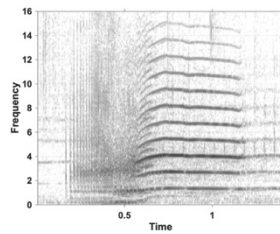
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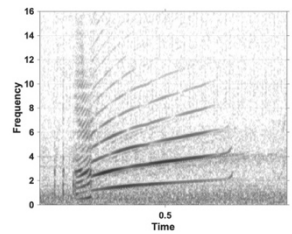
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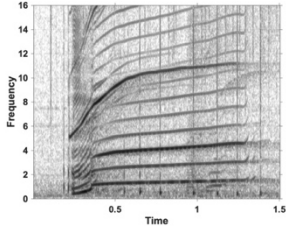
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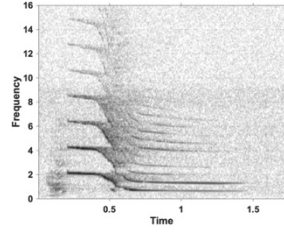
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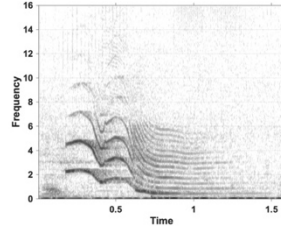
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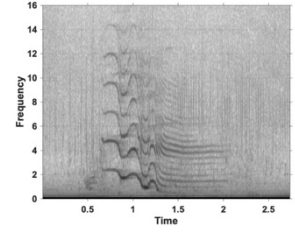
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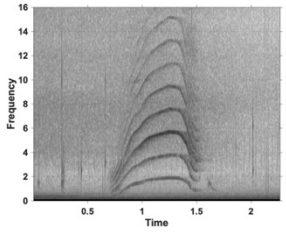
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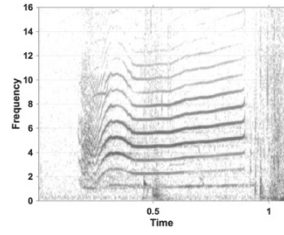
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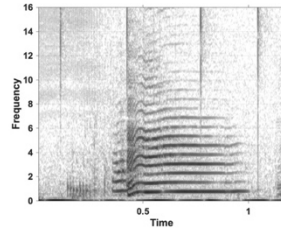
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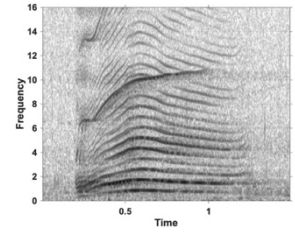
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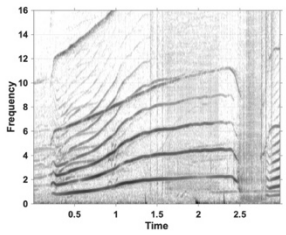
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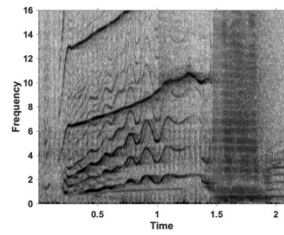
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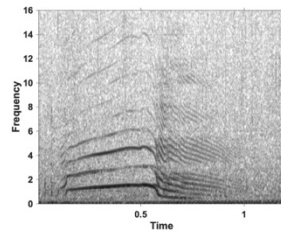
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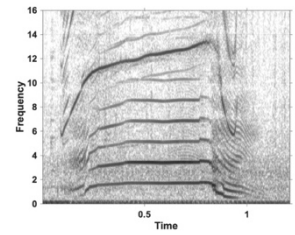
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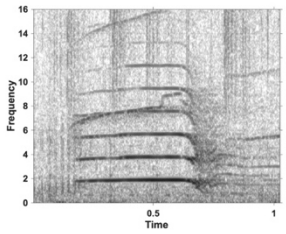
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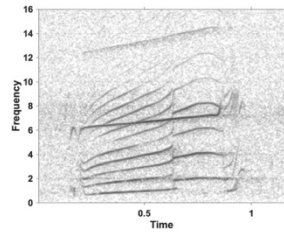
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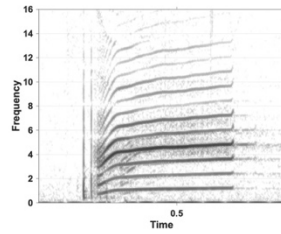
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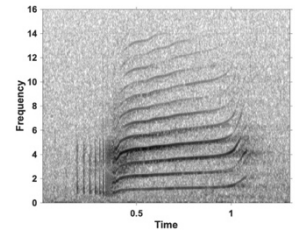
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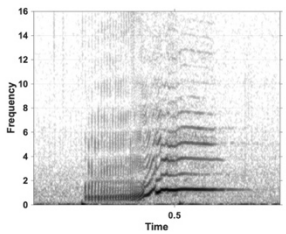
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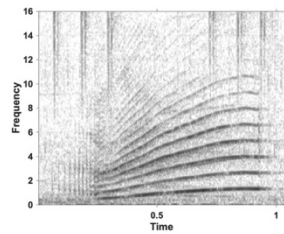
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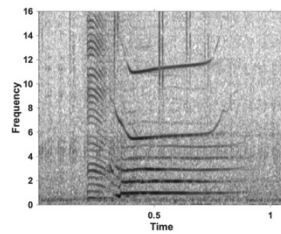
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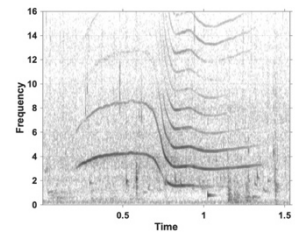
I66 page 77
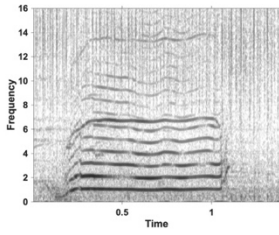
I67 page 78
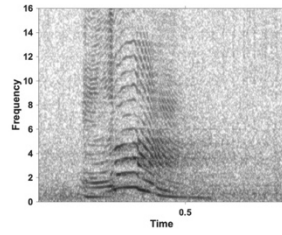
I68 page 79
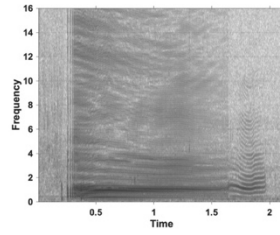
I69 page 80
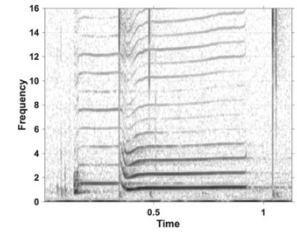
I70 page 81
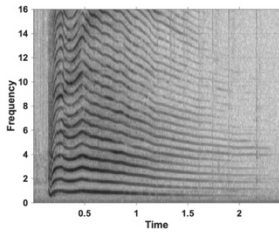
I71 page 82
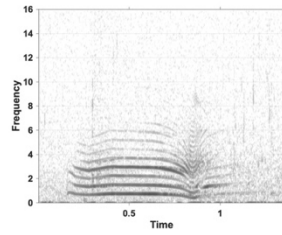
I72.1 page 83
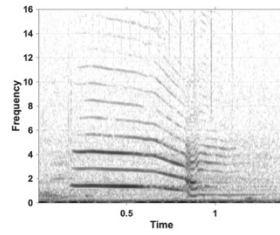
I72.2 page 84
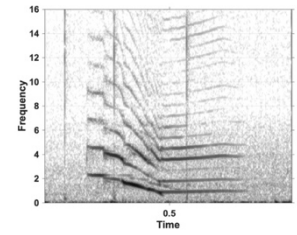
I72.3 page 85
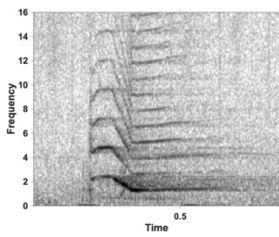
I72.4 page 86
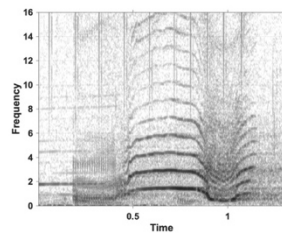
I73 page 87
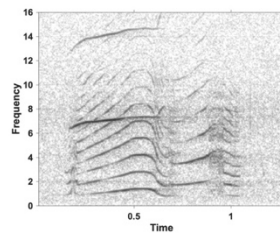
I74.1 page 88
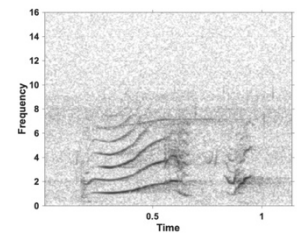
I74.2 page 89
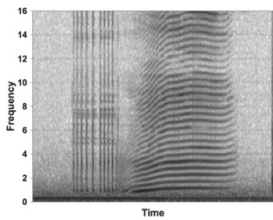
I75 page 90
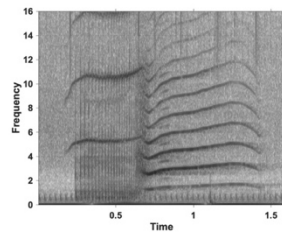
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Call type classification

Call type I5.5

Table 1: Summary of measurements of call type I5.5. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	9	1.07	31.38	0.65	1.67
Start frequency	9	1.10	5.88	1.02	1.21
End frequency	8	0.81	5.06	0.73	0.86
Mid frequency	9	0.98	35.96	0.63	1.45
Maximum frequency	9	0.66	7.20	0.58	0.71
Minimum frequency	9	1.39	4.62	1.26	1.45
Total number of calls	10				
Recording events	1				

Call type I5.5 is a downsweep call with both a LFC and a HFC. The call type has two parts that are separated by a downward frequency shift in the LFC and an upward shift in the HFC.

The call type is considered a likely match to call type I5 described by Moore et al. (1988). Moore et al. (1988) had described call types I5.1 to I5.4. Call type I5.5 was considered a new subtype, since it was not an exact match to these subtypes.

Call type I11.3

Table 2: Summary of measurements of call type I11.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	9	0.74	31.12	0.53	1.20
Start frequency	9	1.34	25.45	0.82	1.87
End frequency	9	1.89	26.27	1.32	3.03
Mid frequency	9	2.04	11.90	1.76	2.46
Minimum frequency	9	1.23	16.01	0.83	1.51
Maximum frequency	9	2.34	15.36	1.85	2.90
Total number of calls	24				
Recording events	10				

Call type I11.3 is an upsweep call with a LFC only. The call structure is simple with a slight downsweep at the end, sometimes preceded by short frequency shifts.

Call types I11.3 to I11.6 are considered likely matches to call types I11.1 and I11.2 as described by Moore et al. (1988). Due to small differences they were labelled as new subtypes.

Call type I11.4

Table 3: Summary of measurements of call type I11.4. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	437	0.99	22.37	0.57	3.05
Start frequency	430	0.81	41.05	0.12	2.04
End frequency	431	2.27	42.88	0.94	7.73
Mid frequency	437	1.44	25.50	0.77	2.06
Minimum frequency	431	0.81	37.95	0.16	1.80
Maximum frequency	430	2.98	34.52	1.34	7.81
Total number of calls	624				
Recording events	43				

Call type I11.4 is an upsweep call with a LFC only. The call type has a distinct end with a varying number of up and down frequency modulations.

Call type I11.4 is considered a likely match to call type I11.2 as described by Moore et al. (1988). Due to the quality of the spectrograms published, it is unclear whether I11.2 has a HFC and therefore call type I11.4 was labelled as a new subtype.

Call type I11.5

Table 4: Summary of measurements of call type I11.5. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	27	1.38	10.72	1.17	1.68
Start frequency	27	0.66	14.07	0.29	0.77
End frequency	27	1.26	12.17	0.83	1.58
Mid frequency	27	0.94	12.53	0.42	1.07
Minimum frequency	27	0.63	13.68	0.30	0.72
Maximum frequency	27	1.70	13.22	1.05	1.98
Total number of calls	37				
Recording events	4				

Call type I11.5 is an upsweep call with a LFC only. The call type is very similar to subtype I11.4 but has a distinct second part that is missing in subtype I11.4.

Call type I11.6

Table 5: Summary of measurements of call type I11.6. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	19	1.87	33.93	1.05	2.99
Start frequency	19	0.80	28.26	0.23	1.24
End frequency	18	1.25	39.45	0.65	2.45
Mid frequency	19	1.23	10.62	1.02	1.57
Minimum frequency	18	0.76	22.96	0.29	1.05
Maximum frequency	19	1.83	18.64	1.28	2.49
Total number of calls	61				
Recording events	11				

Call type I11.6 has both a LFC and a HFC. The LFC is very similar to subtype I11.4. The HFC is a simple, slightly upsweep contour. Often there is a short upsweep sound at the end of the call, separated by a short pause.

Measurements were taken excluding the short upsweep sound at the end because it was not present in all calls.

Call type I36

Table 6: Summary of measurements of call type I36. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	253	2.65	40.69	0.51	5.19
Start frequency	246	0.95	29.90	0.26	1.62
End frequency	252	1.20	29.76	0.50	2.43
Mid frequency	253	0.97	26.14	0.46	1.57
Minimum frequency	251	0.90	27.75	0.28	1.32
Maximum frequency	252	1.22	28.43	0.51	2.42
Total number of calls	619				
Recording events	57				

Call type I36 has a LFC only. The structure is very simple with almost no frequency modulation. In many examples the call has a short upsweep at the end.

Call type I36 is the so-called 'herding call', previously described by Simon et al. (2006), but it can vary in frequency as described in Samarra (2015).

Call type I37.1

Table 7: Summary of measurements of call type I37.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	8	0.74	18.10	0.61	0.92
Start frequency	8	0.58	24.79	0.26	0.68
End frequency	8	1.22	25.09	0.87	1.68
Mid frequency	8	0.64	7.29	0.53	0.67
Minimum frequency	8	0.56	22.29	0.27	0.64
Maximum frequency	8	1.22	25.14	0.88	1.68
Total number of calls	16				
Recording events	3				

Call type I37.1 is an upsweep call with a LFC only. The call type is characterised by a small frequency shift at the start and an upsweep at the end. In most examples there is a short element of clicks at the beginning of the call.

Call type I37.2

Table 8: Summary of measurements of call type I37.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	5	0.86	22.96	0.58	1.05
Start frequency	5	0.49	33.72	0.27	0.63
End frequency	5	1.12	21.76	0.81	1.43
Mid frequency	5	0.78	29.40	0.63	1.19
Minimum frequency	5	0.44	38.25	0.25	0.62
Maximum frequency	5	1.26	25.88	0.85	1.76
Total number of calls	7				
Recording events	2				

Call type I37.2 is an upsweep call with a LFC only. The call type is very similar to subtype I37.1 but has a second part.

Measurements were taken of the entire call, including the short pause.

Call type I37.3

Table 9: Summary of measurements of call type I37.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	3	0.60	6.50	0.55	0.63
Start frequency	3	0.65	4.39	0.62	0.67
End frequency	3	0.96	5.22	0.91	1.01
Mid frequency	3	0.66	3.36	0.64	0.68
Minimum frequency	3	0.64	4.49	0.62	0.67
Maximum frequency	3	0.96	5.94	0.92	1.03
Total number of calls	4				
Recording events	1				

Call type I37.3 is an upsweep call with a LFC only. The call type is similar to subtypes I37.1 and I37.2 but the added part at the end is distinctly upsweep.

Measurements were only taken of the first part of the call, since the second part was mostly poorly visible.

Call type I38

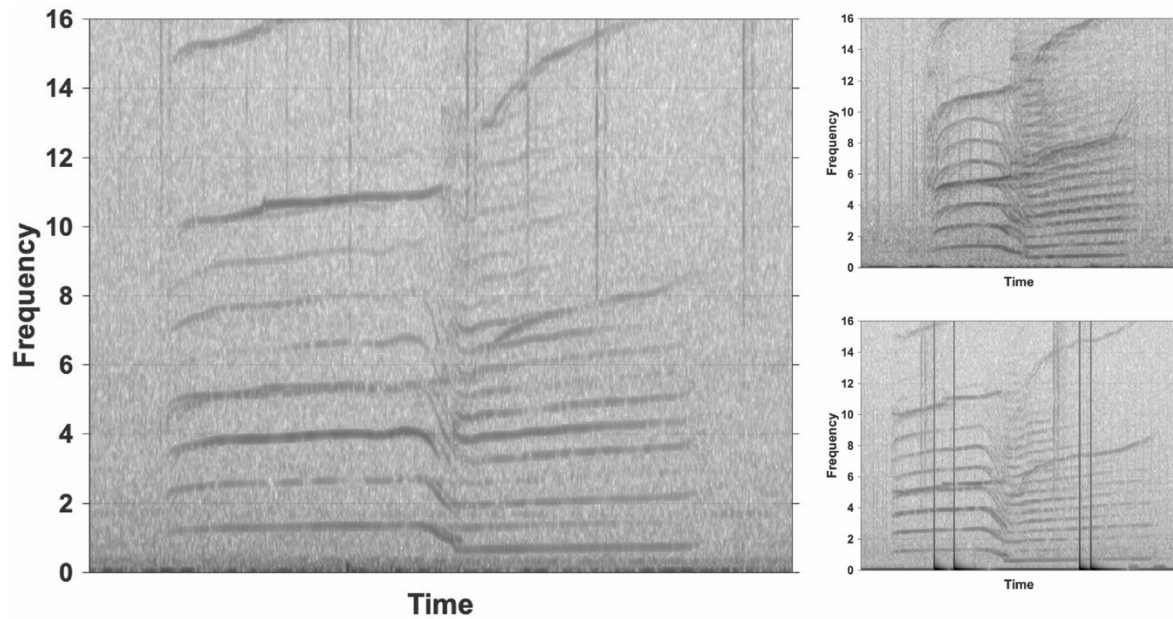*Table 10: Summary of measurements of call type I38. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	58	0.48	27.07	0.21	0.88
Start frequency	35	0.36	14.28	0.20	0.50
End frequency	58	4.89	11.98	3.19	6.53
Mid frequency	43	0.84	83.23	0.30	3.00
Minimum frequency	41	0.31	10.39	0.21	0.37
Maximum frequency	57	5.07	12.28	3.15	6.66
Total number of calls	132				
Recording events	5				

Call type I38 is an upsweep call with a LFC only. It is clearly separated into two parts. The first part is very flat in contour. The second part is always strongly upsweeping but varies in structure. In some examples there is a short pause between the two parts.

Measurements were taken of the entire call, including the short pause.

Call type I39

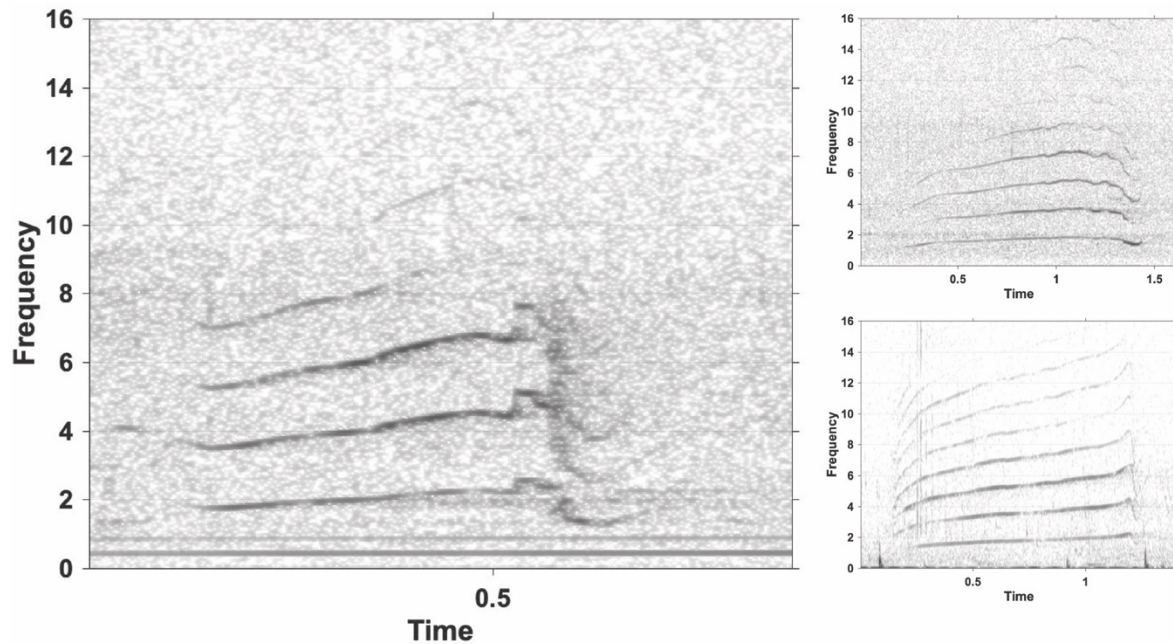*Table 11: Summary of measurements of call type I39. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	67	0.51	26.19	0.27	1.05
Start frequency	67	1.55	45.37	0.35	4.10
End frequency	66	1.97	29.30	0.98	3.80
Mid frequency	67	1.30	22.49	0.90	2.23
Minimum frequency	66	1.08	15.35	0.35	1.37
Maximum frequency	67	2.32	26.05	1.57	4.12
Total number of calls	92				
Recording events	11				

Call type I39 has a LFC only. It is clearly separated into two parts by a downward frequency shift. In most examples there is also a third part at the start of the call, which is either clicks or a short upsweep sound.
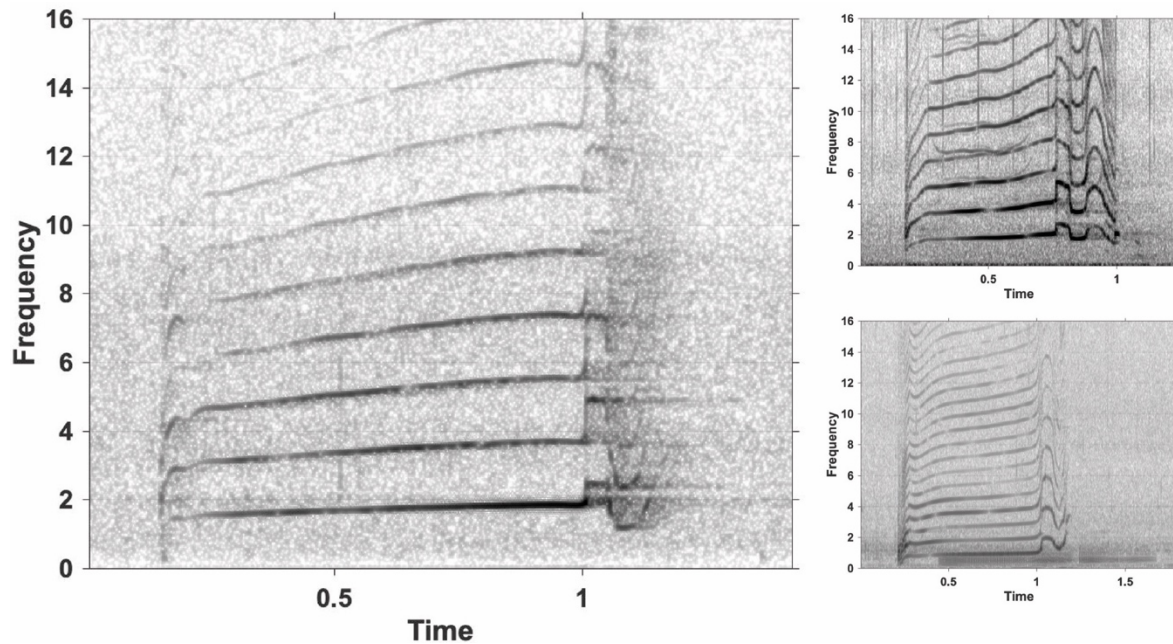
Call type I40.1

Table 12: Summary of measurements of call type I40.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	68	0.75	46.79	0.37	2.40
Start frequency	68	1.12	51.52	0.42	2.69
End frequency	68	3.01	25.99	1.22	5.31
Mid frequency	68	2.39	16.52	1.22	3.37
Minimum frequency	68	1.12	50.46	0.39	2.63
Maximum frequency	68	3.05	24.34	1.22	5.20
Total number of calls	76				
Recording events	13				

Call type I40.1 is an upsweep call with a LFC only. The call type is relatively high in frequency and the contour is usually very flat. The call type often starts with a short upsweep and varies in duration.
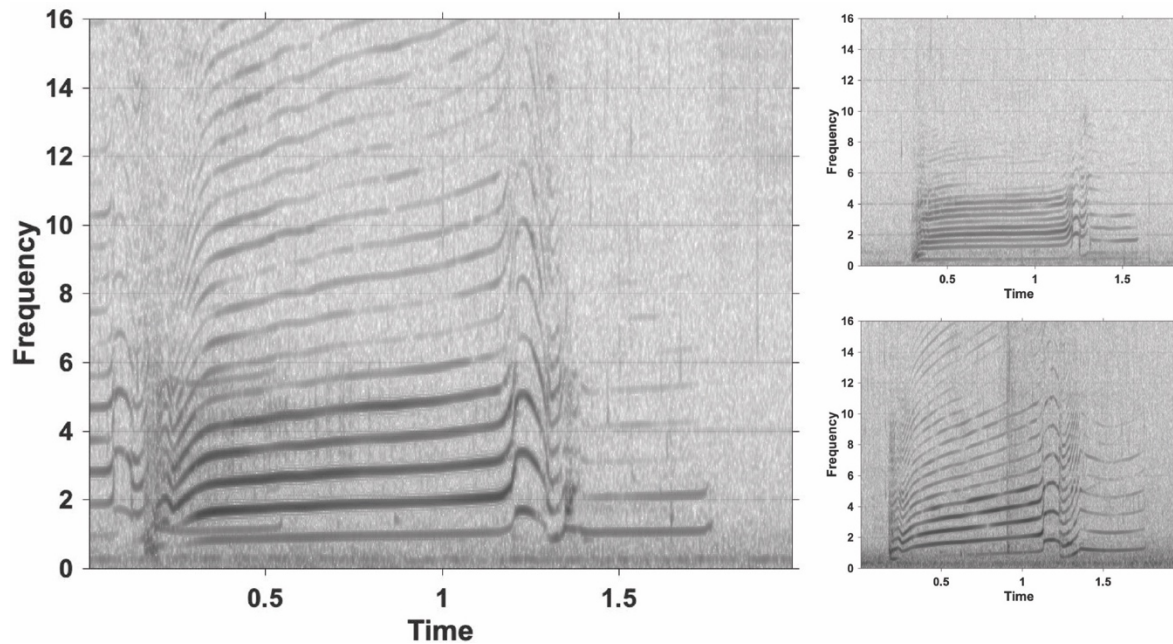
Call type I40.2

Table 13: Summary of measurements of call type I40.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	10	1.17	55.15	0.52	2.65
Start frequency	10	1.04	44.74	0.73	2.29
End frequency	10	3.38	22.26	2.36	4.71
Mid frequency	10	2.74	12.90	2.29	3.14
Minimum frequency	10	1.13	46.43	0.71	2.31
Maximum frequency	10	3.18	20.51	2.37	4.06
Total number of calls	11				
Recording events	3				

Call type I40.2 is an upsweep call with a LFC only. The call type has the same features as subtype I40.1 but has a distinct upward frequency shift.
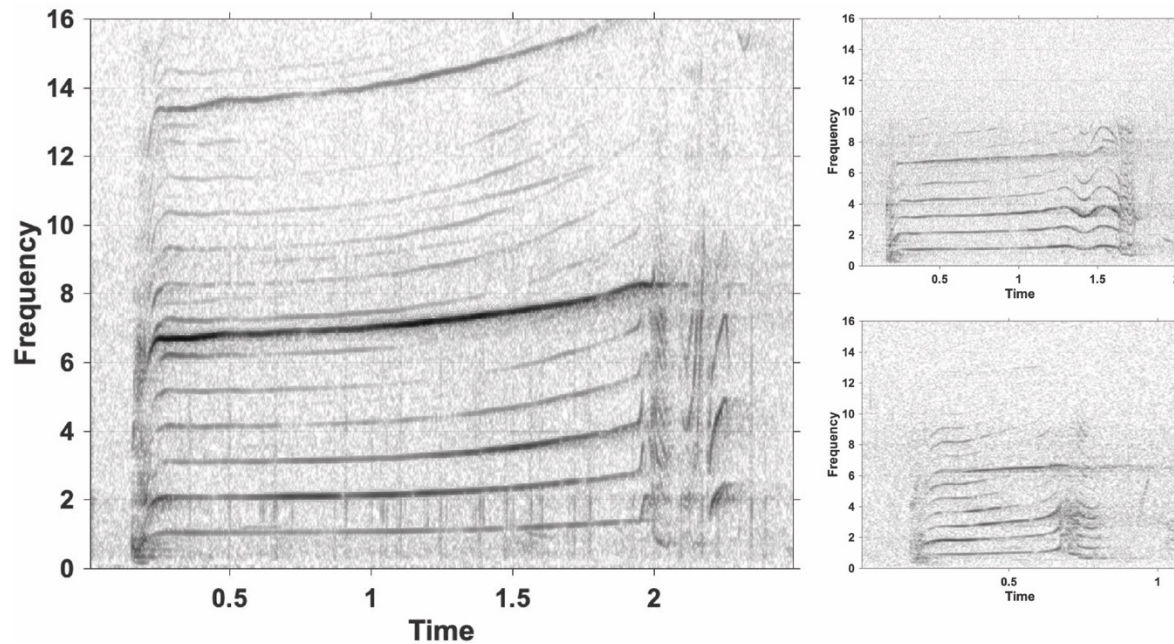
Call type I41.1

Table 14: Summary of measurements of call type I41.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	208	0.79	35.52	0.37	2.15
Start frequency	204	0.67	27.21	0.27	1.22
End frequency	166	0.59	17.08	0.38	0.94
Mid frequency	208	0.57	13.39	0.43	0.82
Minimum frequency	201	0.47	16.15	0.21	0.71
Maximum frequency	205	0.71	22.13	0.46	1.20
Total number of calls	249				
Recording events	18				

Call type I41.1 has a LFC only. The call type has a very simple structure and is low in frequency. In many examples there is a small shift in frequency at the start, which is sometimes separated by a short pause.

Measurements were taken of the entire call, including the short pause if present.
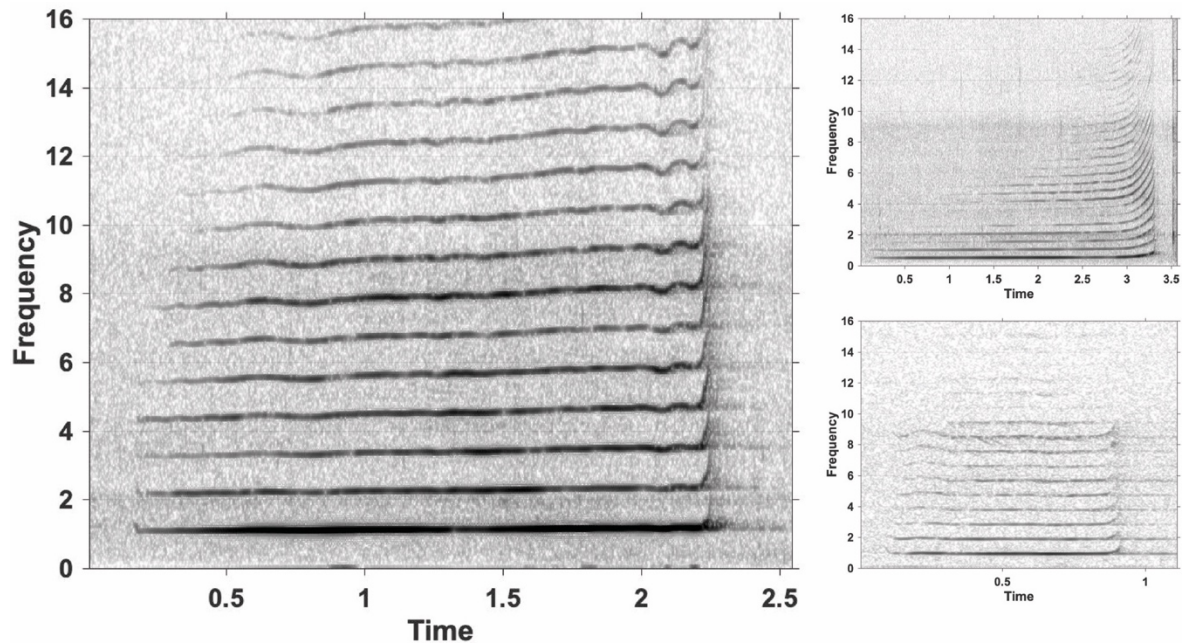
Call type I41.2

Table 15: Summary of measurements of call type I41.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	10	0.20	24.04	0.14	0.28
Start frequency	10	0.61	10.88	0.50	0.71
End frequency	9	0.62	17.57	0.50	0.75
Mid frequency	10	0.59	10.12	0.50	0.71
Minimum frequency	10	0.47	7.83	0.40	0.53
Maximum frequency	10	0.69	8.51	0.59	0.80
Total number of calls	11				
Recording events	1				

Call type I41.2 has a LFC only. It is similar in structure to subtype I41.1 but consistently shorter in duration.
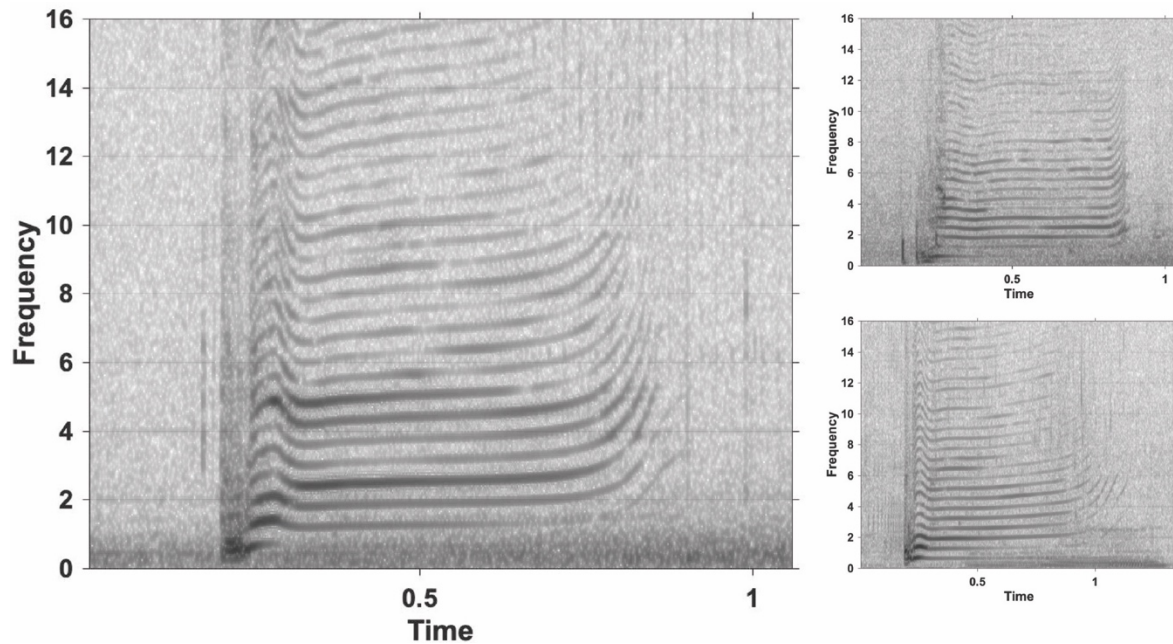
Call type I42.1

Table 16: Summary of measurements of call type I42.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	24	1.43	34.13	0.74	2.88
Start frequency	24	0.81	79.32	0.44	3.45
End frequency	24	0.93	42.45	0.49	2.29
Mid frequency	24	1.12	16.01	0.77	1.45
Minimum frequency	24	0.59	18.43	0.46	0.85
Maximum frequency	24	1.39	40.71	0.92	3.53
Total number of calls	56				
Recording events	15				

Call type I42.1 has both a LFC and a HFC. The LFC is slightly upsweep but the frequency often decreases again at the end. The HFC is also upsweep and decreases in frequency at the end. The HFC sometimes has a downward frequency shift at the start.
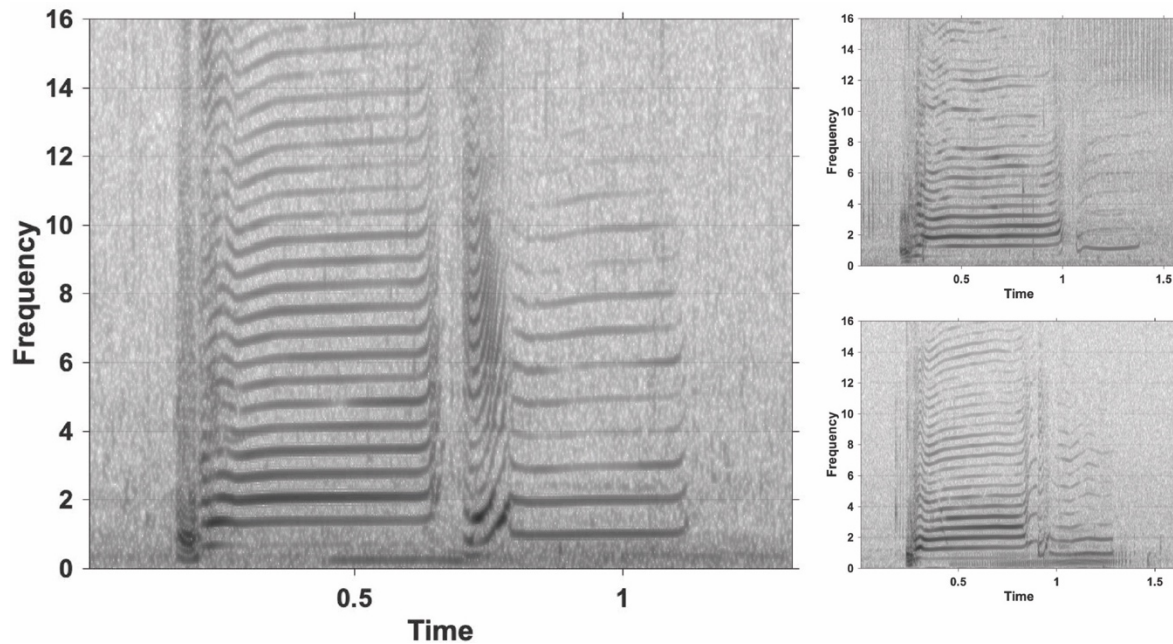
Call type I42.2

Table 17: Summary of measurements of call type I42.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	7	2.95	36.09	1.84	5.04
Start frequency	7	0.81	62.61	0.40	1.72
End frequency	7	0.62	47.73	0.42	1.26
Mid frequency	7	1.04	7.96	0.90	1.15
Minimum frequency	7	0.42	17.95	0.29	0.52
Maximum frequency	7	1.44	32.97	1.11	2.40
Total number of calls	19				
Recording events	9				

Call type I42.2 has both a LFC and a HFC. It is similar in structure to subtype I42.1 but has an added second part. The second part is similar to the first but shorter and mostly lower in frequency.

Call type I42.2
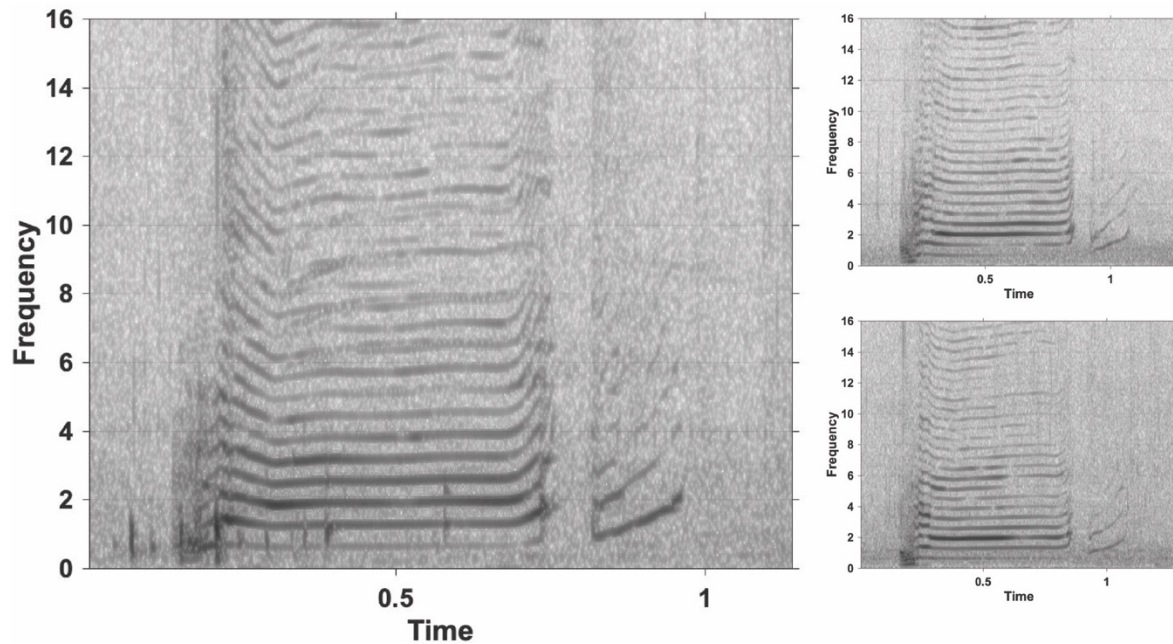

Table 18: Summary of measurements of call type I42.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	-	-	-	-	-
Start frequency	-	-	-	-	-
End frequency	-	-	-	-	-
Mid frequency	-	-	-	-	-
Minimum frequency	-	-	-	-	-
Maximum frequency	-	-	-	-	-
Total number of calls	4				
Recording events	3				

Call type I42.3 has both a LFC and a HFC. It is similar in structure to subtype I42.1 and I42.2 but has an added third part.
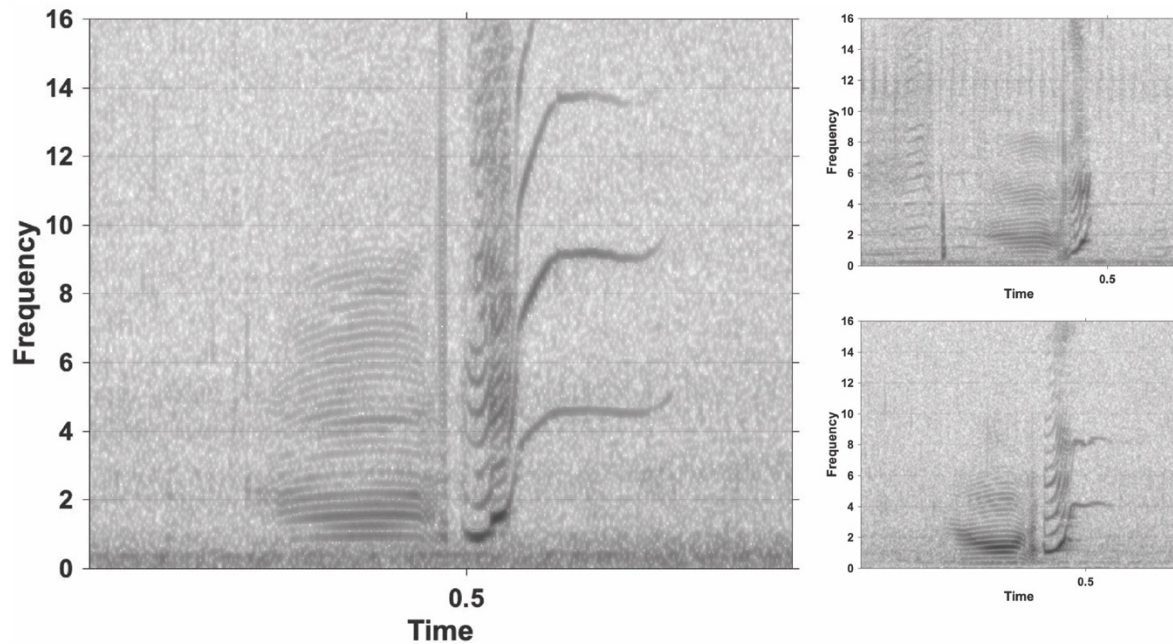
Call type I43.1

Table 19: Summary of measurements of call type I43.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	238	0.79	26.22	0.30	1.99
Start frequency	237	1.38	48.44	0.33	4.95
End frequency	210	0.67	25.26	0.43	1.95
Mid frequency	238	0.59	36.21	0.33	3.29
Minimum frequency	238	0.49	19.38	0.27	1.15
Maximum frequency	238	3.05	30.35	1.18	5.69
Total number of calls	306				
Recording events	17				

Call type I43.1 is a downsweep call with a LFC only. The call type has two parts that are separated by a downward frequency shift. Apart from a short upsweep at the start the two parts show little frequency modulation.

Call types I43.1 to I43.9 are unique in that it appears they are be built from the combination of several elements (Filatova et al., 2015b).
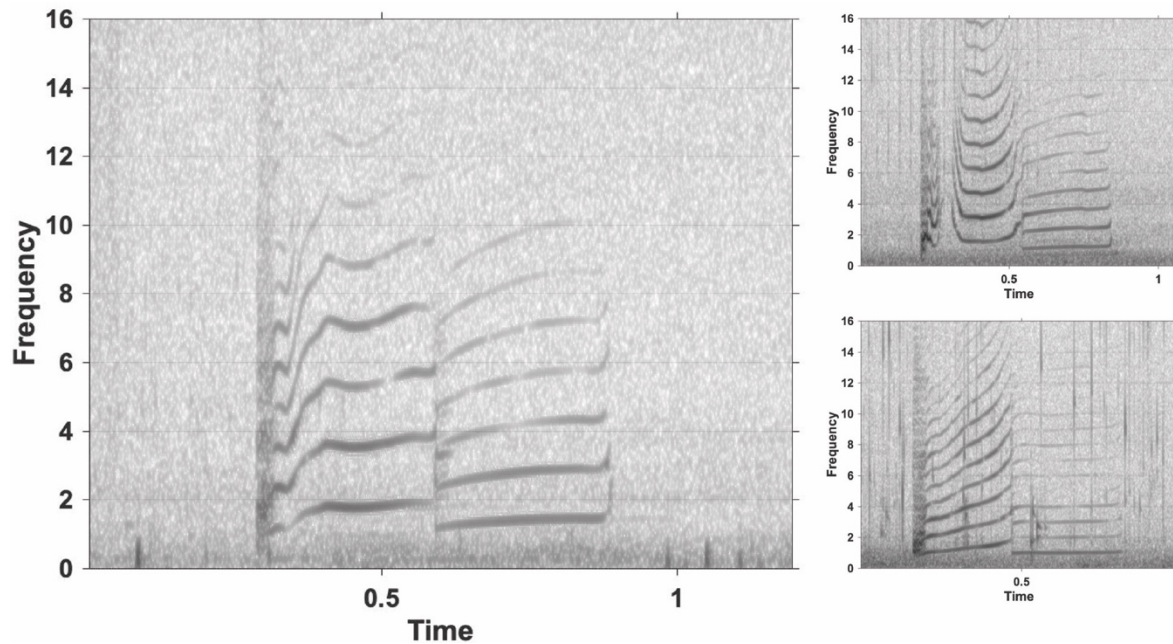
Call type I43.2

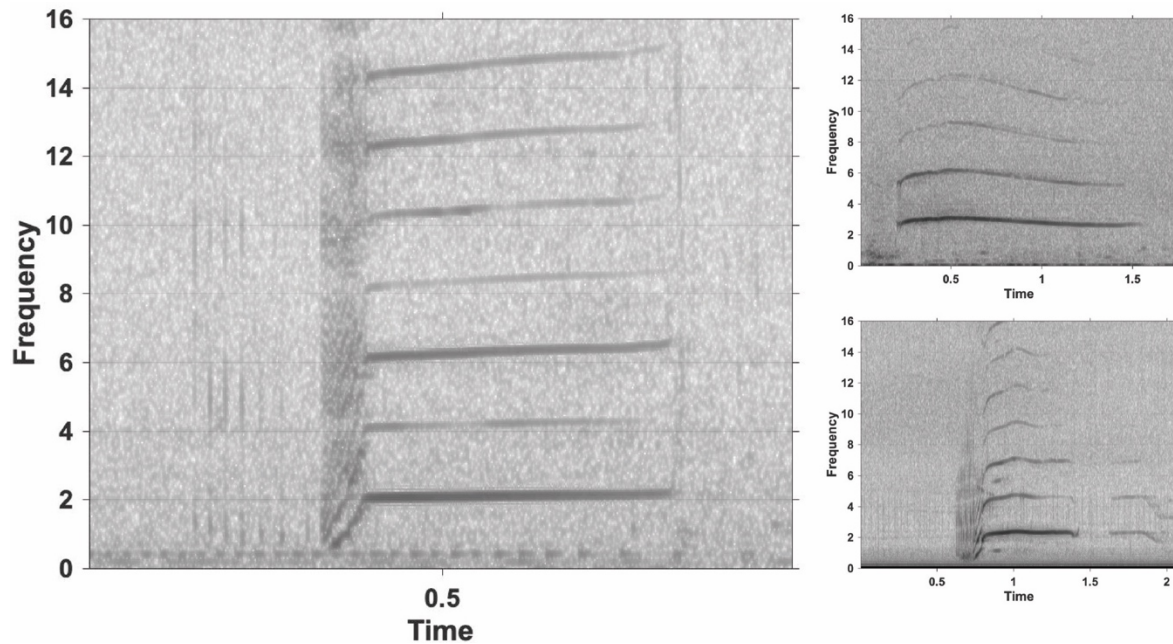*Table 20: Summary of measurements of call type I43.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	153	0.95	21.31	0.49	2.18
Start frequency	153	2.65	48.00	0.46	5.82
End frequency	121	0.80	30.22	0.51	2.80
Mid frequency	153	0.72	146.08	0.27	6.44
Minimum frequency	152	0.36	16.55	0.21	0.53
Maximum frequency	153	5.67	17.13	2.86	7.39
Total number of calls	241				
Recording events	23				

Call type I43.2 is a downsweep call with a LFC only. The call type has two parts that are separated by a downward frequency shift. The first part starts with a short upsweep, after which it is relatively stable in frequency. The second part is characterised by a dip in the frequency contour, followed by little frequency modulation. The CV for the mid frequency is unusually high because the middle of the call sometimes fell onto the first part of the call, which is much higher in frequency.

Call type I43.3

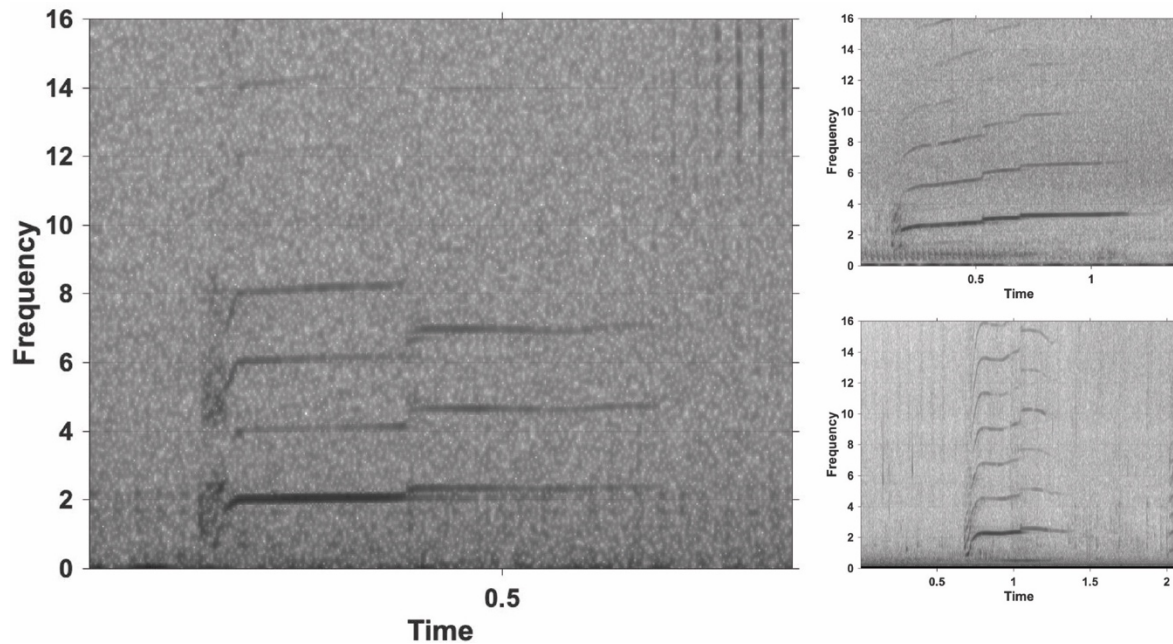*Table 21: Summary of measurements of call type I43.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	221	1.13	27.63	0.50	2.60
Start frequency	221	1.48	13.25	0.79	1.91
End frequency	154	0.90	21.47	0.52	1.57
Mid frequency	221	0.67	59.60	0.23	1.89
Minimum frequency	217	0.38	22.70	0.20	0.63
Maximum frequency	220	1.87	9.61	1.11	2.75
Total number of calls	348				
Recording events	32				

Call type I43.3 is a downsweep call with both a LFC and a HFC. The call type is similar to subtype I43.2 but has an added HFC. The HFC only extends over the first part of the call and is slightly upsweep.
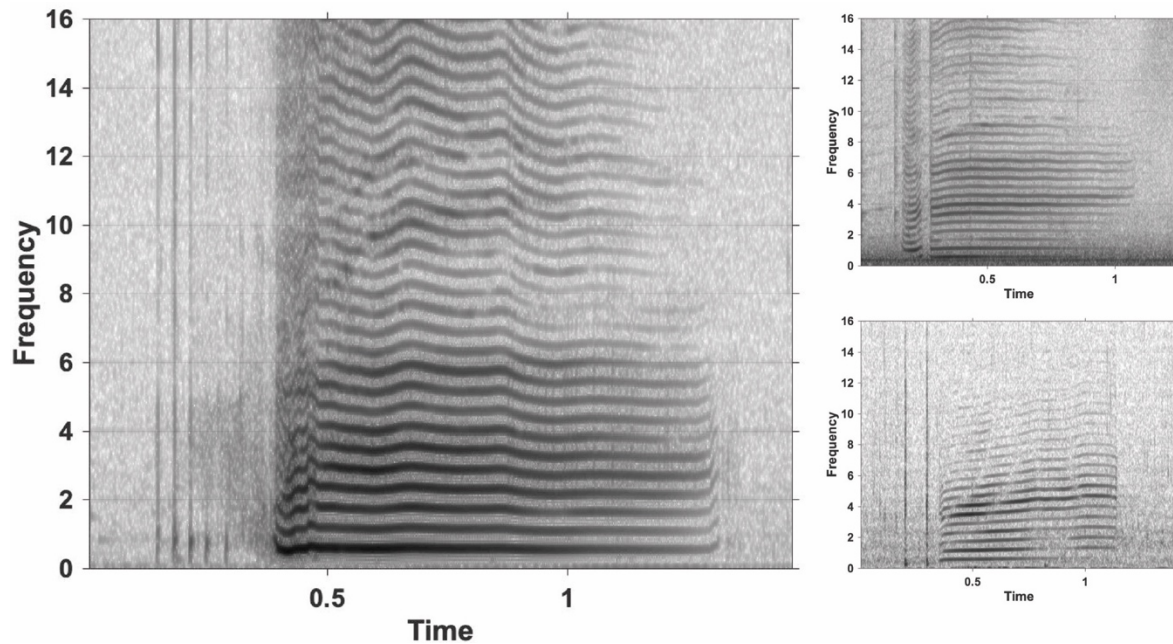
Call type I43.4

Table 22: Summary of measurements of call type I43.4. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	60	1.02	23.10	0.60	1.87
Start frequency	60	2.46	54.77	0.88	5.05
End frequency	44	1.30	22.04	0.73	2.08
Mid frequency	60	0.71	168.37	0.26	5.79
Minimum frequency	60	0.35	13.74	0.24	0.47
Maximum frequency	60	4.91	16.99	1.34	5.79
Total number of calls	127				
Recording events	14				

Call type I43.4 is a downsweep call with a LFC only. In some examples the first part of the call could be an independently modulated HFC (see lower right example). The first part of the call type is high in frequency and starts with a short upsweep. The second part is much lower in frequency and often has a small frequency shift at the start. The third part is of intermediate frequency and is not always clearly visible. The CV of the mid frequency is unusually high because the middle duration of the call sometimes fell onto the first part of the call which is much higher in frequency.
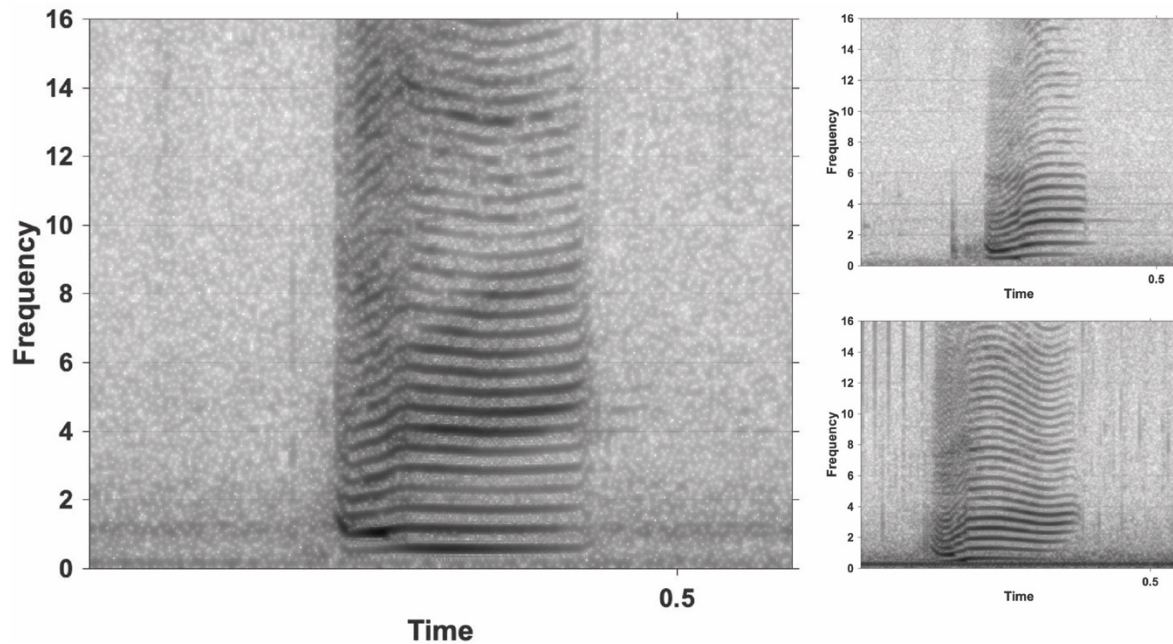
Call type I43.5

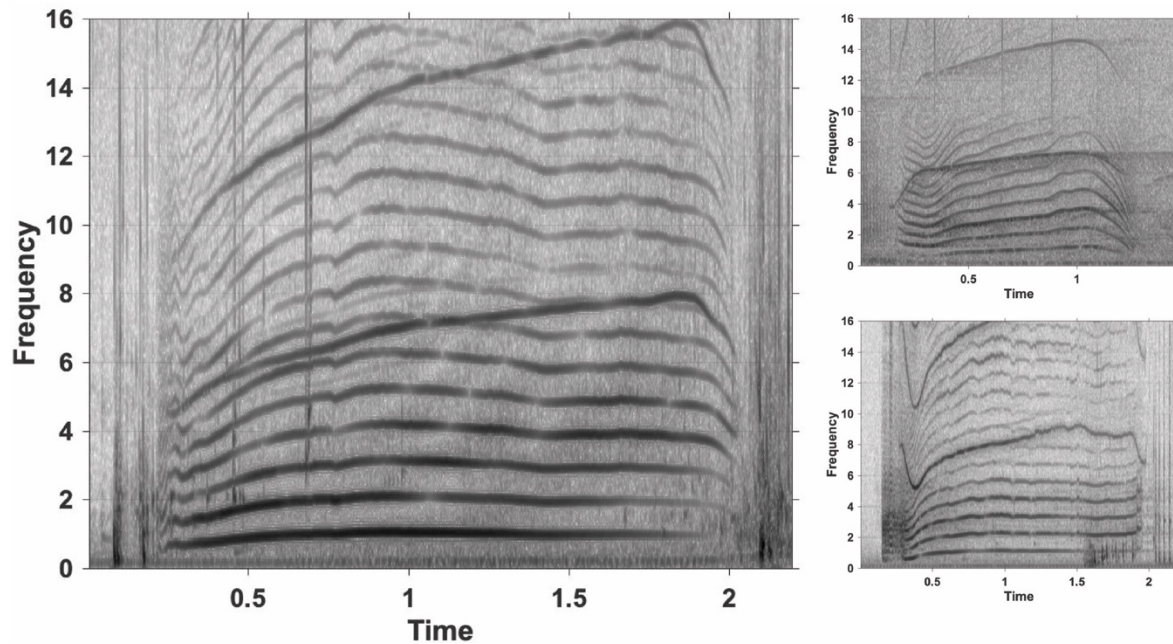*Table 23: Summary of measurements of call type I43.5. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	170	0.88	29.58	0.47	2.10
Start frequency	170	0.79	28.22	0.31	2.20
End frequency	138	1.25	16.83	0.50	1.71
Mid frequency	169	0.43	92.14	0.18	2.39
Minimum frequency	166	0.29	23.03	0.18	0.73
Maximum frequency	168	1.99	26.46	0.99	2.83
Total number of calls	257				
Recording events	22				

Call type I43.5 has a LFC only. The call type is divided into three parts and similar in structure to subtype I43.4. However, the first part of the call is lower in frequency than in subtype I43.4, where it is always above 3 kHz and usually around 4 kHz. In call type I43.5 the first part of the call is usually around 2 kHz but always below 3 kHz.

Call type I43.6

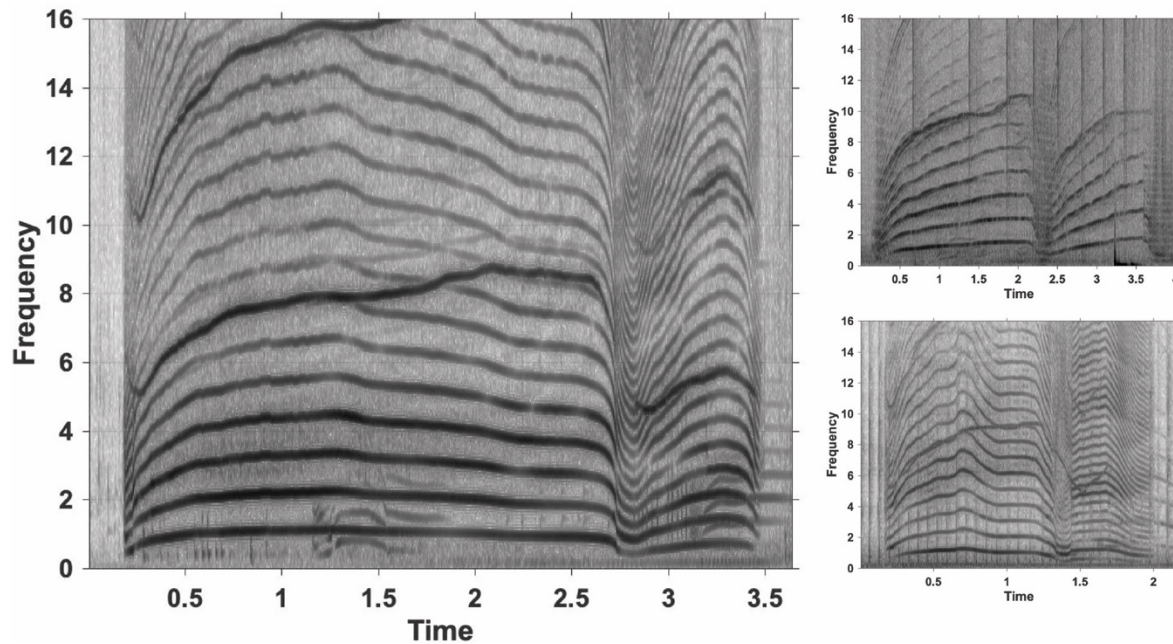*Table 24: Summary of measurements of call type I43.6. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	6	0.93	20.08	0.61	1.17
Start frequency	6	1.17	7.34	1.10	1.30
End frequency	5	1.43	6.27	1.29	1.54
Mid frequency	6	0.48	8.09	0.45	0.56
Minimum frequency	5	0.46	5.64	0.43	0.50
Maximum frequency	5	1.40	11.95	1.12	1.57
Total number of calls	25				
Recording events	6				

Call type I43.6 appears to have a LFC and HFC. The call type is very similar to subtype I43.5 but has an added part at the start composed of clicks, which seem overlapped by a HFC. The second part corresponds to the first part in subtype I43.5 but is much shorter.

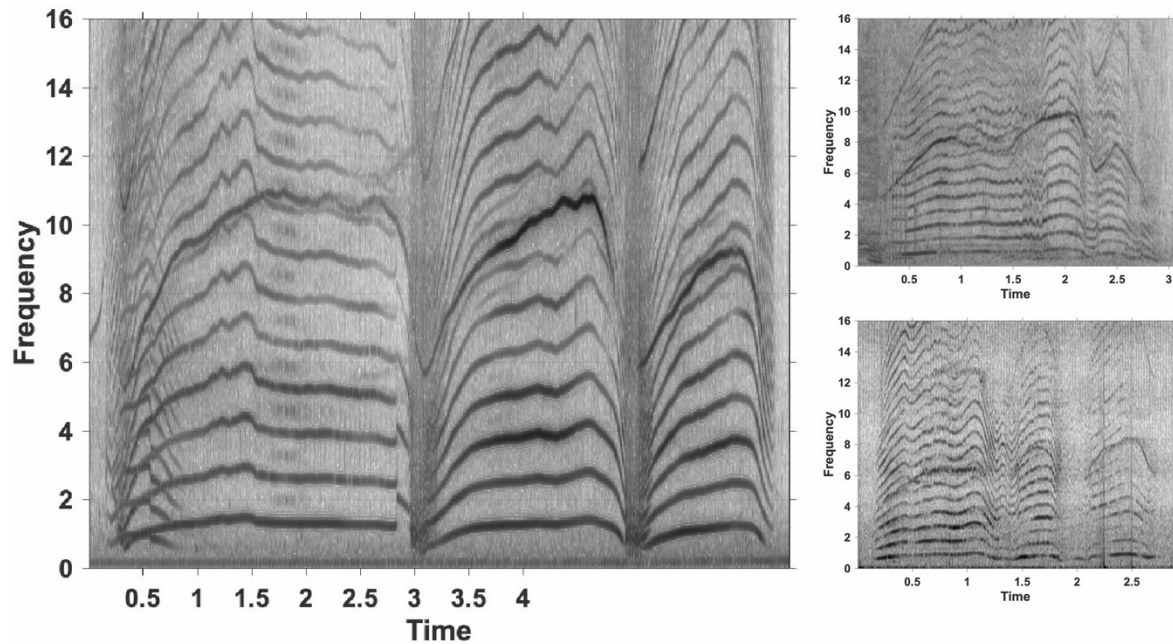Measurements were taken excluding the clicks at the start.

Call type I43.7

Table 25: Summary of measurements of call type I43.7. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	88	0.44	25.10	0.19	0.79
Start frequency	88	1.25	33.06	0.71	2.48
End frequency	75	1.46	16.77	0.78	2.23
Mid frequency	88	0.59	61.91	0.18	1.95
Minimum frequency	84	0.41	23.66	0.15	0.61
Maximum frequency	78	1.57	23.08	1.07	3.14
Total number of calls	131				
Recording events	15				

Call type I43.7 has both a LFC and a HFC. The HFC starts before the LFC and ends soon after the start of the LFC. The HFC is relatively flat in contour with a short increase in frequency at the start and sometimes also at the end.

In all call types measurements were only taken of the LFC. For consistency, measurements of call type I43.7 also only include the LFC. It should be noted that this affects the measured duration.

Call type I43.8

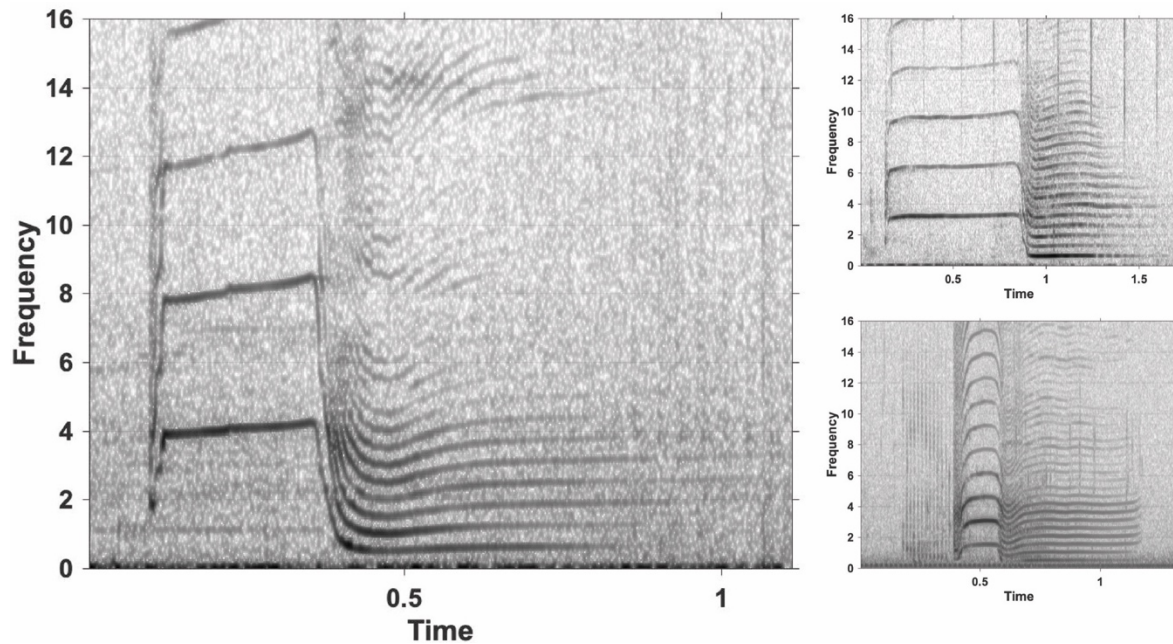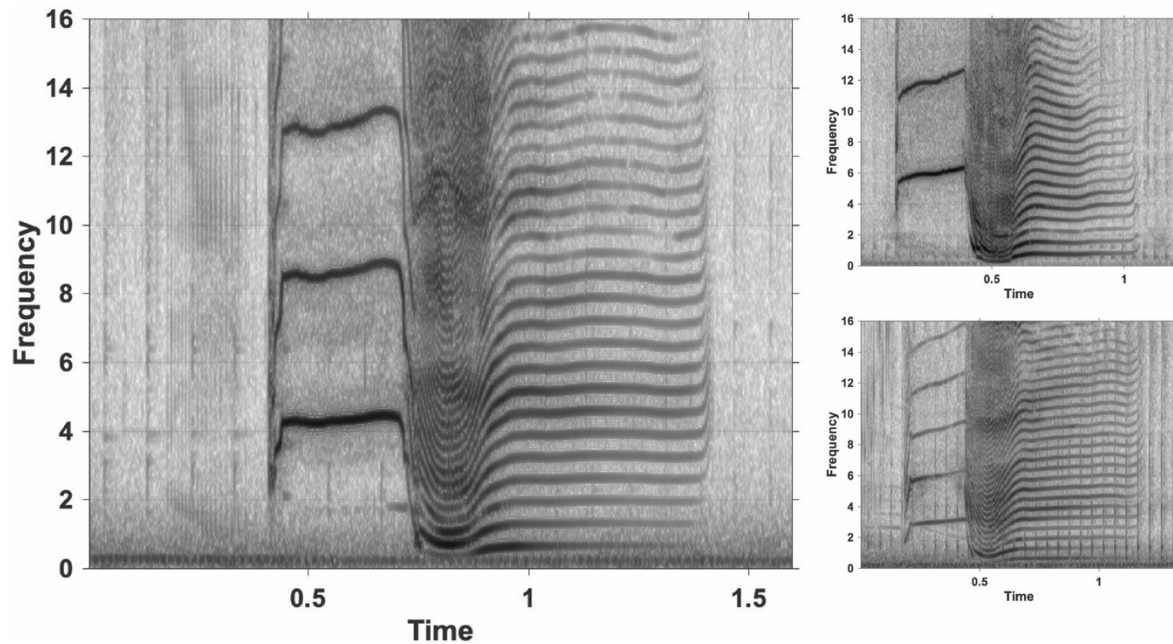*Table 26: Summary of measurements of call type I43.8. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	50	0.88	33.34	0.60	2.17
Start frequency	50	1.00	16.24	0.61	1.37
End frequency	48	1.59	16.30	0.80	2.18
Mid frequency	50	1.00	38.43	0.37	1.73
Minimum frequency	47	0.49	19.82	0.33	0.96
Maximum frequency	50	1.60	15.56	1.16	2.16
Total number of calls	75				
Recording events	13				

Call type I43.8 is an upsweep call with both a LFC and a HFC. The call type has three parts. The first and the third part are similar in frequency but separated by the second, lower frequency part. The HFC only extends over the duration of the first part and is an upsweep contour.

Call type I43.9

Table 27: Summary of measurements of call type I43.9. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	70	0.91	39.17	0.55	1.95
Start frequency	70	1.20	54.71	0.59	4.99
End frequency	60	1.43	19.49	0.69	2.19
Mid frequency	69	1.32	49.20	0.33	5.81
Minimum frequency	47	0.40	28.80	0.19	0.65
Maximum frequency	66	1.79	47.77	1.03	5.81
Total number of calls	112				
Recording events	21				

Call type I43.9 has a LFC only. The call type is similar in structure to subtype I43.8 but lacks the HFC.
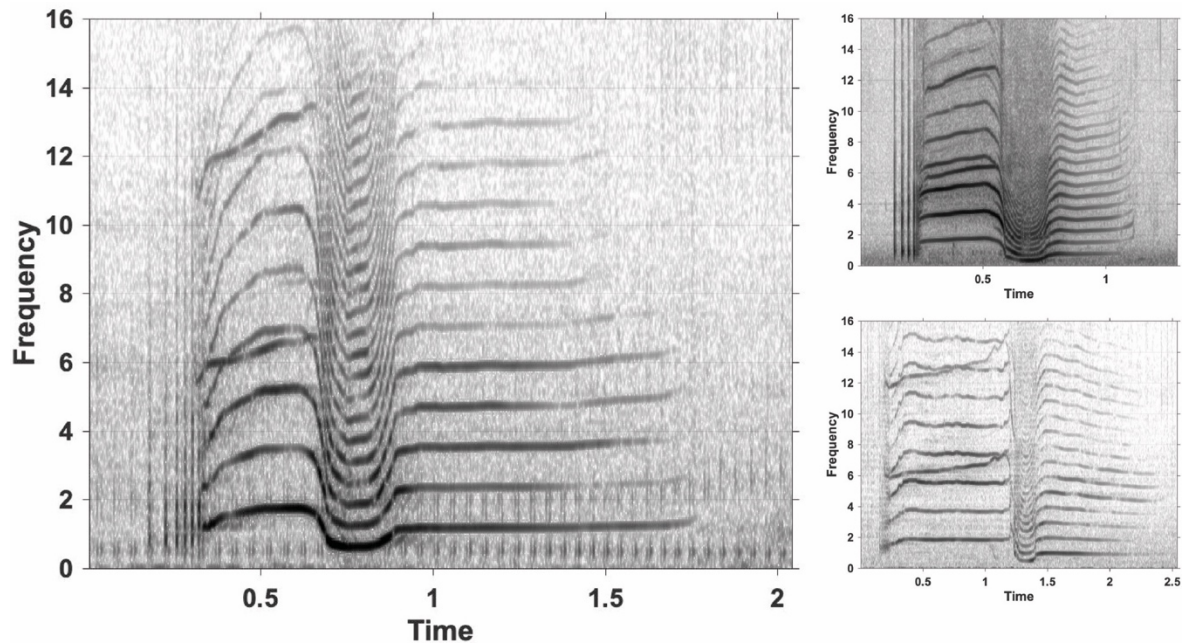
Call type I44

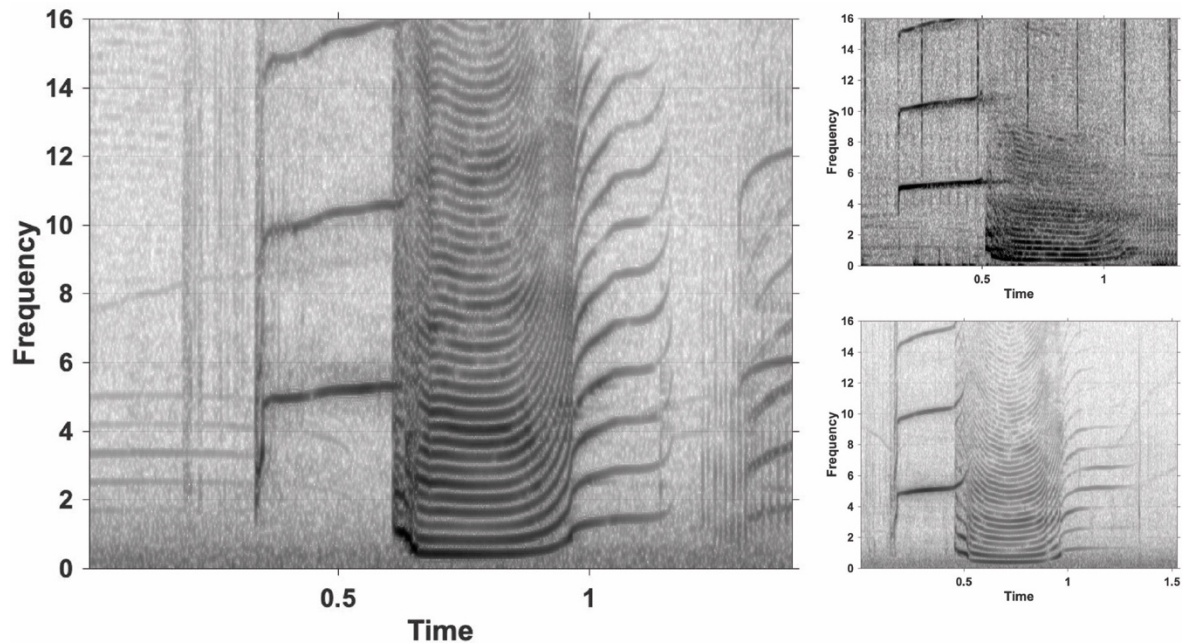*Table 28: Summary of measurements of call type I44. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	273	0.92	38.08	0.34	2.40
Start frequency	271	1.69	29.09	0.61	4.18
End frequency	207	0.86	42.08	0.37	2.16
Mid frequency	273	0.84	32.48	0.48	1.91
Minimum frequency	235	0.55	22.27	0.36	1.15
Maximum frequency	272	1.84	25.51	0.99	4.29
Total number of calls	690				
Recording events	54				

Call type I44 is highly variable. Most examples only have a LFC but some examples appear to have an added HFC but it is often not clear (see main spectrogram). The LFC is often downsweep but sometimes also relatively stable. The call type is distinguished by a unique, short first part, which is especially clear when listening to the calls. The first part is sometimes separated by a short pause.

Measurements were taken of the entire call, including the short pause if present.

Call type I45

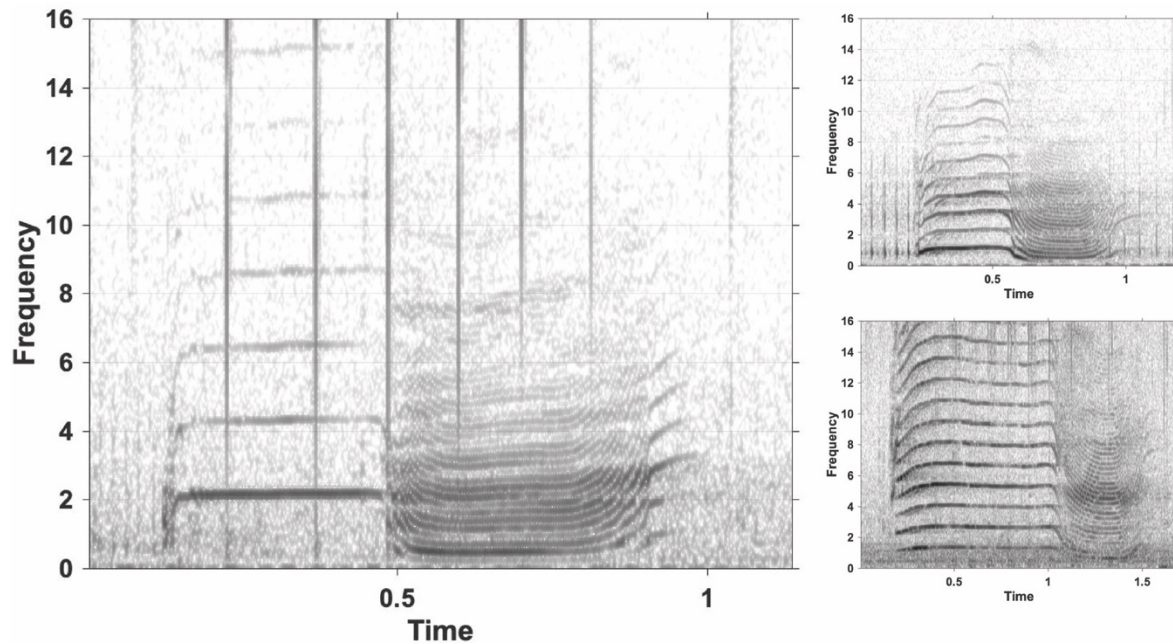*Table 29: Summary of measurements of call type I45. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	812	0.93	45.72	0.22	2.57
Start frequency	809	0.73	27.14	0.20	1.53
End frequency	758	1.01	25.04	0.04	1.96
Mid frequency	812	0.96	15.45	0.54	1.64
Minimum frequency	774	0.69	25.52	0.27	1.24
Maximum frequency	811	1.12	17.41	0.64	1.96
Total number of calls	1111				
Recording events	54				

Call type I45 has a LFC only. The call type is very simple in structure but highly variable. The call type is distinguished by clicks at the start, followed by a very simple, usually slightly downsweep contour. However, in some cases the contour is very straight or even slightly upsweep.

Measurements were taken excluding the clicks at the start.

Call type I46
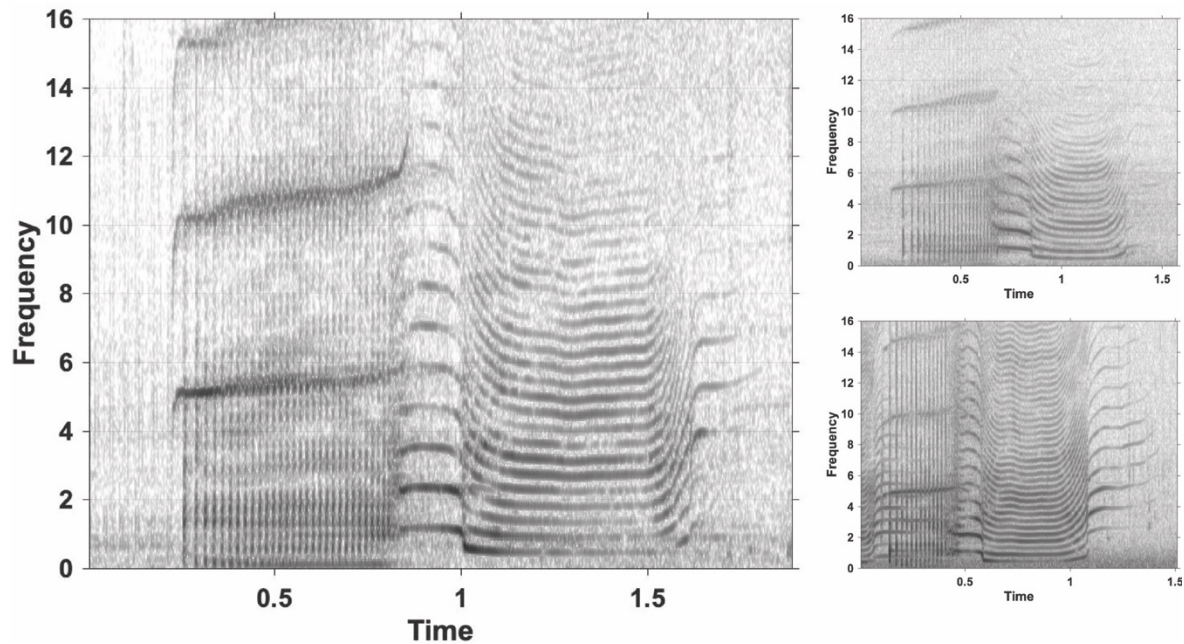

Table 30: Summary of measurements of call type I46. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	47	0.28	14.29	0.17	0.39
Start frequency	47	1.24	18.78	0.35	1.66
End frequency	46	1.09	23.87	0.65	2.02
Mid frequency	47	0.92	19.47	0.65	1.91
Minimum frequency	47	0.77	13.96	0.33	0.98
Maximum frequency	47	1.56	24.39	1.00	2.54
Total number of calls	68				
Recording events	5				

Call type I46 has a LFC only. The call type is short in duration and has little frequency modulation, except for one or two shifts at the start. Sometimes the frequency shift is separated by a short pause.

Measurements were taken of the entire call, including the short pause if present.

Call type I47

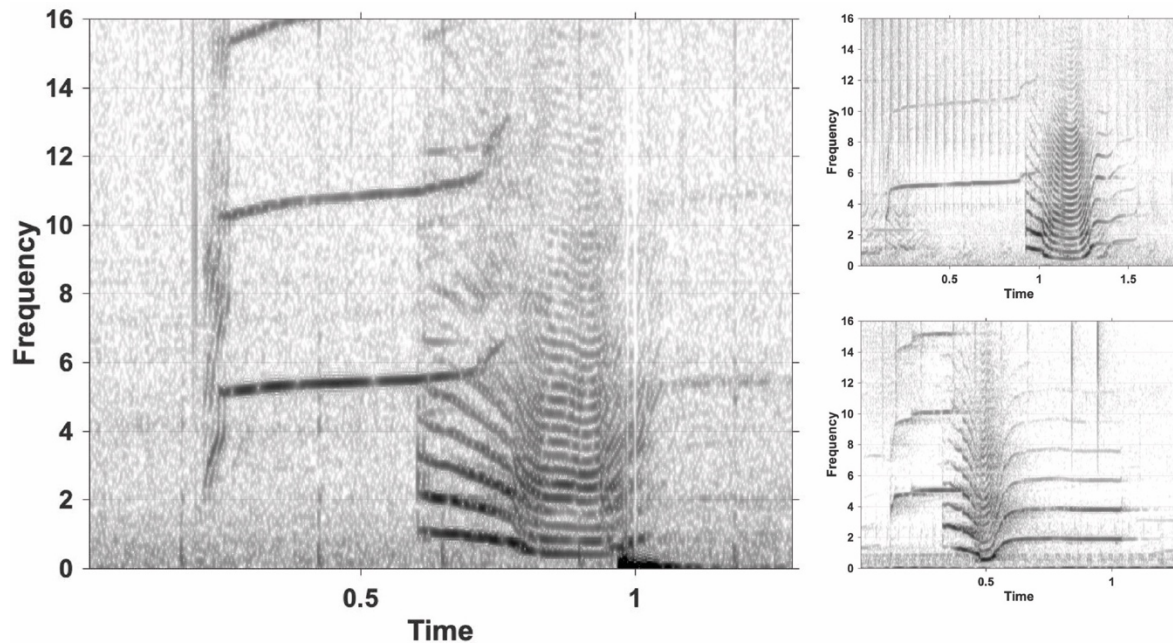*Table 31: Summary of measurements of call type I47. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	49	0.97	13.69	0.64	1.33
Start frequency	49	0.80	11.82	0.63	1.10
End frequency	47	1.32	29.01	0.88	2.31
Mid frequency	49	1.27	11.64	0.92	1.55
Minimum frequency	49	0.81	10.21	0.59	1.01
Maximum frequency	49	1.45	20.28	1.01	2.27
Total number of calls	51				
Recording events	1				

Call type I47 is an upsweep call with both a LFC and a HFC. The call type starts with clicks, followed by a mostly straight or upsweep contour, which usually has an increase in frequency at the very end. The HFC starts after the clicks, is upsweep in contour and ends before the LFC.

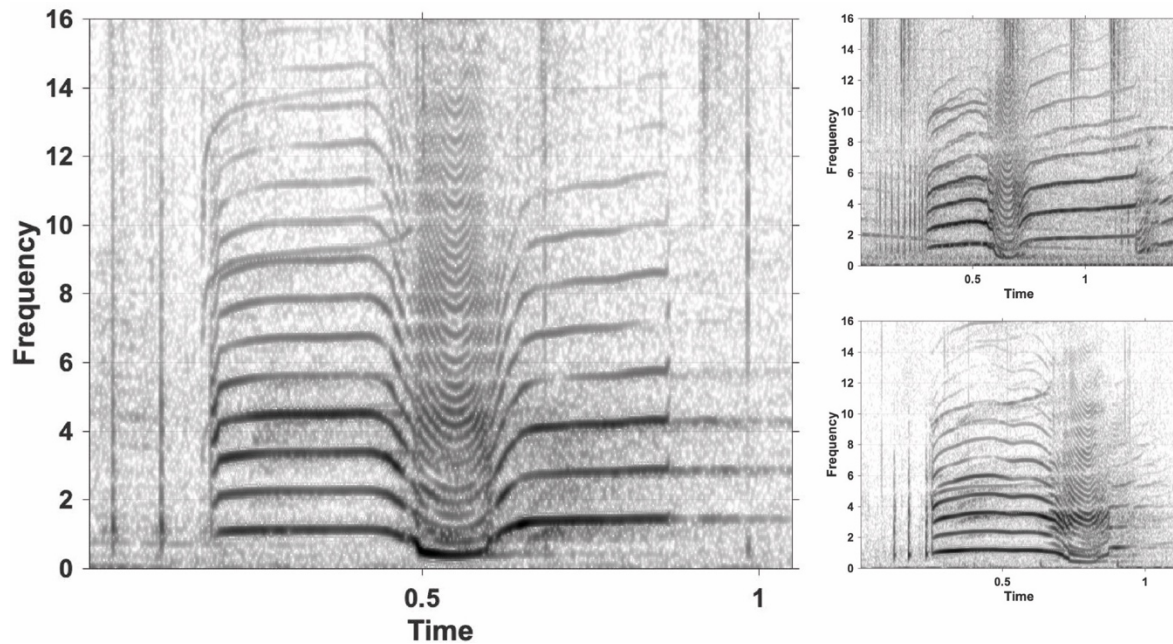Measurements were taken excluding the clicks at the start.

Call type I48.1

Table 32: Summary of measurements of call type I48.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	118	0.91	42.30	0.31	2.00
Start frequency	118	0.91	21.03	0.38	1.94
End frequency	108	0.79	25.17	0.27	1.77
Mid frequency	118	0.70	16.95	0.31	1.20
Minimum frequency	116	0.66	17.41	0.29	1.00
Maximum frequency	118	1.02	16.88	0.76	1.92
Total number of calls	157				
Recording events	17				

Call type I48.1 has a LFC only. The call type starts with clicks and the main contour is characterised by a short downward shift in frequency at the start.

Measurements were taken excluding the clicks at the start.

Call type I48.2

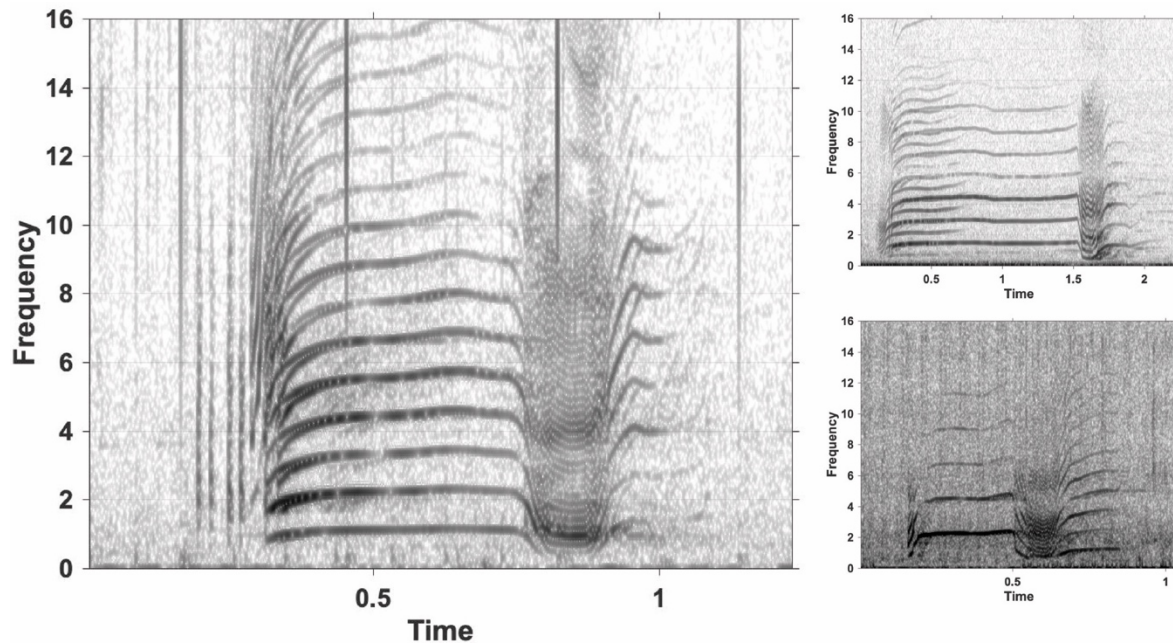*Table 33: Summary of measurements of call type I48.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	10	0.60	16.77	0.35	0.67
Start frequency	10	1.23	5.17	1.14	1.32
End frequency	10	1.24	17.31	0.98	1.76
Mid frequency	10	0.91	15.56	0.70	1.18
Minimum frequency	10	0.57	9.80	0.50	0.67
Maximum frequency	10	1.37	14.05	1.14	1.78
Total number of calls	16				
Recording events	3				

Call type I48.2 has a LFC only. It is similar in structure to subtype I48.1 but has an additional distinct dip in frequency.

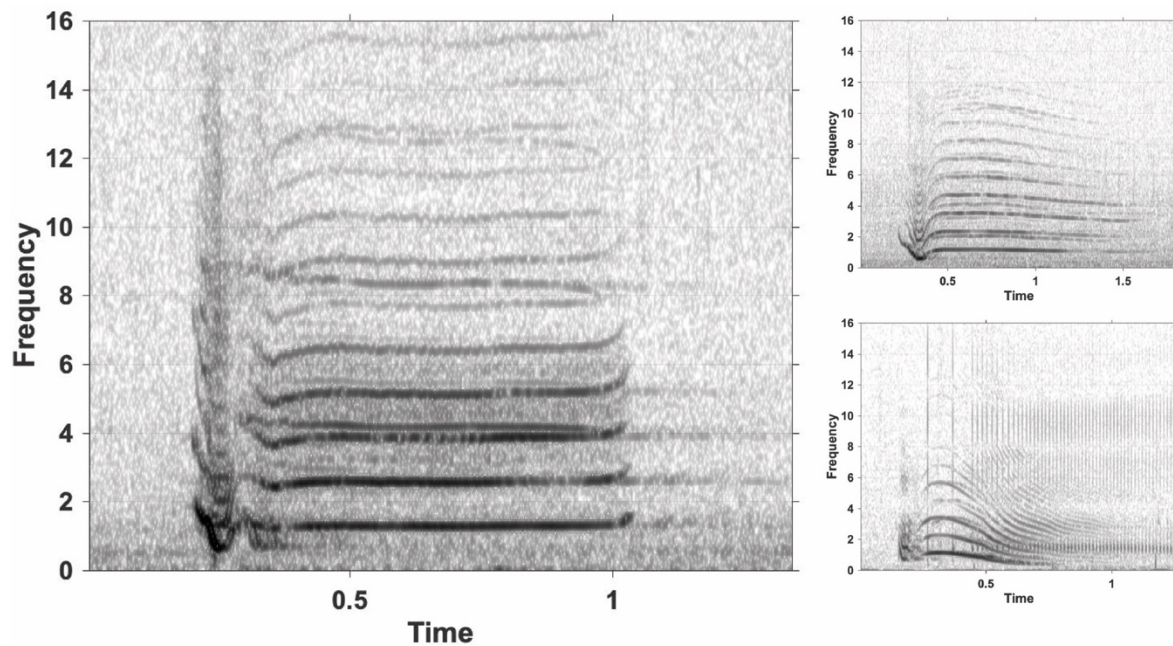Measurements were taken excluding the clicks at the start.

Call type I48.3

Table 34: Summary of measurements of call type I48.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	6	1.00	43.39	0.59	1.76
Start frequency	6	0.89	25.43	0.44	1.05
End frequency	4	1.02	17.88	0.82	1.20
Mid frequency	6	1.03	8.01	0.96	1.17
Minimum frequency	4	0.81	25.07	0.51	0.94
Maximum frequency	6	1.54	9.00	1.39	1.70
Total number of calls	32				
Recording events	8				

Call type I48.3 has a LFC only. It is very similar in structure to subtype I48.1. However, the call type is not always preceded by clicks and the frequency shift at the start of the main contour is more pronounced.

Measurements were taken excluding the clicks at the start if present.
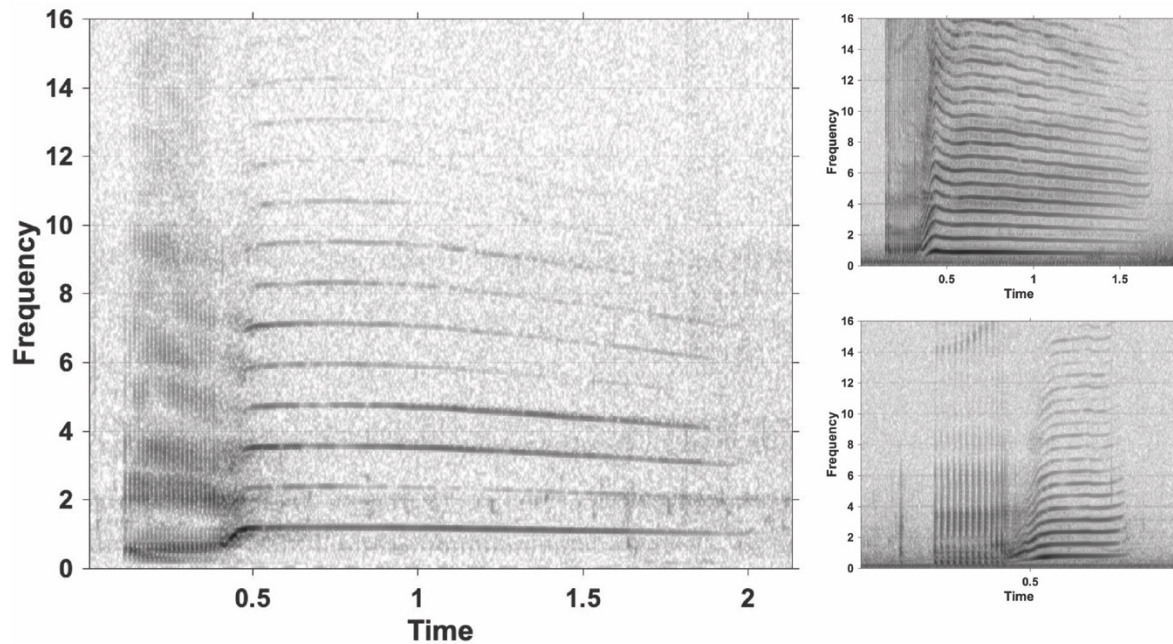
Call type I49.1

Table 35: Summary of measurements of call type I49.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	16	0.99	33.41	0.65	1.80
Start frequency	9	0.55	24.00	0.35	0.67
End frequency	16	0.70	20.67	0.46	1.18
Mid frequency	16	0.65	14.66	0.50	0.96
Minimum frequency	15	0.22	19.30	0.16	0.32
Maximum frequency	16	0.71	20.20	0.52	1.20
Total number of calls	71				
Recording events	10				

Call type I49.1 has a LFC only. It is characterised by a small down and up shift in frequency at the start, which sometimes could also be a series of clicks.
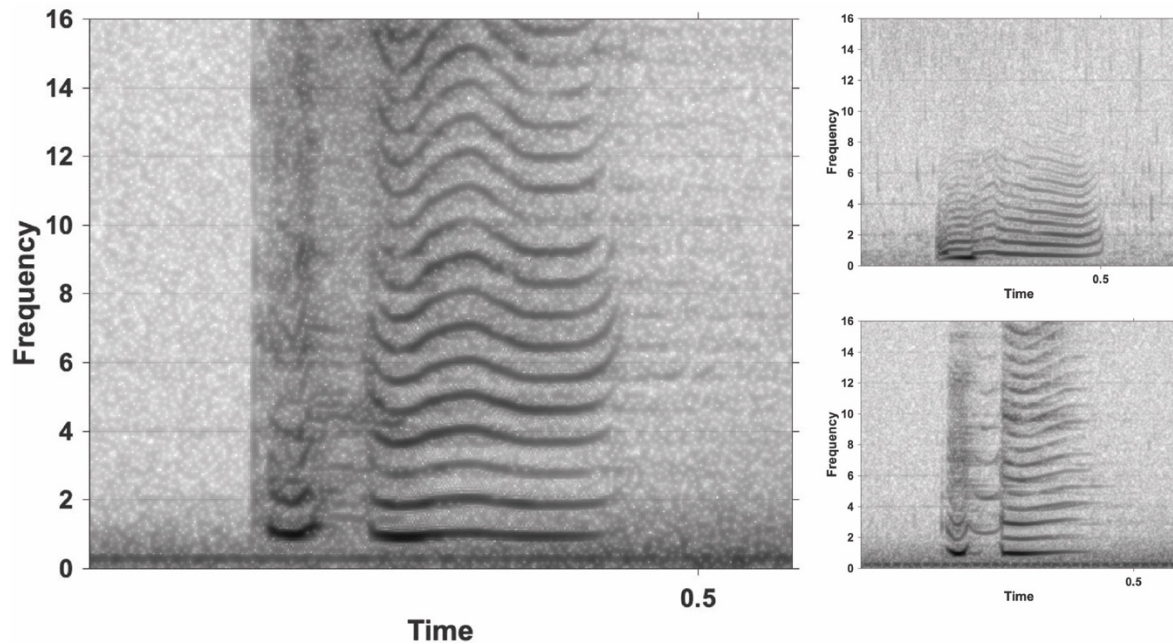
Call type I49.2

Table 36: Summary of measurements of call type I49.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	13	1.18	38.08	0.66	2.06
Start frequency	9	0.31	24.17	0.21	0.47
End frequency	13	0.81	16.80	0.59	1.03
Mid frequency	13	0.69	10.94	0.60	0.81
Minimum frequency	10	0.31	19.43	0.20	0.42
Maximum frequency	13	0.82	16.18	0.62	1.05
Total number of calls	47				
Recording events	10				

Call type I49.2 is an upsweep call with a LFC only. The call type is similar to subtype I49.1 but is missing the first part.
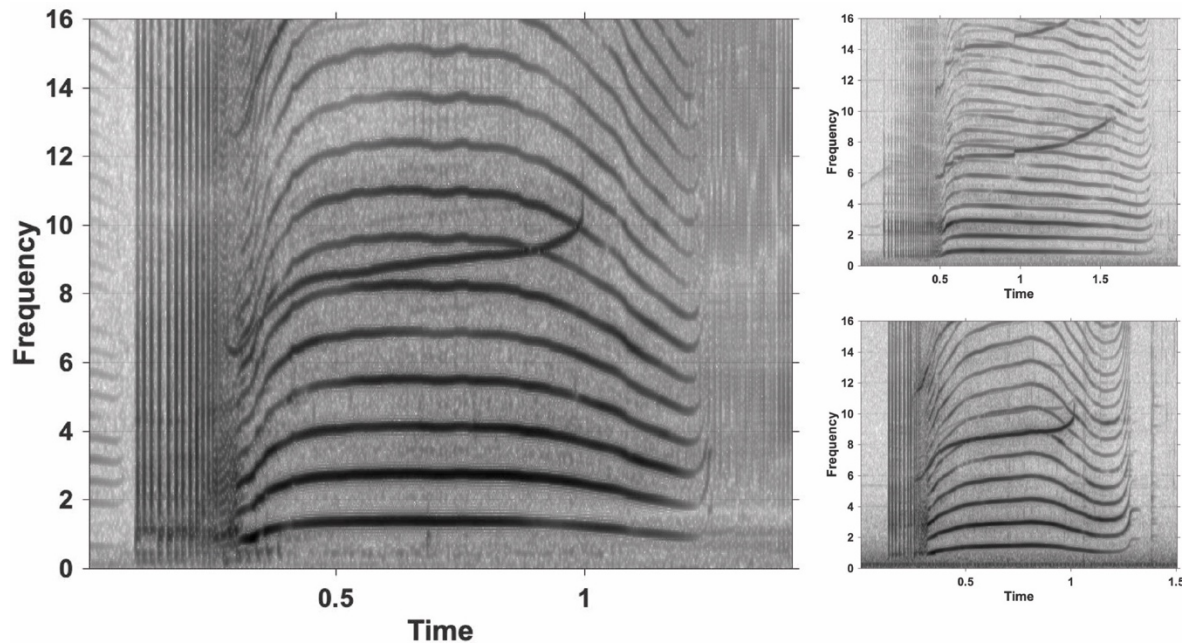
Call type I50

Table 37: Summary of measurements of call type I50. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	5	0.58	23.85	0.40	0.75
Start frequency	5	0.72	16.98	0.52	0.80
End frequency	4	1.24	11.88	1.09	1.41
Mid frequency	5	1.11	16.29	0.84	1.28
Minimum frequency	5	0.60	7.28	0.56	0.67
Maximum frequency	4	1.24	12.65	1.07	1.41
Total number of calls	6				
Recording events	2				

Call type I50 is an upsweep call with a LFC only. The call type has a flat contour with a slight upward frequency shift.
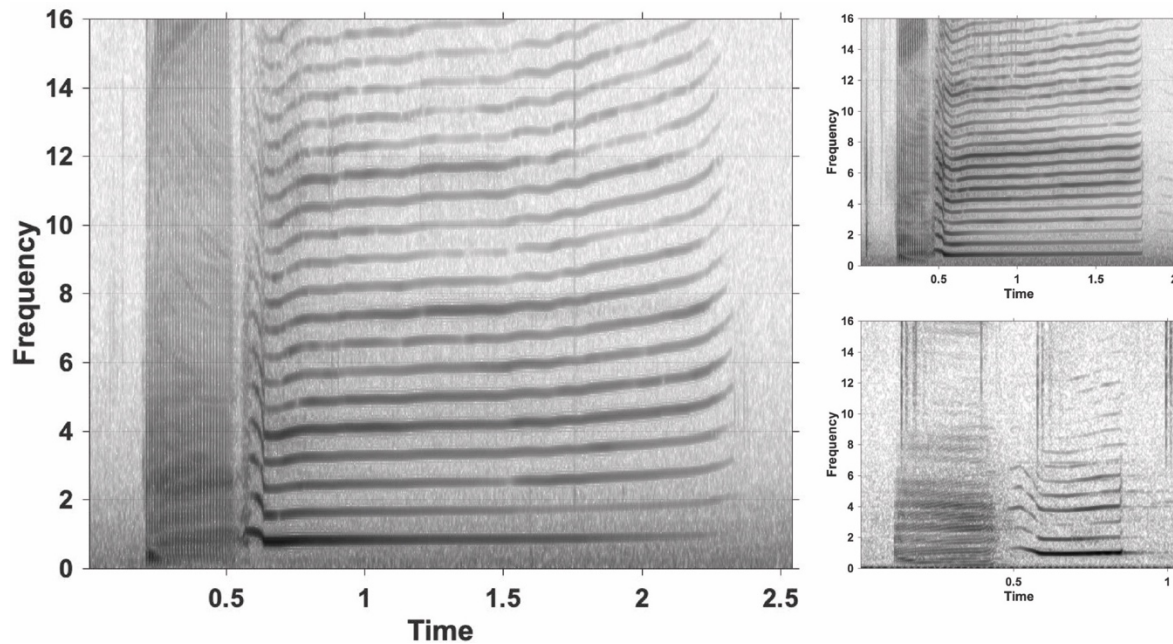
Call type I51

Table 38: Summary of measurements of call type I51. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	216	0.69	26.46	0.18	1.54
Start frequency	216	0.66	29.96	0.23	2.22
End frequency	215	1.45	24.22	0.79	3.07
Mid frequency	216	1.30	23.25	0.76	2.76
Minimum frequency	216	0.62	20.92	0.23	1.00
Maximum frequency	215	1.46	23.95	0.84	3.04
Total number of calls	370				
Recording events	42				

Call type I51 is an upsweep call with a LFC only. The call type is preceded by a series of clicks and is very distinct when listened to.

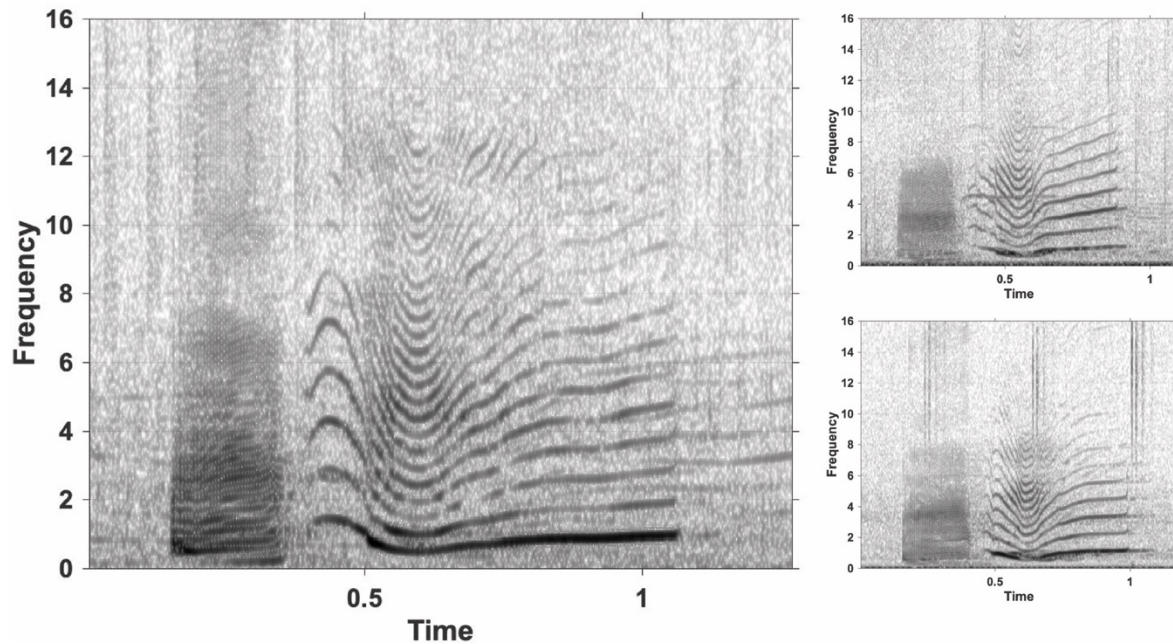Measurements were taken excluding the clicks at the start.

Call type I52

Table 39: Summary of measurements of call type I52. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	21	0.58	20.98	0.35	0.87
Start frequency	21	1.12	17.84	0.54	1.34
End frequency	21	1.49	19.59	0.93	2.17
Mid frequency	21	1.34	9.55	0.99	1.60
Minimum frequency	21	1.11	19.08	0.49	1.31
Maximum frequency	21	1.56	16.60	1.12	2.31
Total number of calls	32				
Recording events	8				

Call type I52 has a LFC only. The call type starts with a series of clicks followed by a relatively flat contour, which is sometimes slightly upsweep. In some examples it appears that the call has an added HFC (see lower right example) but it is not clear.

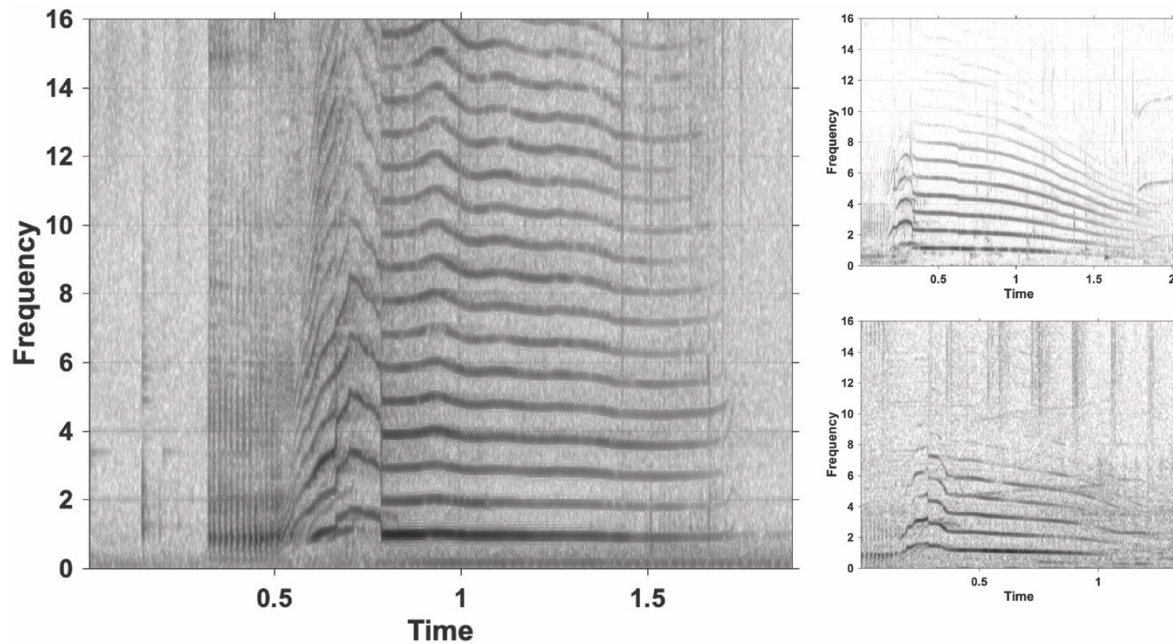Measurements were taken excluding the clicks at the start.

Call type I53.1

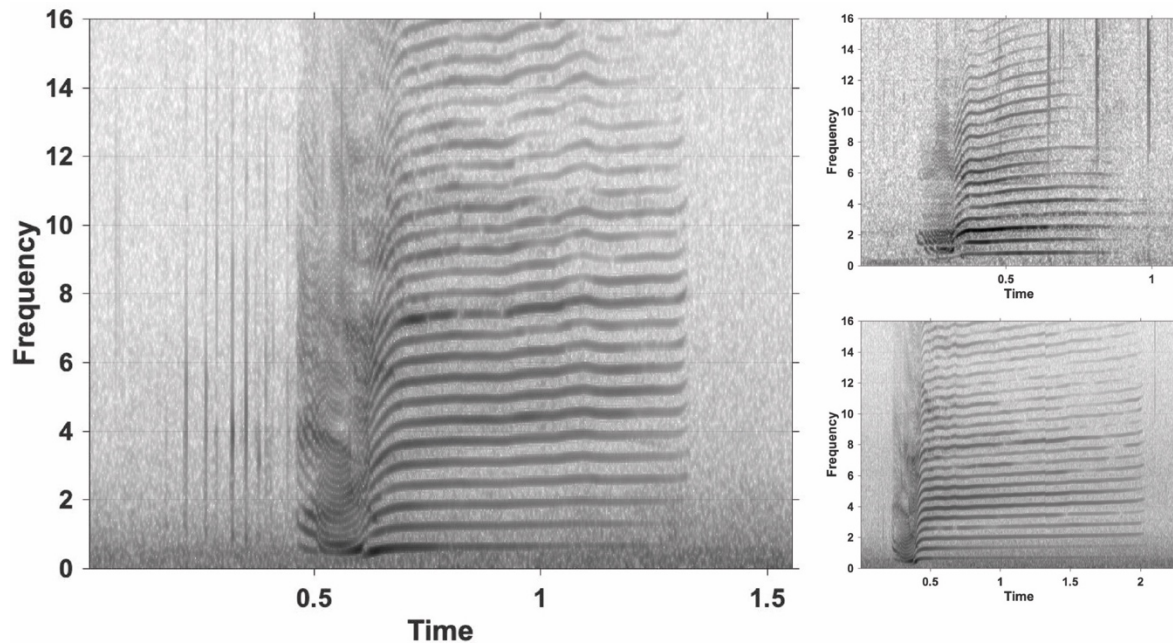*Table 40: Summary of measurements of call type I53.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	85	0.63	27.22	0.38	1.20
Start frequency	74	0.46	33.53	0.27	1.07
End frequency	85	1.81	30.73	0.79	2.85
Mid frequency	85	1.50	29.90	0.73	2.54
Minimum frequency	74	0.44	31.56	0.29	1.11
Maximum frequency	85	1.82	30.76	0.79	2.89
Total number of calls	214				
Recording events	26				

Call type I53.1 is an upsweep call with a LFC only. The call type has a distinct upward frequency shift at the start.
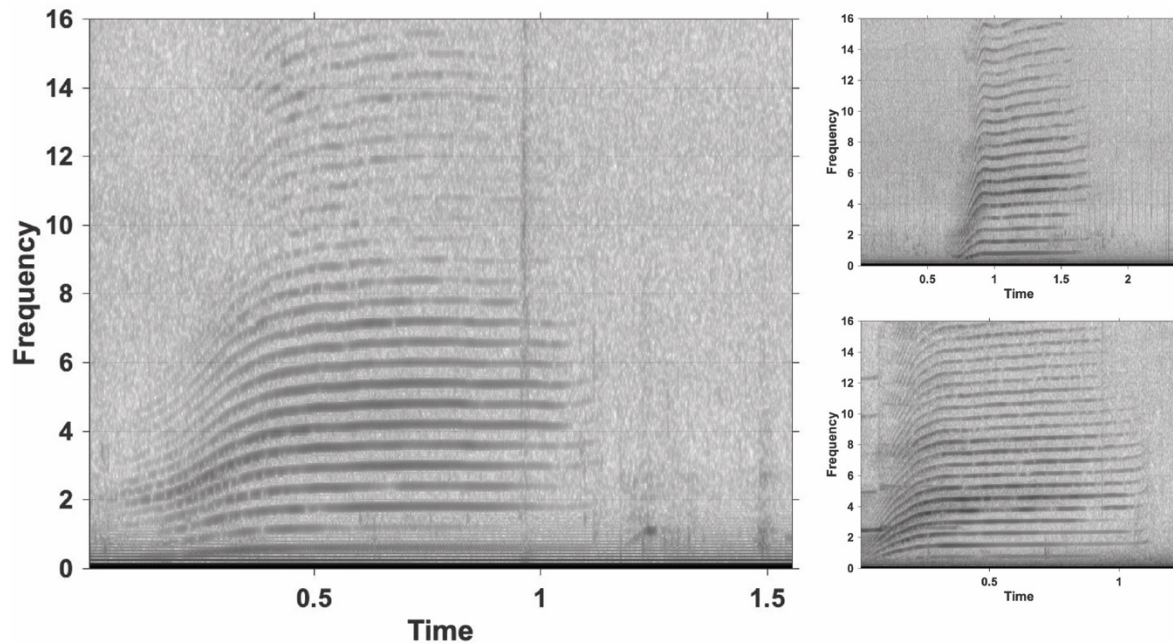
Call type I53.2

Table 41: Summary of measurements of call type I53.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	43	0.82	33.42	0.51	1.75
Start frequency	40	0.45	17.24	0.35	0.74
End frequency	42	2.09	19.12	1.30	3.32
Mid frequency	43	1.53	13.49	1.15	2.05
Minimum frequency	40	0.45	13.06	0.36	0.70
Maximum frequency	42	2.11	18.27	1.32	3.33
Total number of calls	113				
Recording events	13				

Call type I53.2 is an upsweep call with both a LFC and a HFC. The call type is very similar in structure to subtype I53.1 but has an added HFC.
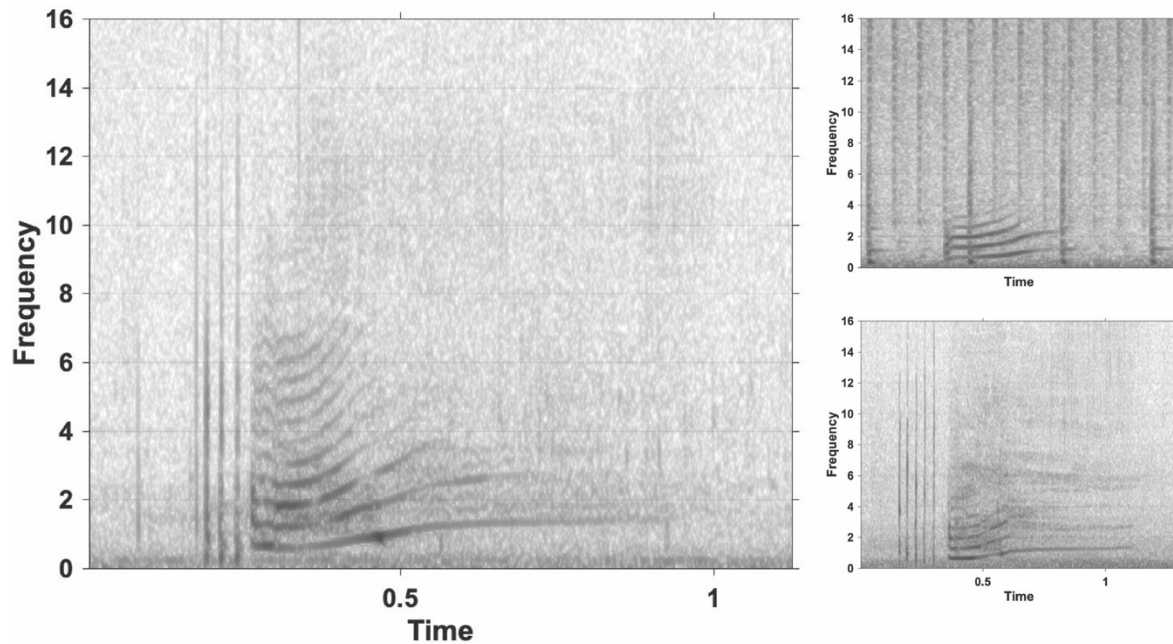
Call type I54.1

Table 42: Summary of measurements of call type I54.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	121	1.15	37.18	0.56	2.37
Start frequency	121	2.32	16.39	1.41	3.58
End frequency	107	0.60	18.72	0.33	0.92
Mid frequency	121	0.92	45.67	0.36	2.12
Minimum frequency	114	0.59	18.45	0.34	0.80
Maximum frequency	121	2.34	15.22	1.39	3.58
Total number of calls	216				
Recording events	19				

Call type I54.1 is a downsweep call with a LFC only. The call type is characterised by a clear downward frequency shift, which sometimes includes small additional up and down shifts.
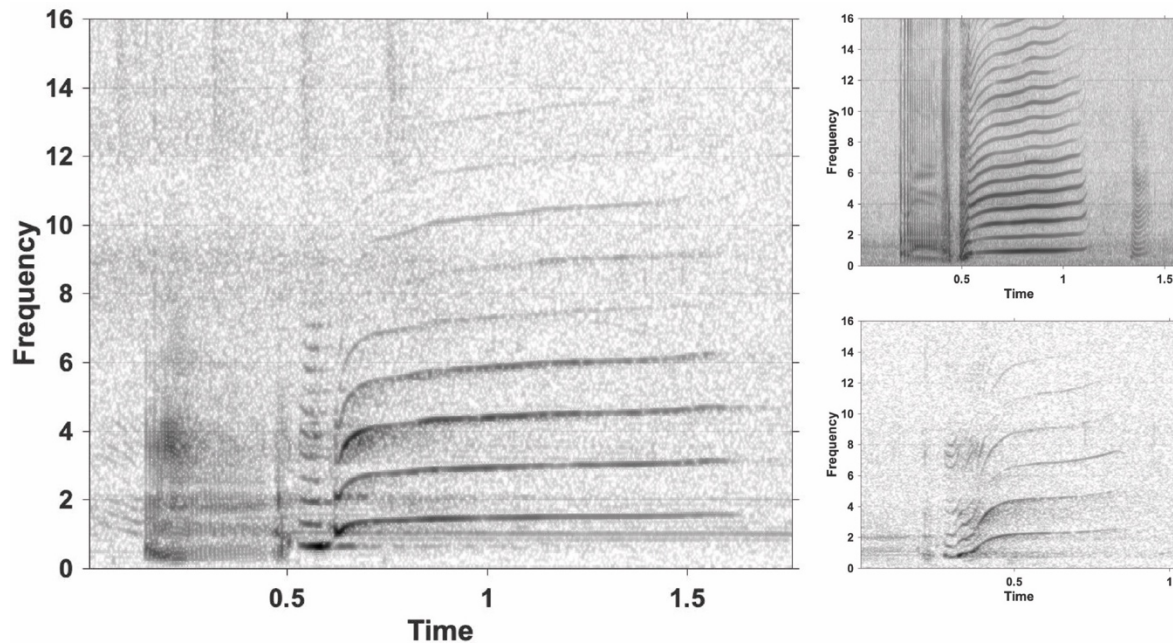
Call type I54.2

Table 43: Summary of measurements of call type I54.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	54	1.07	26.53	0.57	1.78
Start frequency	54	2.42	7.64	1.95	2.86
End frequency	47	0.50	16.77	0.30	0.69
Mid frequency	54	0.85	55.73	0.39	1.88
Minimum frequency	51	0.49	15.72	0.31	0.64
Maximum frequency	54	2.45	5.98	2.14	2.88
Total number of calls	96				
Recording events	10				

Call type I54.2 is a downsweep call with a LFC only. The call type is similar to subtype I54.1 but has a distinct second downward frequency shift.
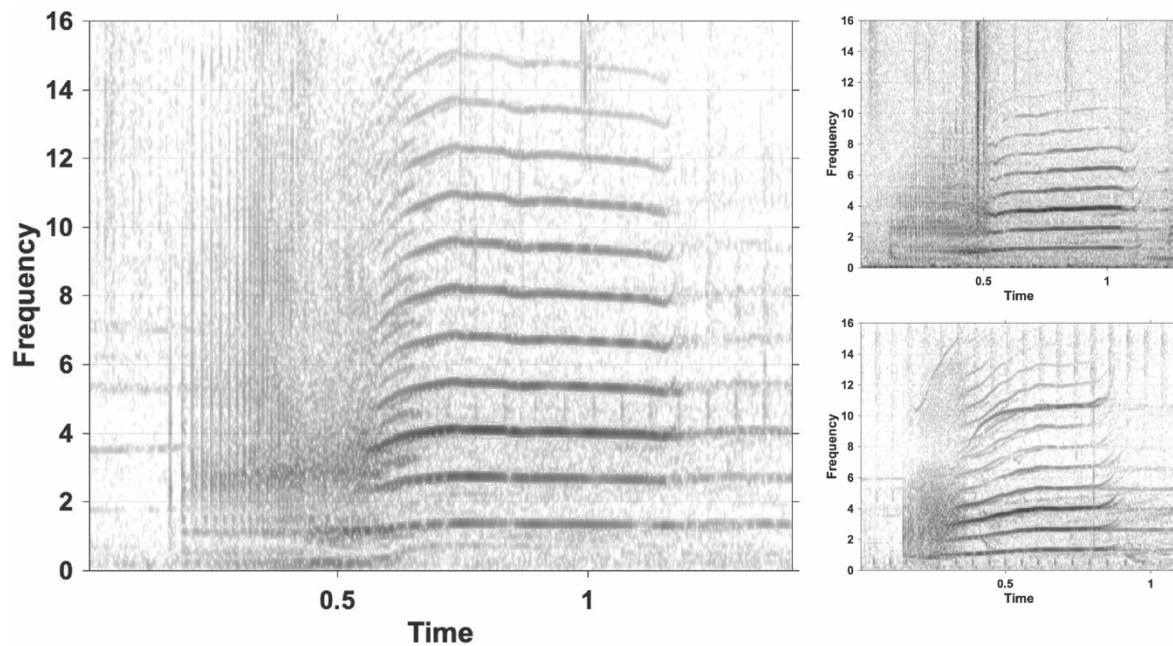
Call type I54.3

Table 44: Summary of measurements of call type I54.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	10	0.92	29.56	0.56	1.41
Start frequency	10	2.43	10.88	2.06	2.88
End frequency	10	0.49	33.91	0.33	0.86
Mid frequency	10	1.24	37.61	0.52	2.02
Minimum frequency	10	0.49	32.78	0.35	0.86
Maximum frequency	10	2.46	10.65	2.16	2.94
Total number of calls	11				
Recording events	6				

Call type I54.3 is a downsweep call with a LFC only. The call type is similar to subtypes I54.1 and I54.2 but has three distinct downward shifts in frequency.

Call type I55

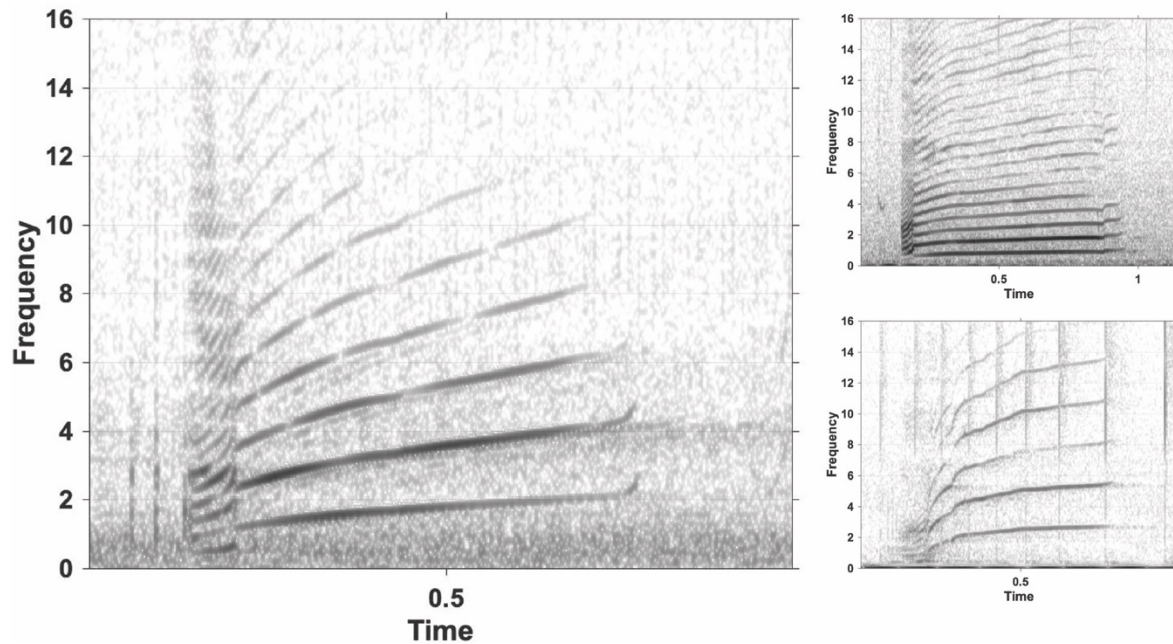*Table 45: Summary of measurements of call type I55. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	35	0.67	30.18	0.26	1.16
Start frequency	31	0.76	42.10	0.23	1.49
End frequency	33	0.93	15.78	0.65	1.24
Mid frequency	35	1.68	16.49	1.17	2.35
Minimum frequency	30	0.68	33.19	0.24	0.99
Maximum frequency	34	1.90	16.99	1.31	3.16
Total number of calls	67				
Recording events	16				

Call type I55 has a LFC only. The call type has a simple contour, first increasing and then decreasing in frequency.
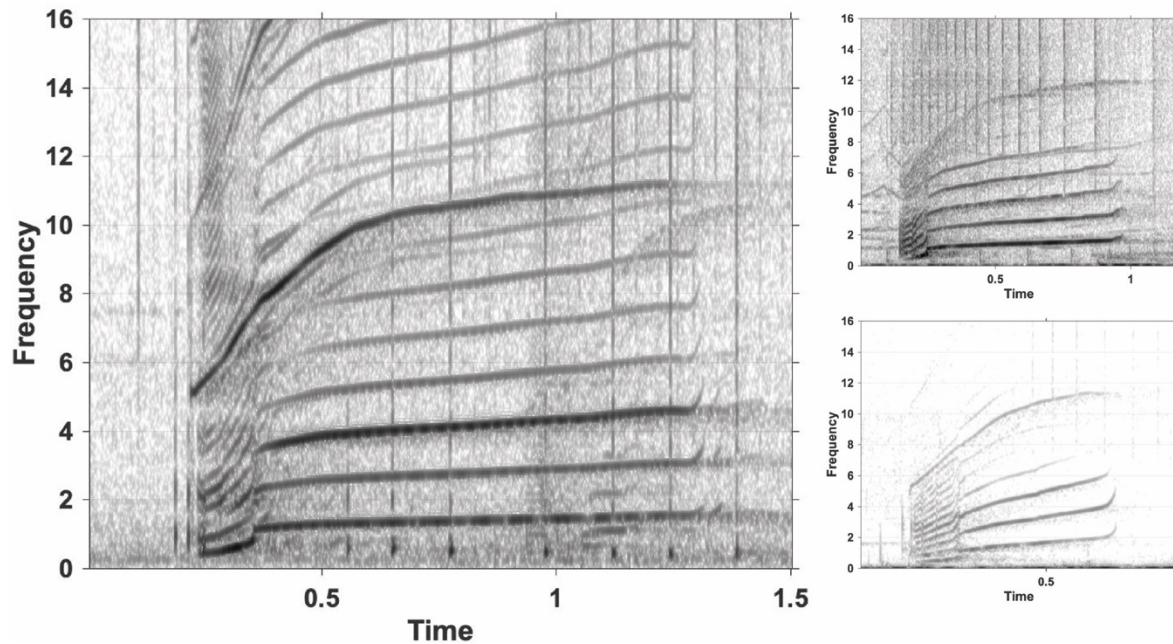
Call type I56

Table 46: Summary of measurements of call type I56. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	5	0.66	2.23	0.65	0.68
Start frequency	5	0.94	16.98	0.76	1.09
End frequency	5	1.42	7.48	1.32	1.58
Mid frequency	5	1.16	3.19	1.13	1.22
Minimum frequency	5	0.93	19.17	0.73	1.20
Maximum frequency	5	1.45	7.01	1.35	1.59
Total number of calls	6				
Recording events	1				

Call type I56 has a LFC only. It is characterised by two frequency shifts at the start followed by a slightly upsweep contour.

All six examples of the call type are from the same recording and were recorded sequentially.
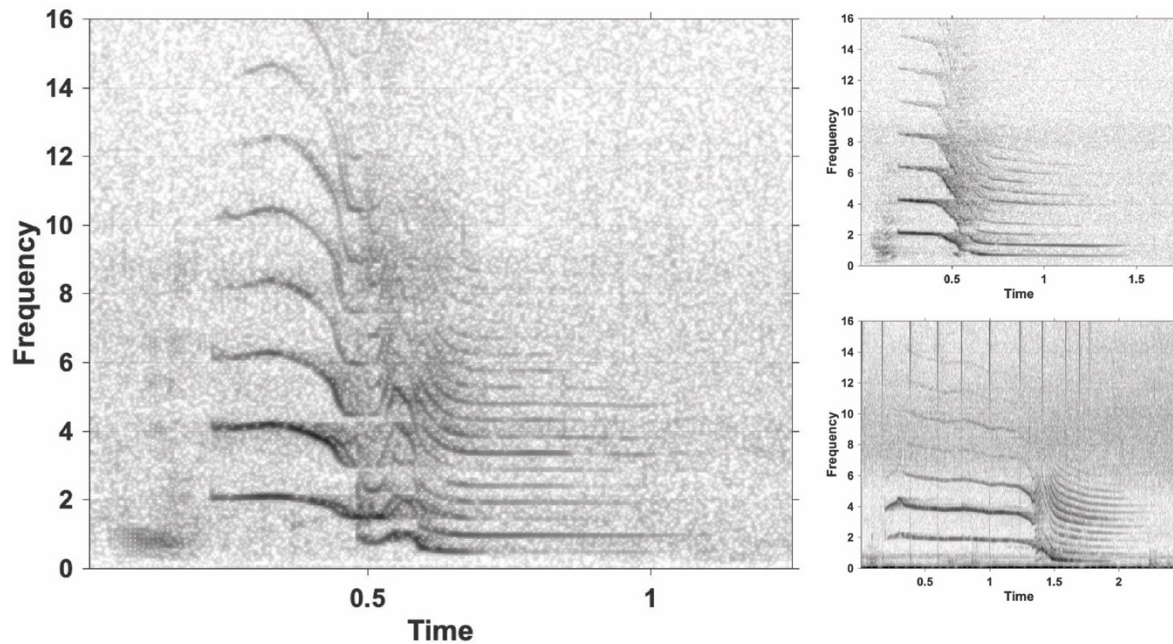
Call type I57

Table 47: Summary of measurements of call type I57. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	8	0.67	22.91	0.53	0.93
Start frequency	8	0.81	16.44	0.60	0.97
End frequency	8	0.75	8.89	0.63	0.82
Mid frequency	8	0.73	9.13	0.61	0.80
Minimum frequency	7	0.47	15.27	0.39	0.59
Maximum frequency	8	0.84	12.90	0.68	0.99
Total number of calls	25				
Recording events	5				

Call type I57 has a LFC only. The call type has a small frequency shift at the start but otherwise little frequency modulation.
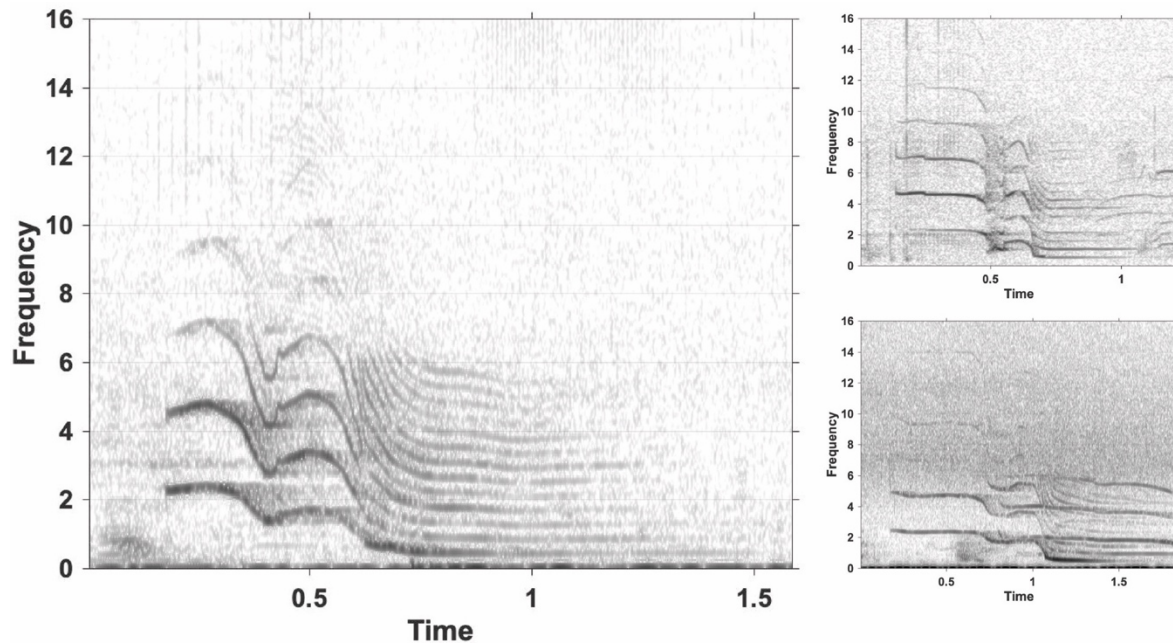
Call type I58

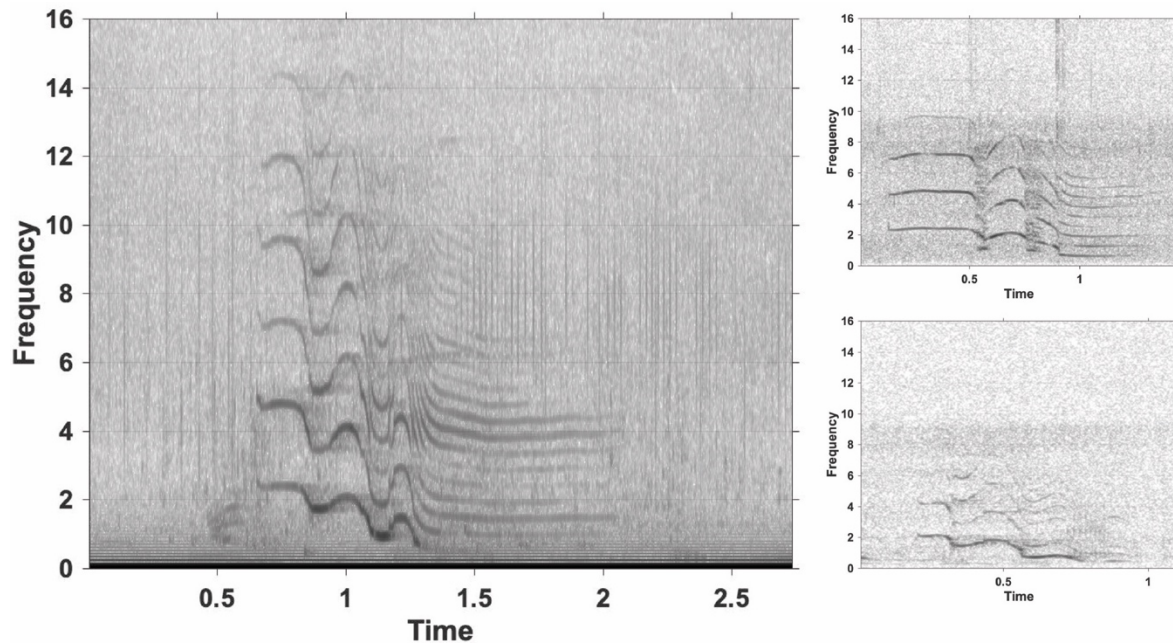*Table 48: Summary of measurements of call type I58. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	9	1.17	34.08	0.91	2.02
Start frequency	9	0.43	26.49	0.31	0.70
End frequency	9	0.99	19.70	0.76	1.34
Mid frequency	9	0.85	9.28	0.74	0.97
Minimum frequency	9	0.42	27.17	0.31	0.71
Maximum frequency	9	1.00	18.75	0.76	1.37
Total number of calls	67				
Recording events	14				

Call type I58 is an upsweep call with both a LFC and a HFC. The LFC is very simple. The HFC often has a small shift in frequency at the start and usually ends before the LFC.
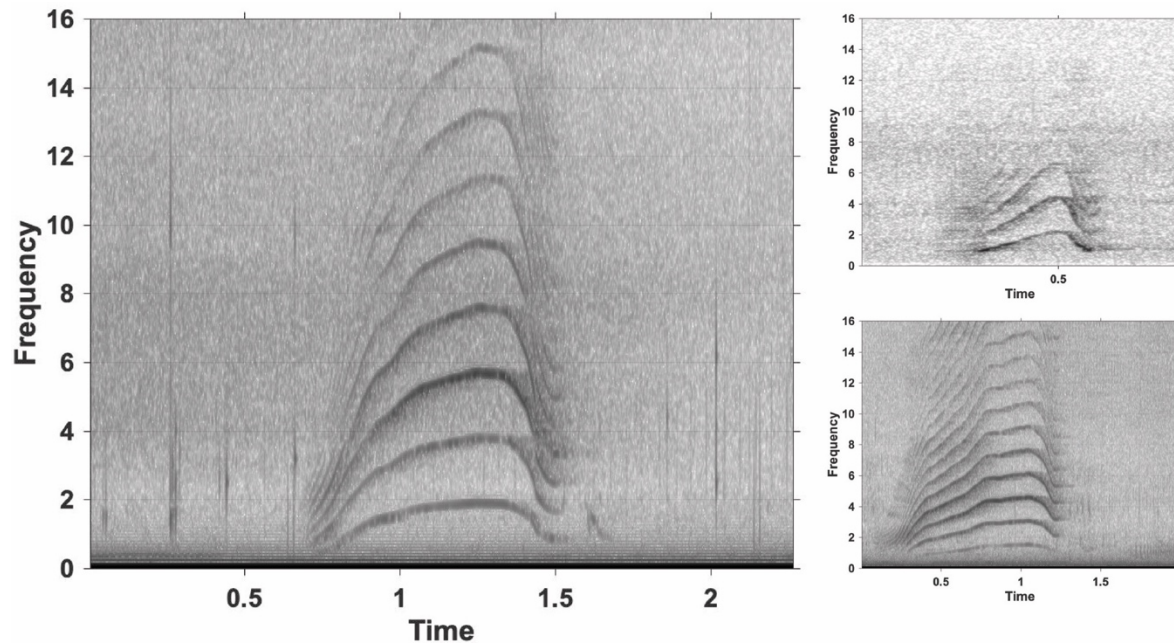
Call type I59.1

Table 49: Summary of measurements of call type I59.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	40	2.12	32.70	0.77	3.37
Start frequency	40	0.85	20.53	0.47	1.18
End frequency	40	1.74	32.61	0.36	3.13
Mid frequency	40	1.83	21.81	1.03	2.40
Minimum frequency	40	0.74	19.44	0.37	1.13
Maximum frequency	40	2.30	16.47	1.43	3.39
Total number of calls	102				
Recording events	22				

Call type I59.1 is an upsweep call with both a LFC and a HFC. The LFC is mostly upsweep but decreases slightly in frequency at the end. The HFC is also upsweep and decreases at the end. The call type is highly variable and regularly shows small frequency changes throughout the main LFC contour.
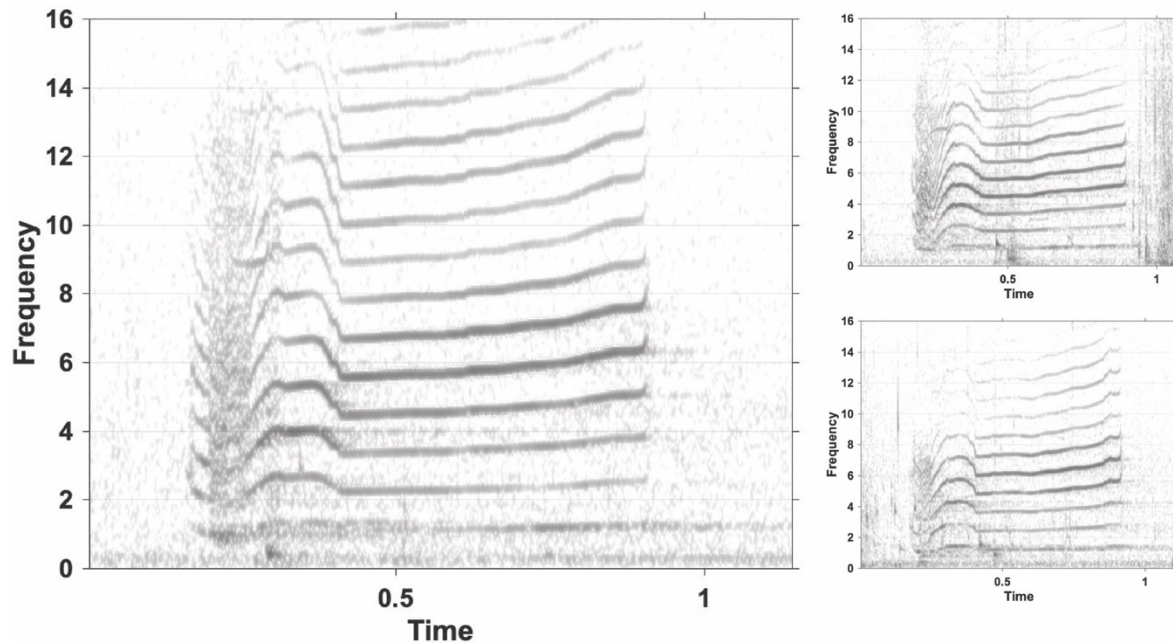
Call type I59.2

Table 50: Summary of measurements of call type I59.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	4	0.98	11.71	0.81	1.06
Start frequency	4	0.83	20.25	0.63	1.04
End frequency	4	2.32	12.81	2.04	2.69
Mid frequency	4	1.48	16.68	1.28	1.82
Minimum frequency	4	0.77	13.09	0.66	0.90
Maximum frequency	4	2.30	12.97	2.04	2.68
Total number of calls	14				
Recording events	7				

Call type I59.2 is an upsweep call with both a LFC and a HFC. The call type is similar to subtype I59.1 but both the LFC and HFC are continuously upsweep until the end of the call. The LFC and HFC often have small frequency shifts throughout the main contour.
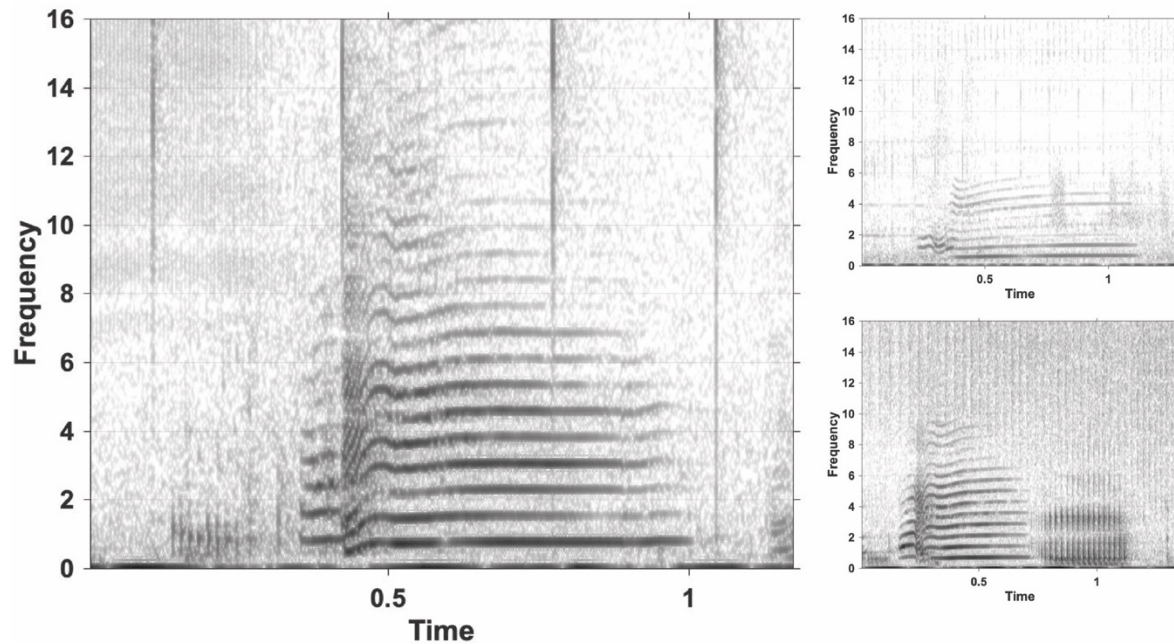
Call type I60.1

Table 51: Summary of measurements of call type I60.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	4	0.85	8.86	0.77	0.91
Start frequency	4	0.78	22.01	0.67	0.98
End frequency	3	0.67	44.13	0.46	0.88
Mid frequency	4	1.61	4.56	1.52	1.66
Minimum frequency	2	0.54	15.02	0.48	0.59
Maximum frequency	4	1.70	7.92	1.56	1.83
Total number of calls	6				
Recording events	5				

Call type I60.1 has a LFC only. The call type is characterised by a short increase in frequency at the start and a longer decrease in frequency at the end.
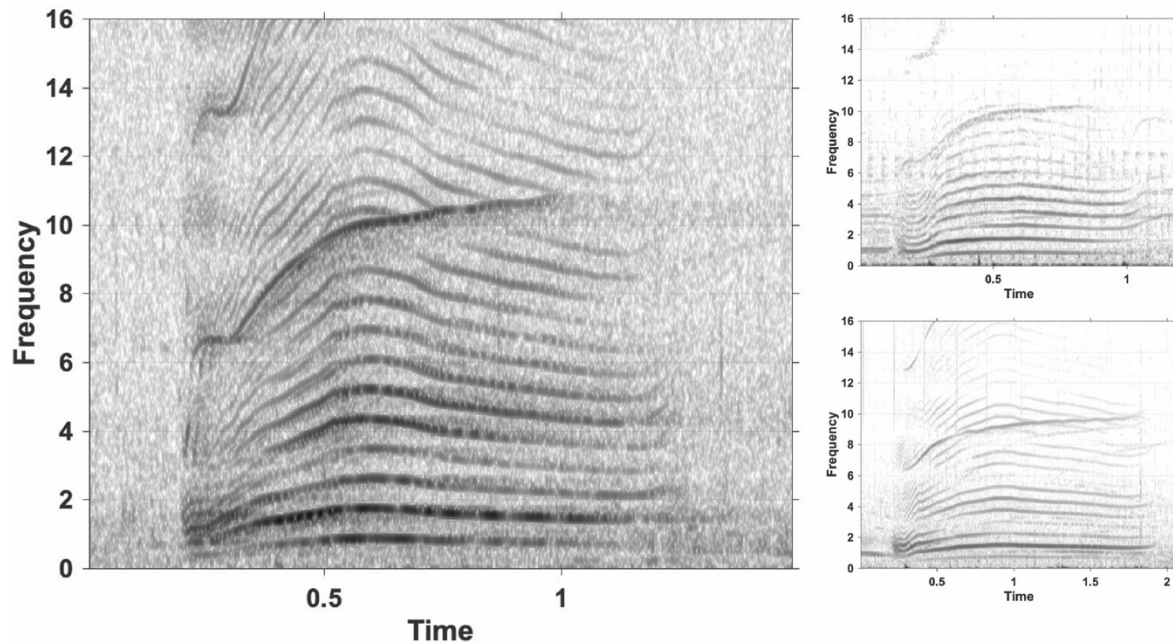
Call type I60.2

Table 52: Summary of measurements of call type I60.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	37	0.94	41.02	0.52	2.29
Start frequency	35	0.80	37.57	0.50	1.62
End frequency	20	0.58	55.66	0.29	1.77
Mid frequency	37	1.63	13.69	0.59	2.06
Minimum frequency	19	0.52	23.64	0.30	0.77
Maximum frequency	37	1.75	7.84	1.51	2.10
Total number of calls	89				
Recording events	15				

Call type I60.2 has both a LFC and a HFC. The call type is similar in structure to subtype I60.1 but has an added HFC. The HFC has a strong increase in frequency at the start and a strong decrease at the end.
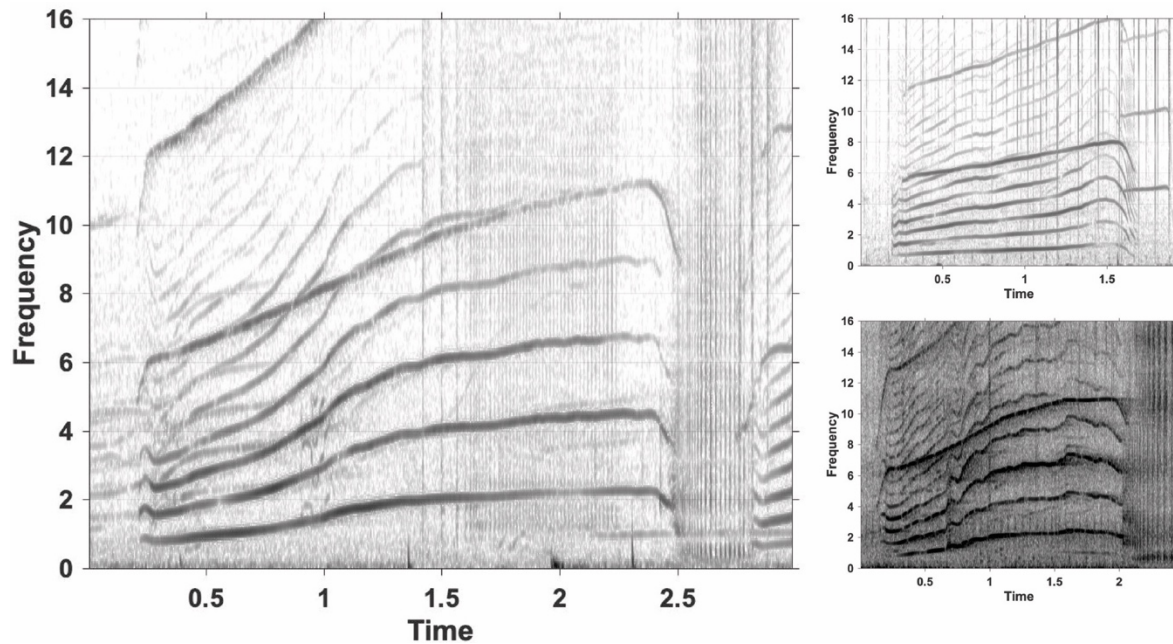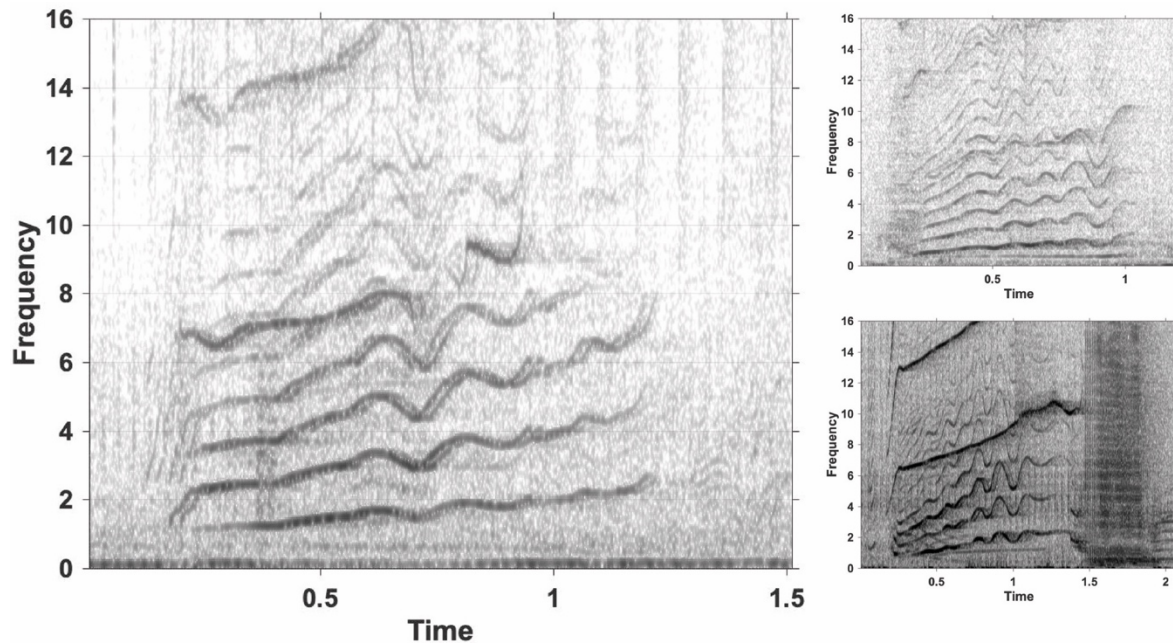
Call type I60.3

Table 53: Summary of measurements of call type I60.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	5	0.41	11.94	0.35	0.47
Start frequency	5	1.79	2.92	1.74	1.85
End frequency	5	1.48	15.30	1.32	1.85
Mid frequency	5	1.85	8.60	1.68	1.98
Minimum frequency	5	1.50	14.61	1.32	1.87
Maximum frequency	5	1.87	7.09	1.72	1.98
Total number of calls	17				
Recording events	6				

Call type I60.3 has both a LFC and a HFC. The call type is similar in structure to subtype I60.2 but is lacking the increase in frequency at the start of the LFC. The decrease in frequency at the end of the LFC is also less clear. The HFC is a continuous upsweep and lacks the increase and decrease that is distinct in subtype I60.2.

Call type I61

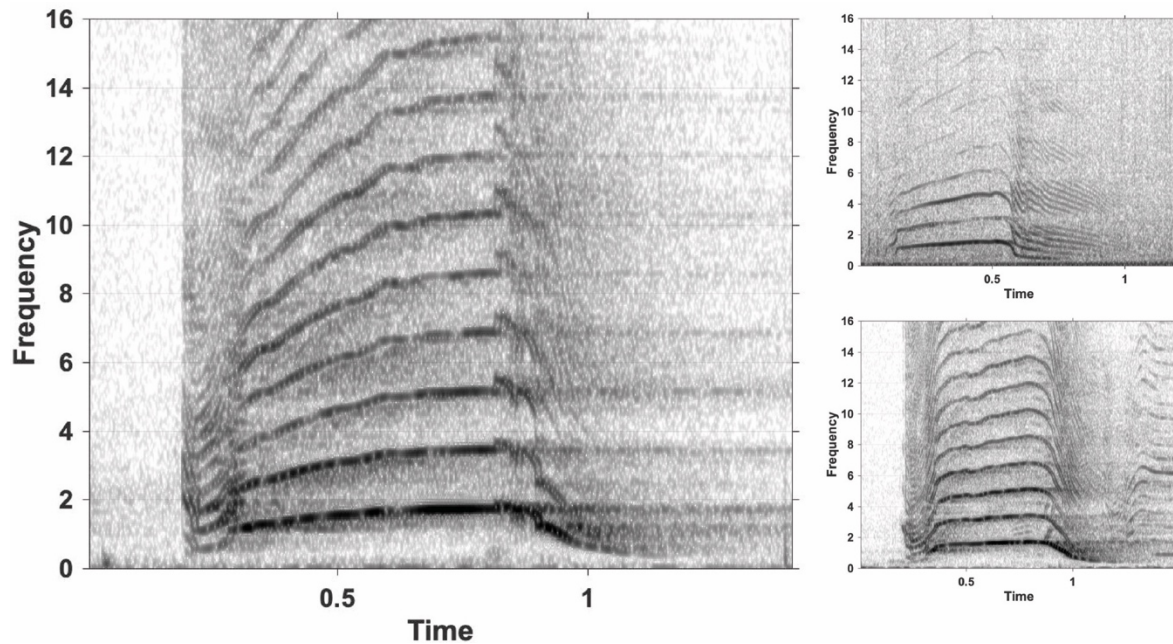*Table 54: Summary of measurements of call type I61. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	3	0.66	5.24	0.62	0.69
Start frequency	3	0.92	13.50	0.79	1.04
End frequency	3	2.10	6.05	1.95	2.19
Mid frequency	3	1.25	22.94	1.05	1.58
Minimum frequency	3	0.87	24.52	0.67	1.10
Maximum frequency	3	2.17	2.50	2.13	2.23
Total number of calls	9				
Recording events	2				

Call type I61 is an upsweep call with both a LFC and a HFC. The call type has a distinct upward frequency shift in the LFC. The HFC is slightly upsweep and has a short increase in frequency at the start and end.
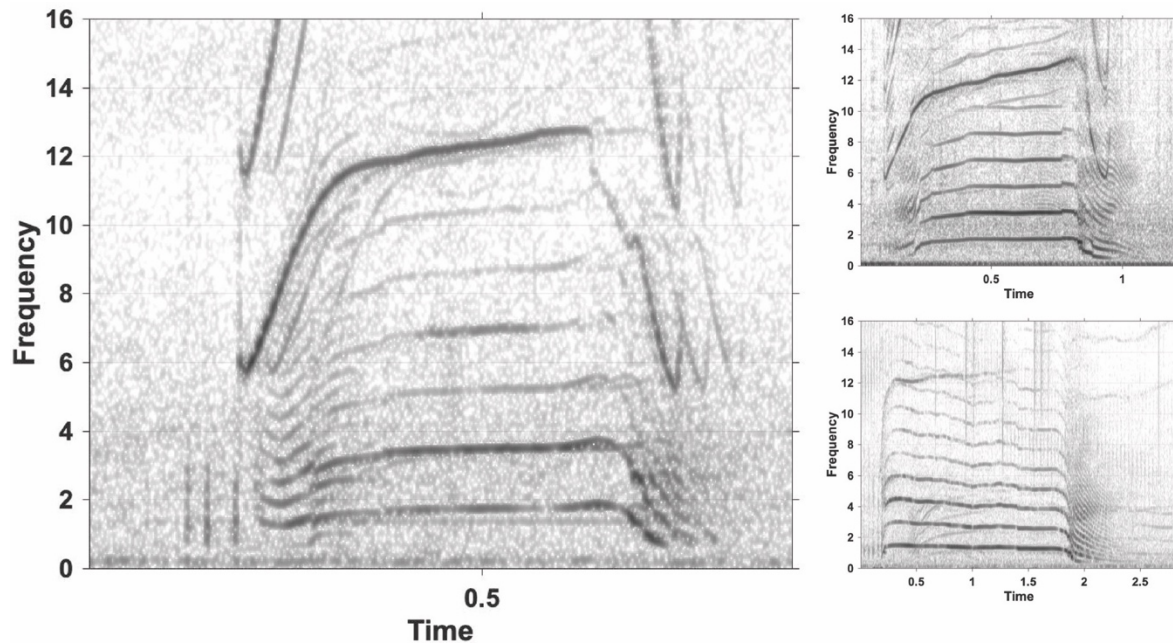
Call type I62.1

Table 55: Summary of measurements of call type I62.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	76	0.69	34.66	0.41	1.45
Start frequency	75	0.72	19.14	0.34	1.09
End frequency	76	1.24	17.46	0.78	1.82
Mid frequency	76	1.13	15.71	0.78	1.63
Minimum frequency	75	0.72	18.38	0.34	1.15
Maximum frequency	76	1.25	17.32	0.80	1.82
Total number of calls	125				
Recording events	25				

Call type I62.1 is an upsweep call with a LFC only. The call type is very simple in structure, with an increase in frequency at the start and little frequency modulation after that.

Call type I62.2

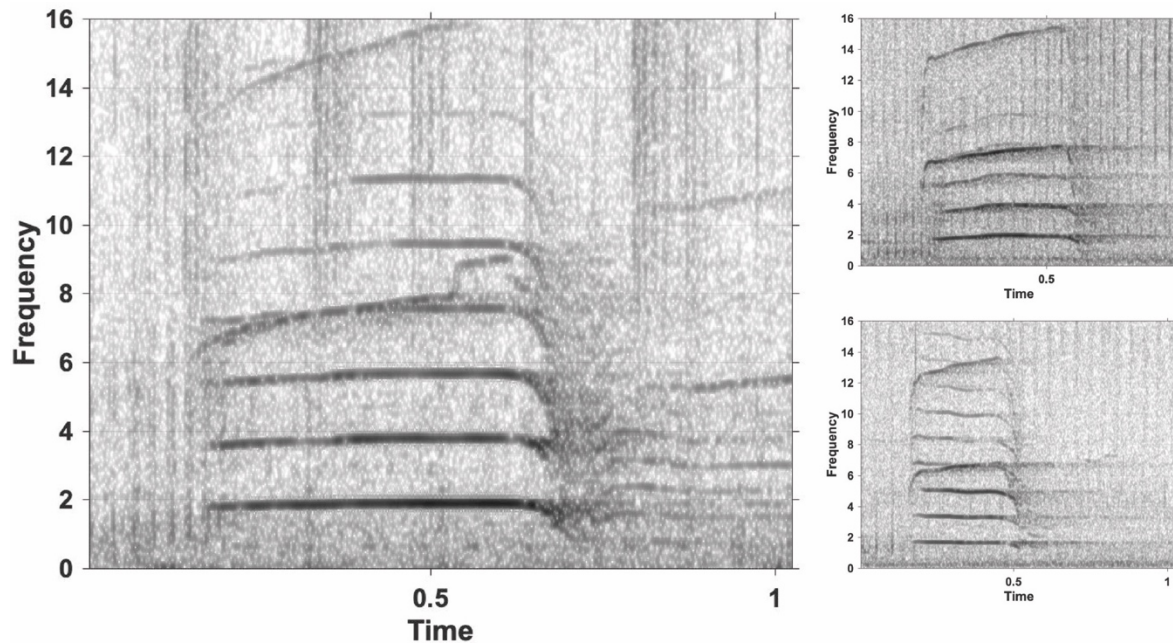*Table 56: Summary of measurements of call type I62.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	13	0.79	19.88	0.51	0.98
Start frequency	13	0.80	17.66	0.59	1.02
End frequency	13	2.16	20.41	1.34	3.07
Mid frequency	13	1.15	11.21	0.96	1.35
Minimum frequency	13	0.75	11.70	0.58	0.88
Maximum frequency	13	2.17	19.41	1.47	3.09
Total number of calls	30				
Recording events	10				

Call type I62.2 is an upsweep call with a LFC only. The call type is similar in structure to subtype I62.1 but has a distinct upsweep at the end.
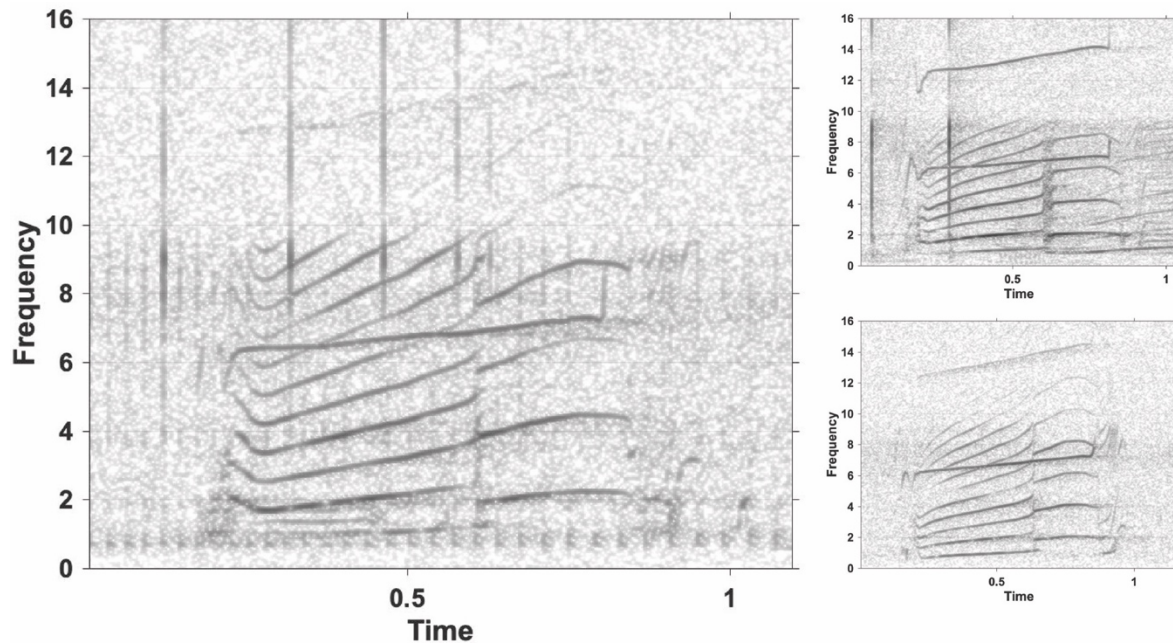
Call type I63

Table 57: Summary of measurements of call type I63. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	33	0.20	42.75	0.07	0.41
Start frequency	33	0.86	28.26	0.42	1.37
End frequency	33	1.21	17.85	0.94	1.72
Mid frequency	33	1.21	16.60	0.96	1.70
Minimum frequency	33	0.83	25.12	0.42	1.41
Maximum frequency	33	1.27	15.73	1.02	1.72
Total number of calls	38				
Recording events	10				

Call type I63 has a LFC only. The call type is very short and starts with a series of clicks. The contour usually shows a few small frequency modulations.

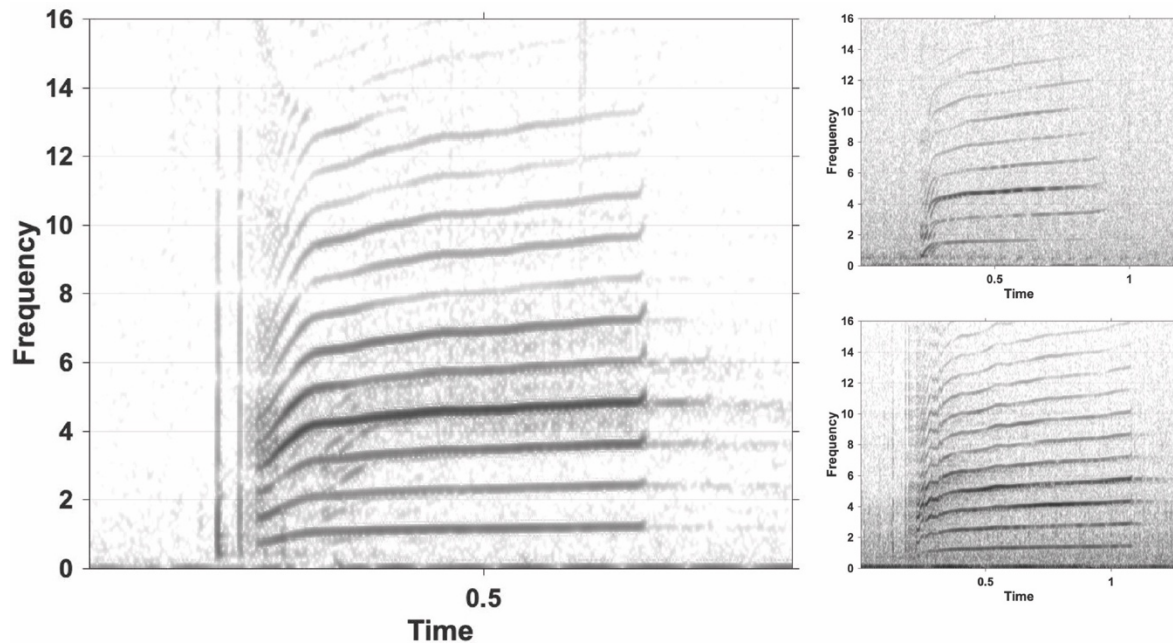Measurements were taken excluding the clicks at the start.

Call type I64

Table 58: Summary of measurements of call type I64. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	10	0.76	38.65	0.52	1.53
Start frequency	10	0.54	23.08	0.39	0.75
End frequency	10	1.59	14.64	1.26	1.99
Mid frequency	10	1.24	14.16	0.90	1.43
Minimum frequency	10	0.55	26.15	0.33	0.74
Maximum frequency	10	1.60	14.32	1.30	1.96
Total number of calls	26				
Recording events	5				

Call type I64 is an upsweep call with a LFC only. Some examples might have an added HFC (see upper right example) but it is not clear.

Call type I65

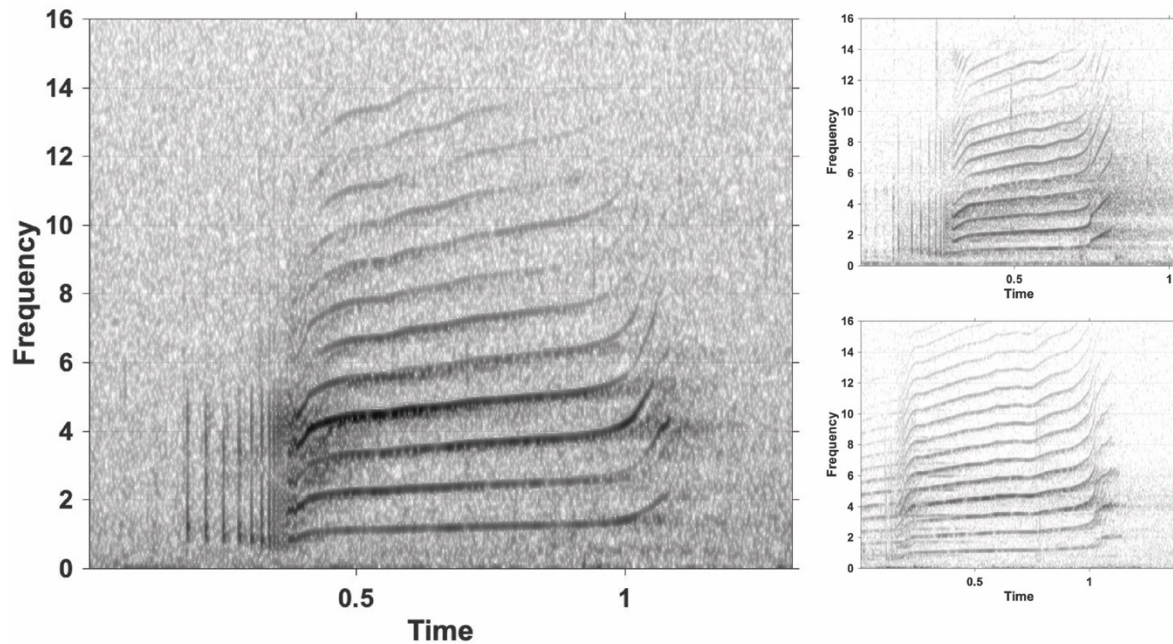*Table 59: Summary of measurements of call type I65. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	1	0.51	-	-	-
Start frequency	1	0.80	-	-	-
End frequency	1	0.98	-	-	-
Mid frequency	1	1.01	-	-	-
Minimum frequency	1	0.80	-	-	-
Maximum frequency	1	1.01	-	-	-
Total number of calls	12				
Recording events	5				

Call type I65 has both a LFC and a HFC. The LFC has a small shift in frequency at the start. The HFC starts after this frequency shift and has a strong decrease in frequency at the start and increase at the end.
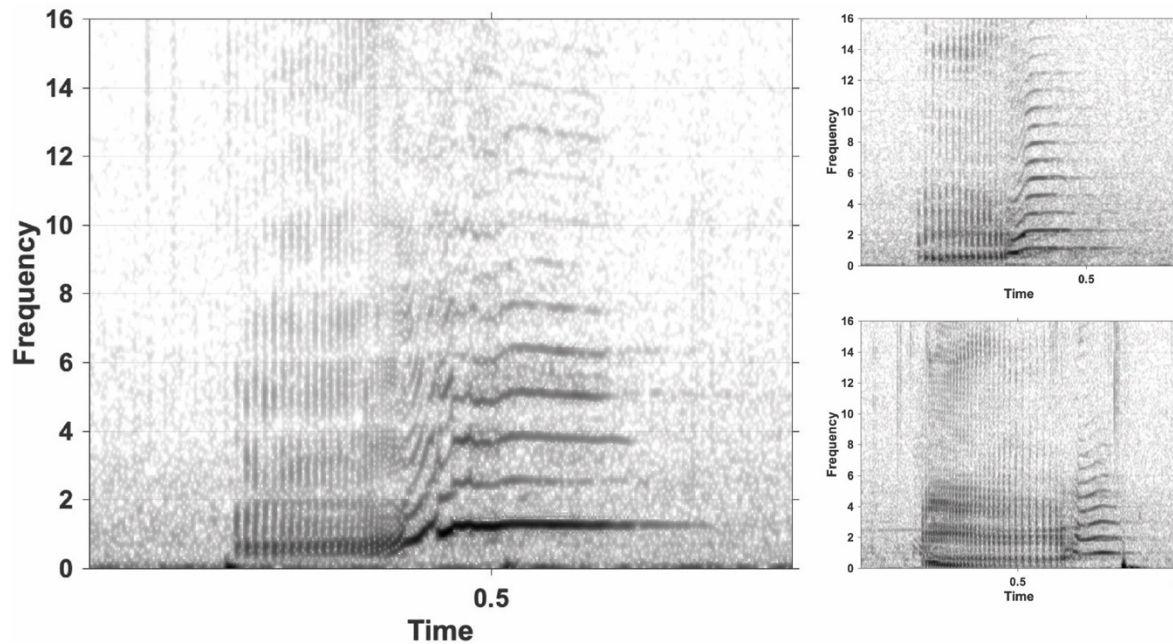
Call type I66

Table 60: Summary of measurements of call type I66. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	4	0.94	18.52	0.73	1.14
Start frequency	4	3.38	8.85	3.03	3.73
End frequency	4	1.53	19.96	1.15	1.71
Mid frequency	4	2.58	30.96	1.76	3.41
Minimum frequency	4	1.35	19.44	0.96	1.52
Maximum frequency	4	4.50	2.83	4.32	4.63
Total number of calls	6				
Recording events	3				

Call type I66 is a downsweep call with a LFC only. The call type starts at a relatively high frequency which decreases strongly around the middle of the call, followed by some minor frequency modulations.
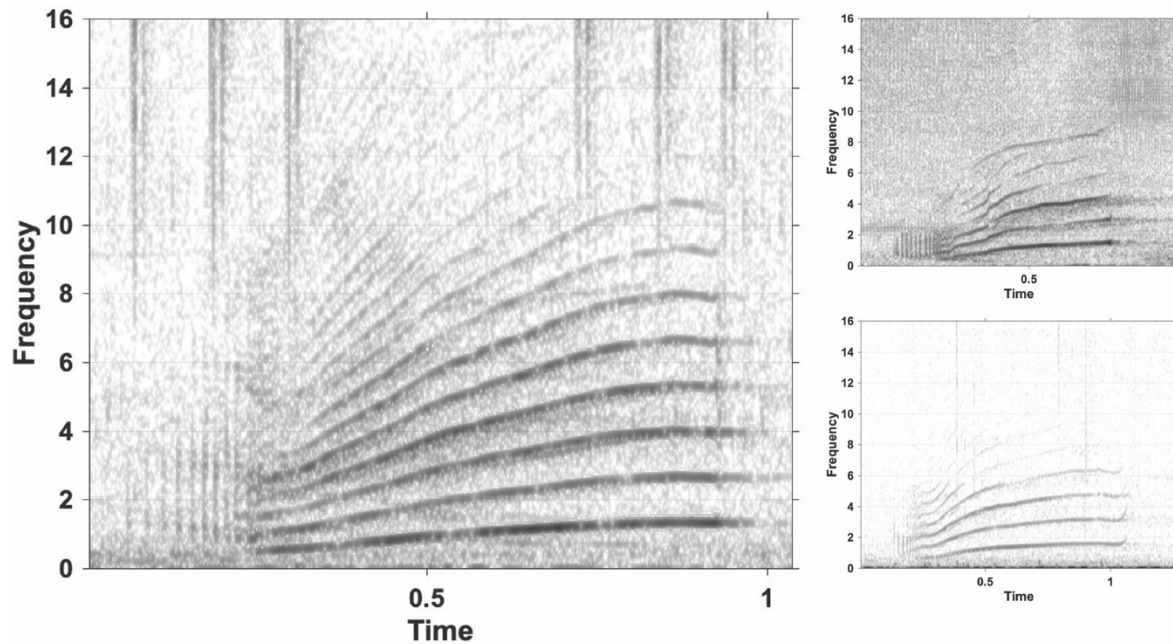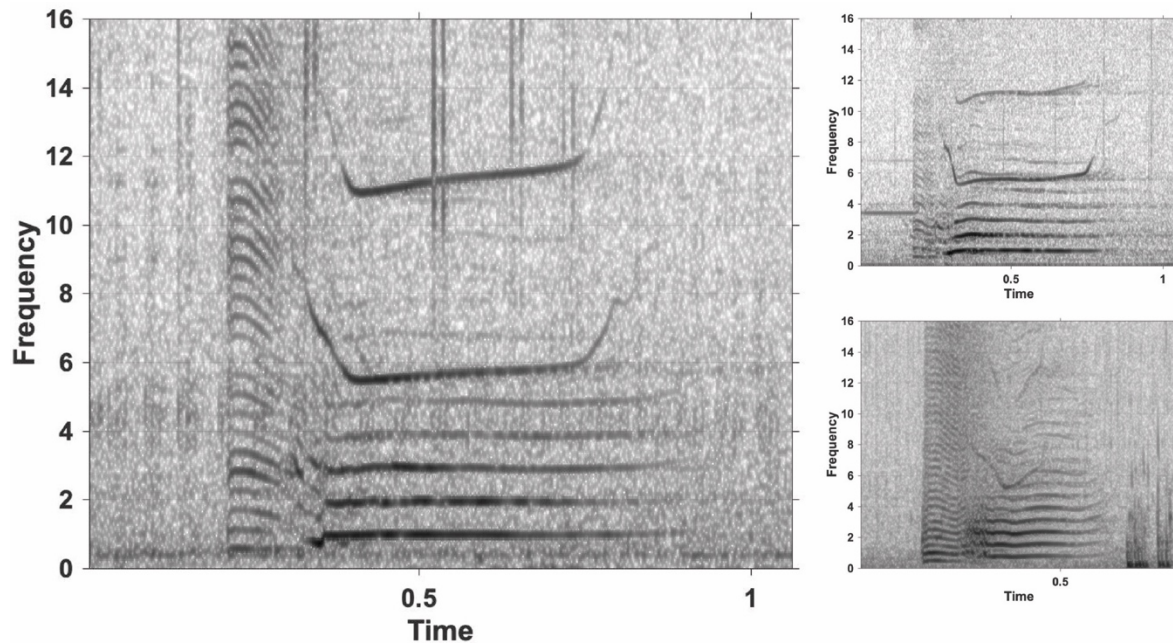
Call type I67

Table 61: Summary of measurements of call type I67. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	5	0.78	17.77	0.65	0.95
Start frequency	5	0.63	32.78	0.43	0.94
End frequency	5	2.75	9.91	2.38	3.04
Mid frequency	5	0.99	1.02	0.98	1.00
Minimum frequency	5	0.61	27.22	0.45	0.88
Maximum frequency	5	2.76	6.87	2.54	2.94
Total number of calls	7				
Recording events	2				

Call type I67 has both a LFC and a HFC. Both contours show little frequency modulation, except for small increases at the start and the end.
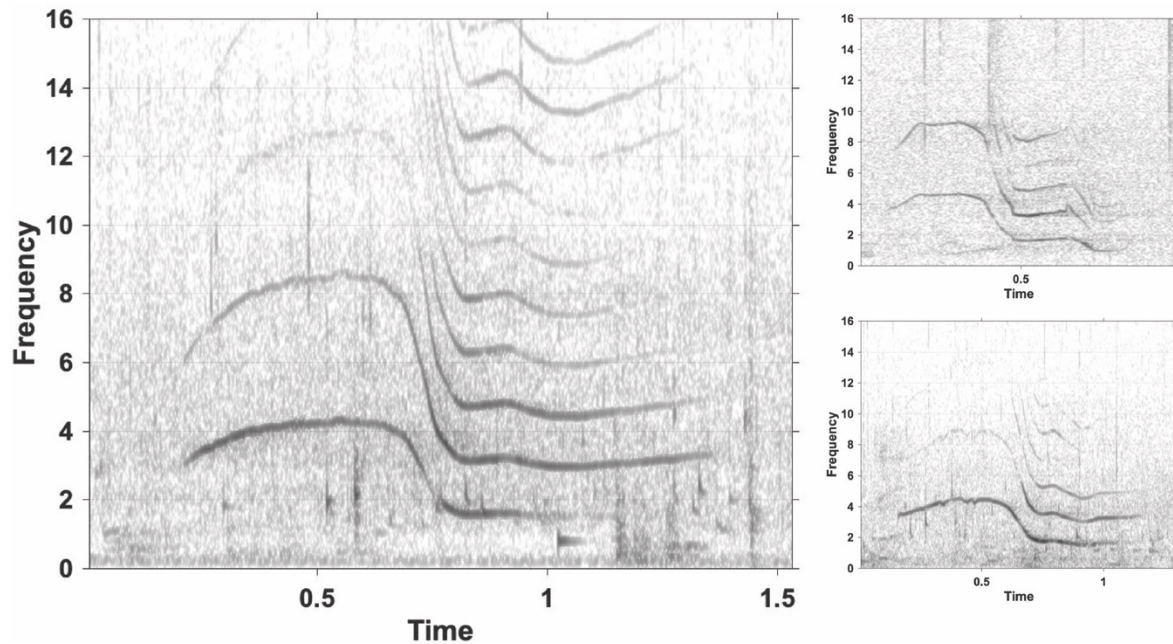
Call type I68

Table 62: Summary of measurements of call type I68. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	4	0.34	25.14	0.27	0.43
Start frequency	2	0.92	8.79	0.86	0.98
End frequency	4	0.31	5.81	0.29	0.33
Mid frequency	4	0.74	14.06	0.61	0.86
Minimum frequency	4	0.32	7.40	0.29	0.35
Maximum frequency	4	1.18	10.94	1.03	1.34
Total number of calls	4				
Recording events	3				

Call type I68 is a downsweep call with a LFC only. The call type is separated into two parts. The first part is usually short and lower in frequency but can also be a series of clicks. The second part is a downsweep contour.
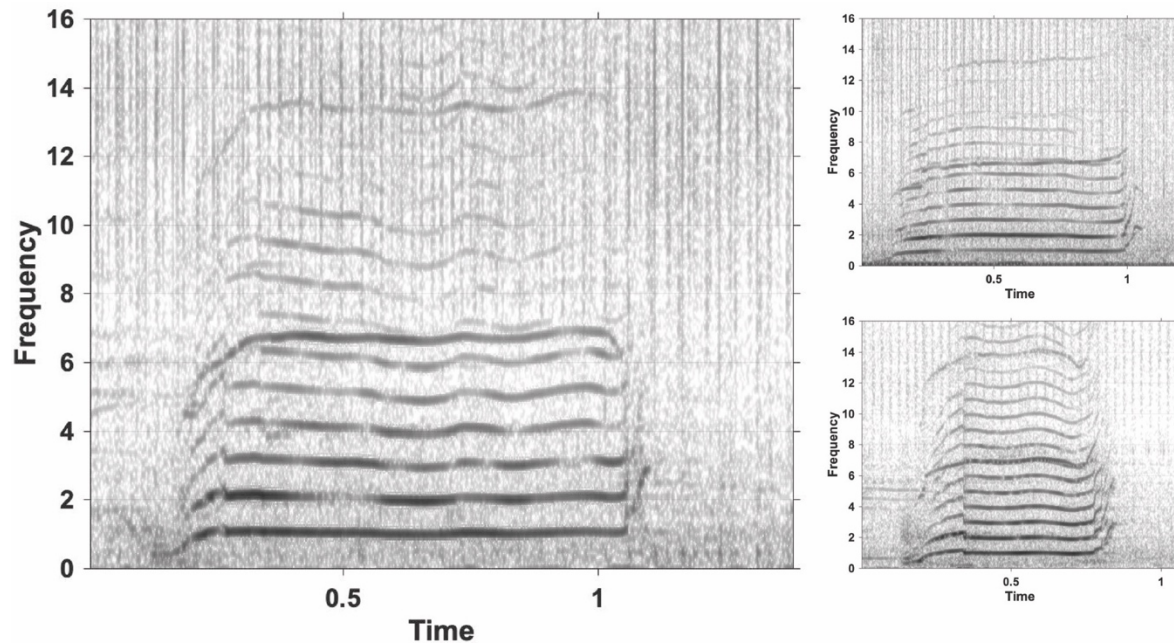
Call type I69

Table 63: Summary of measurements of call type I69. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	-	-	-	-	-
Start frequency	-	-	-	-	-
End frequency	-	-	-	-	-
Mid frequency	-	-	-	-	-
Minimum frequency	-	-	-	-	-
Maximum frequency	-	-	-	-	-
Total number of calls	97				
Recording events	3				

Call type I69 has a LFC only. The call type looks and sounds similar to a buzz. However, it is highly stereotyped and has a distinct end, where frequency bands are visible.

No measurements were taken of this call type, as it is not possible to distinguish clear frequency contours.
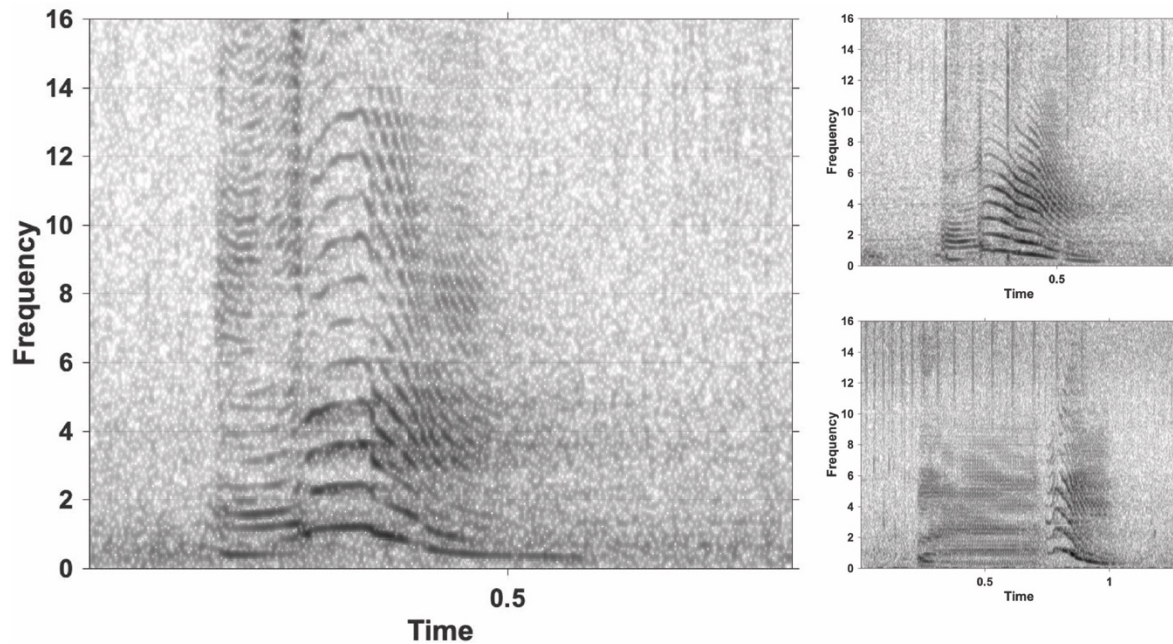
Call type I70

Table 64: Summary of measurements of call type I70. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	14	0.57	22.46	0.43	0.78
Start frequency	14	1.01	33.48	0.65	1.58
End frequency	14	1.24	5.81	1.11	1.41
Mid frequency	14	1.12	7.29	0.90	1.22
Minimum frequency	14	0.85	14.17	0.69	1.11
Maximum frequency	13	1.65	14.82	1.36	2.08
Total number of calls	38				
Recording events	2				

Call type I70 has a LFC only. The call type has little frequency modulation except for a small downward shift in frequency.
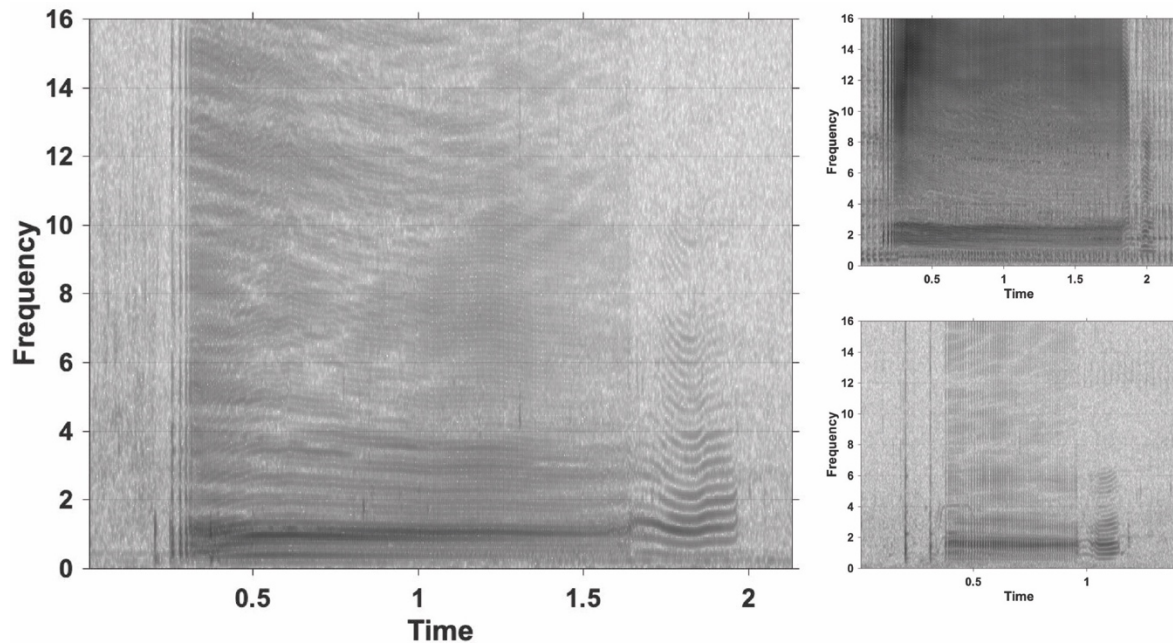
Call type I71

Table 65: Summary of measurements of call type I71. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	30	1.32	24.78	0.50	2.16
Start frequency	30	0.95	21.49	0.56	1.26
End frequency	25	0.54	26.55	0.41	0.99
Mid frequency	30	0.60	14.03	0.39	0.79
Minimum frequency	29	0.47	14.40	0.37	0.65
Maximum frequency	30	1.12	14.33	0.73	1.46
Total number of calls	34				
Recording events	1				

Call type I71 has a LFC only. The call type is mostly downsweep and all examples show small frequency modulations to different degrees throughout the main contour.
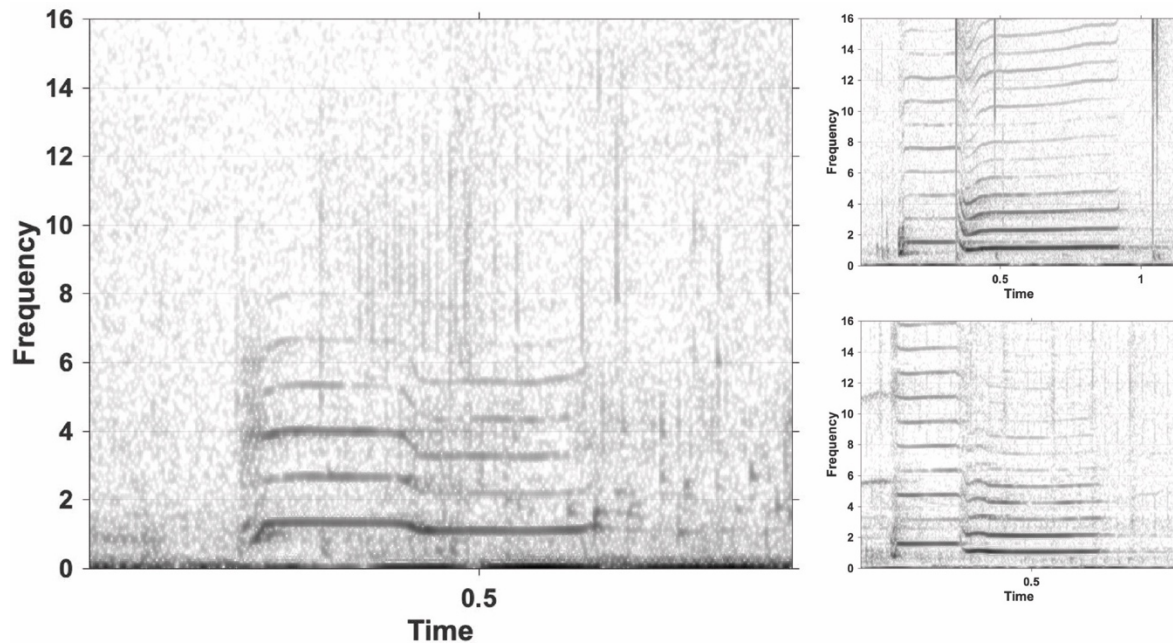
Call type I72.1

Table 66: Summary of measurements of call type I72.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	30	0.81	22.13	0.52	1.34
Start frequency	30	1.44	37.96	0.63	2.61
End frequency	29	0.95	18.24	0.64	1.36
Mid frequency	30	0.78	23.27	0.44	1.22
Minimum frequency	30	0.55	28.19	0.27	1.05
Maximum frequency	29	1.48	36.80	0.67	2.66
Total number of calls	62				
Recording events	12				

Call type I72.1 is a downsweep call with a LFC only. The call type has a distinct frequency shift that leads to similar aural qualities despite variations in duration before the shift.
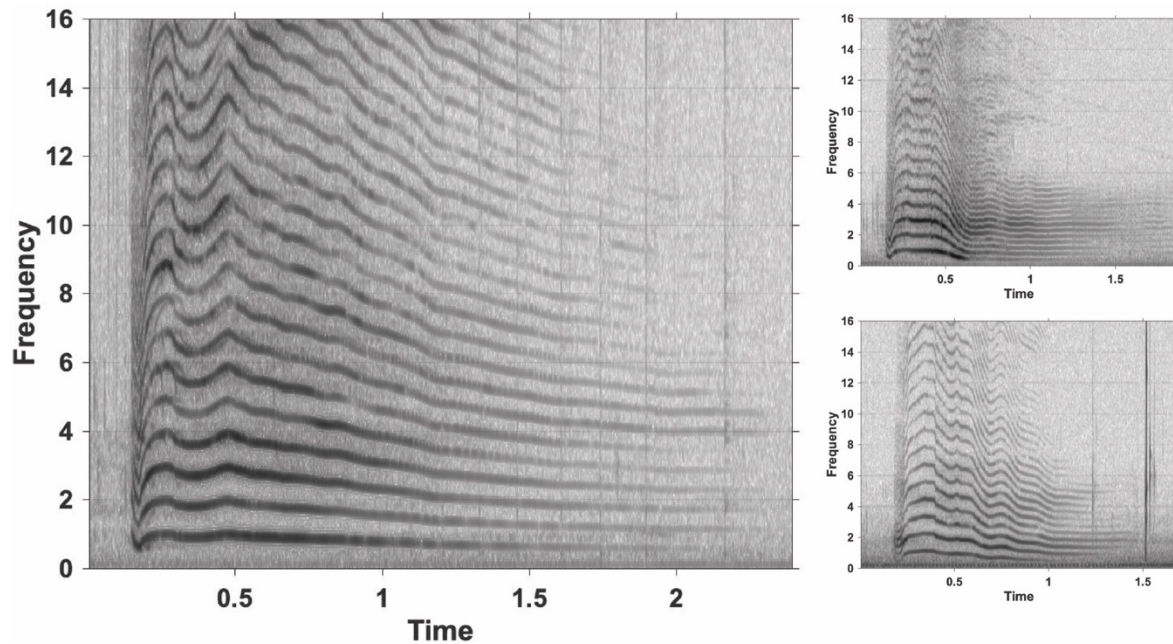
Call type I72.2

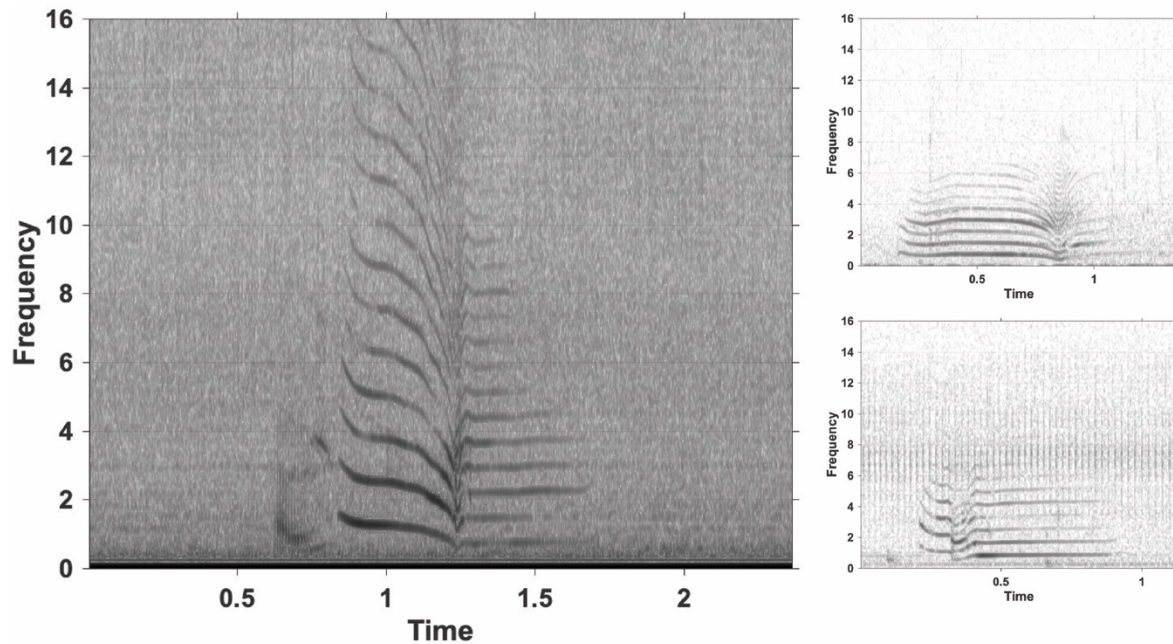*Table 67: Summary of measurements of call type I72.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	10	0.97	39.93	0.67	1.93
Start frequency	10	1.37	20.96	0.93	1.76
End frequency	10	0.61	12.74	0.46	0.75
Mid frequency	10	0.94	31.42	0.54	1.36
Minimum frequency	10	0.55	14.45	0.39	0.65
Maximum frequency	10	1.41	21.44	0.93	1.85
Total number of calls	20				
Recording events	5				

Call type I72.2 is a downsweep call with a LFC only. Similar to subtype I72.1 the call type has a downward frequency shift but the shift usually occurs around the middle of the call and the two subtypes can be clearly distinguished when listened to.
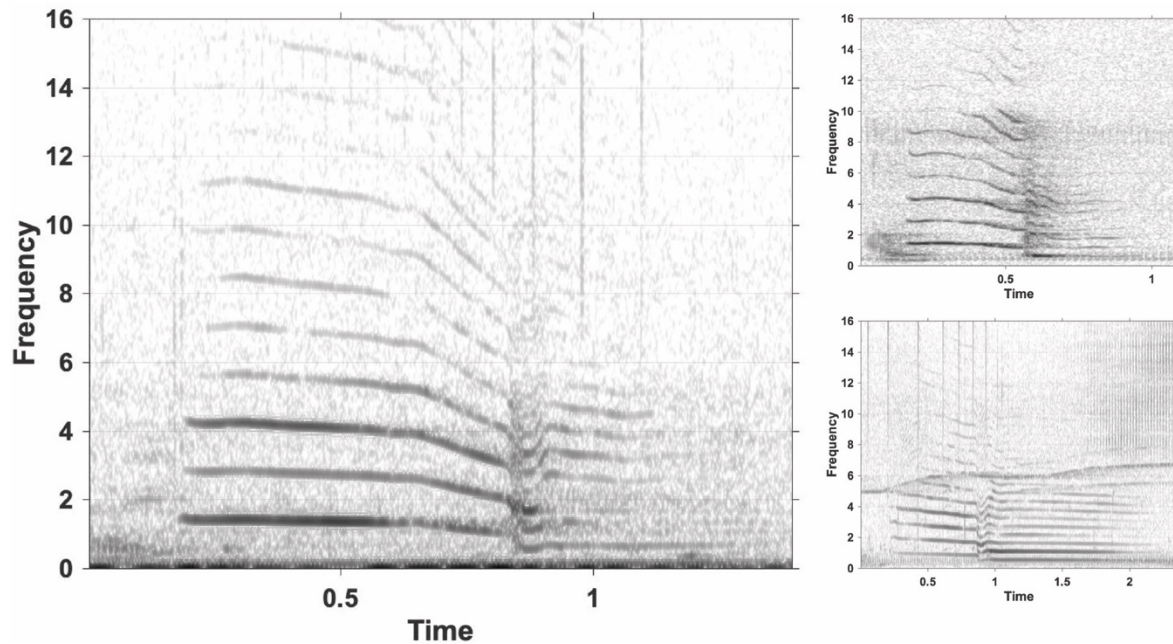
Call type I72.3

Table 68: Summary of measurements of call type I72.3. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	23	0.69	35.60	0.37	1.38
Start frequency	23	2.26	22.94	1.43	3.70
End frequency	17	0.85	24.86	0.66	1.41
Mid frequency	23	0.81	23.45	0.63	1.27
Minimum frequency	23	0.70	21.65	0.52	0.97
Maximum frequency	23	2.28	22.51	1.45	3.64
Total number of calls	61				
Recording events	11				

Call type I72.3 is a downsweep call with a LFC only. The first part of the call type is distinctly downsweep and the second part is straight or slightly upsweep.
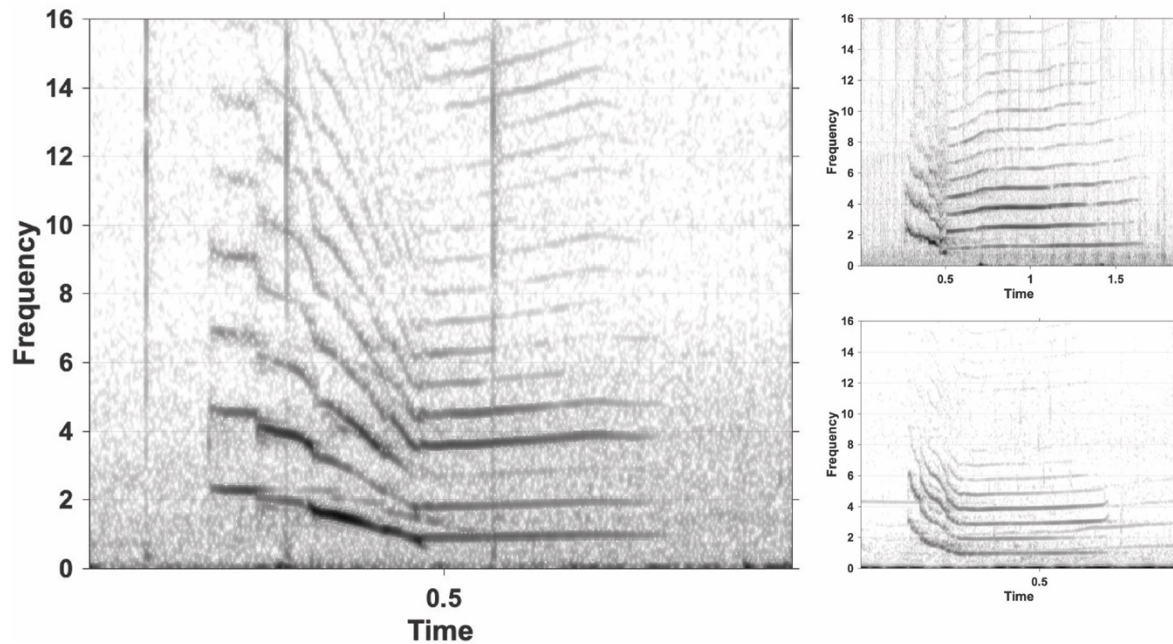
Call type I72.4

Table 69: Summary of measurements of call type I72.4. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	17	0.53	35.88	0.27	1.03
Start frequency	17	2.23	15.36	1.45	2.92
End frequency	10	1.41	31.39	1.15	2.65
Mid frequency	17	1.24	5.67	1.11	1.36
Minimum frequency	17	1.14	13.88	0.62	1.30
Maximum frequency	17	2.40	8.49	2.14	2.94
Total number of calls	35				
Recording events	6				

Call type I72.4 is a downsweep call with a LFC only. The call type is separated into two parts by a downward shift in frequency. The second part is similar to I72.3 but because the first part starts with an upsweep in frequency, followed by a downsweep it was considered a different subtype.

Call type I73

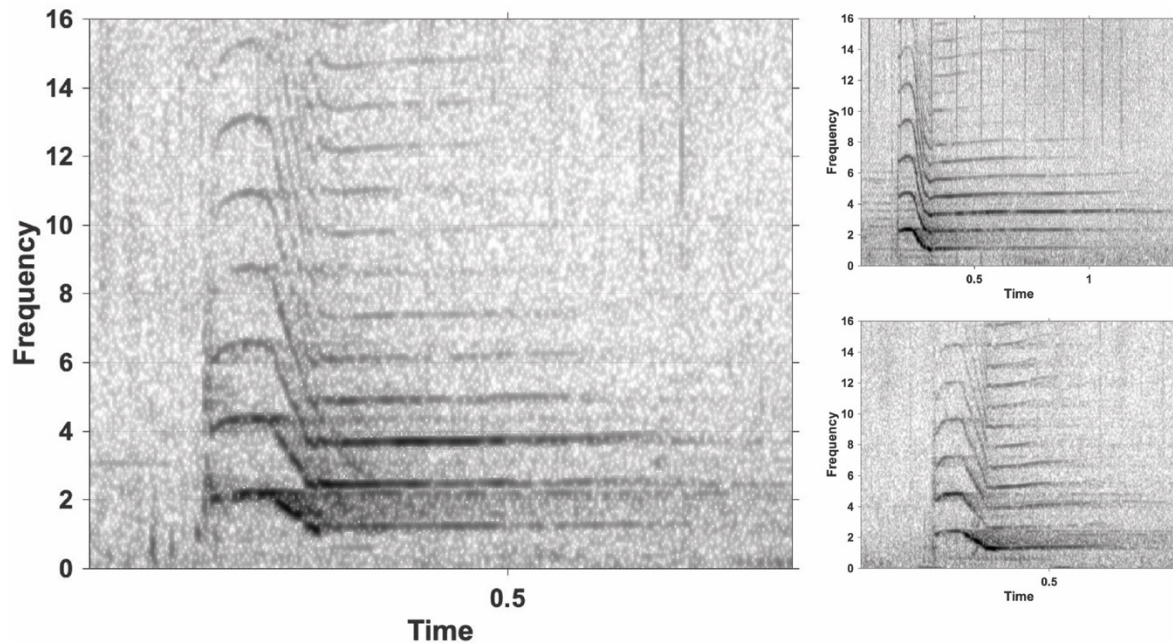*Table 70: Summary of measurements of call type I73. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.*

Measurement	N	Mean	CV	Min	Max
Duration	3	0.69	3.57	0.66	0.71
Start frequency	3	0.68	38.26	0.44	0.96
End frequency	3	1.04	12.91	0.89	1.15
Mid frequency	3	1.50	6.52	1.41	1.60
Minimum frequency	3	0.44	2.47	0.42	0.44
Maximum frequency	3	1.46	24.38	1.07	1.77
Total number of call	5				
Recording events	3				

Call type I73 has a LFC only. The call type starts with a series of clicks followed by several frequency shifts.

Measurements were taken excluding the clicks at the start.
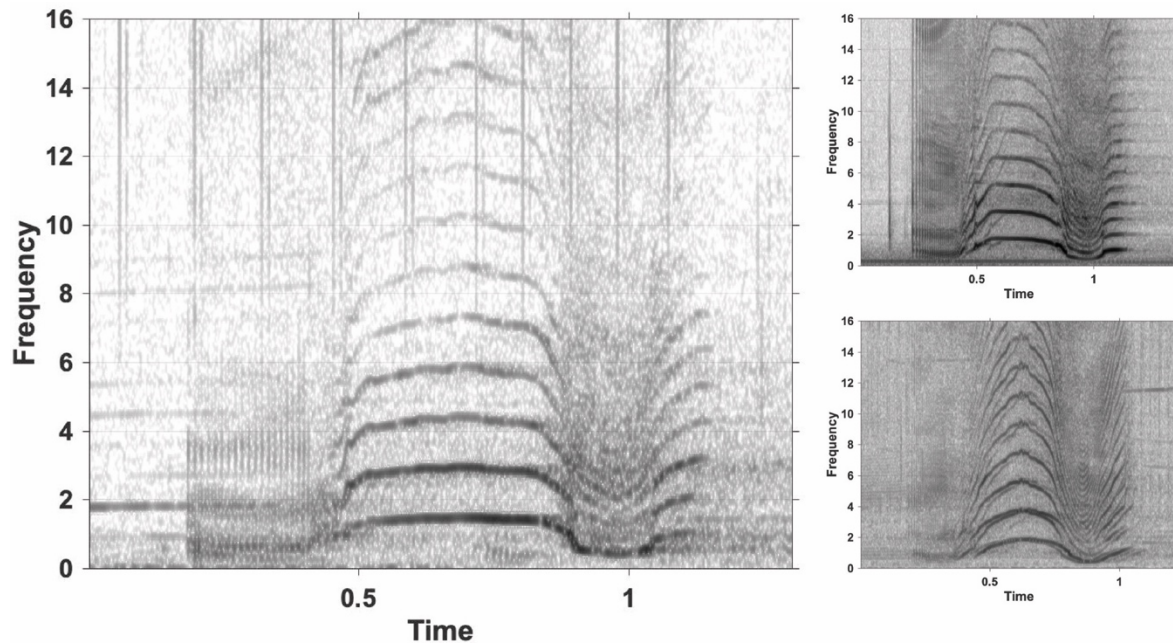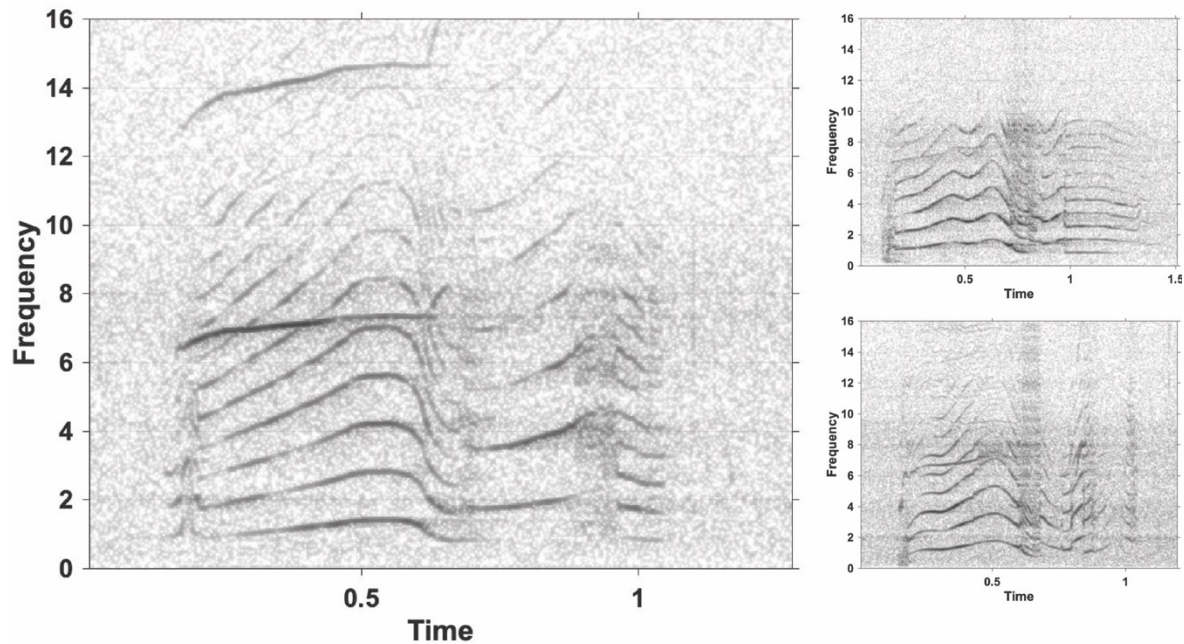
Call type I74.1

Table 71: Summary of measurements of call type I74.1. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	3	0.87	4.34	0.83	0.90
Start frequency	3	0.82	6.07	0.77	0.86
End frequency	3	0.87	4.29	0.84	0.91
Mid frequency	3	1.17	9.12	1.07	1.28
Minimum frequency	3	0.80	3.60	0.77	0.82
Maximum frequency	3	1.63	11.70	1.43	1.82
Total number of calls	6				
Recording events	3				

Call type I74.1 has both a LFC and a HFC. The call type has three parts that all show high variation. The HFC only extends over the duration of the first part of the LFC.
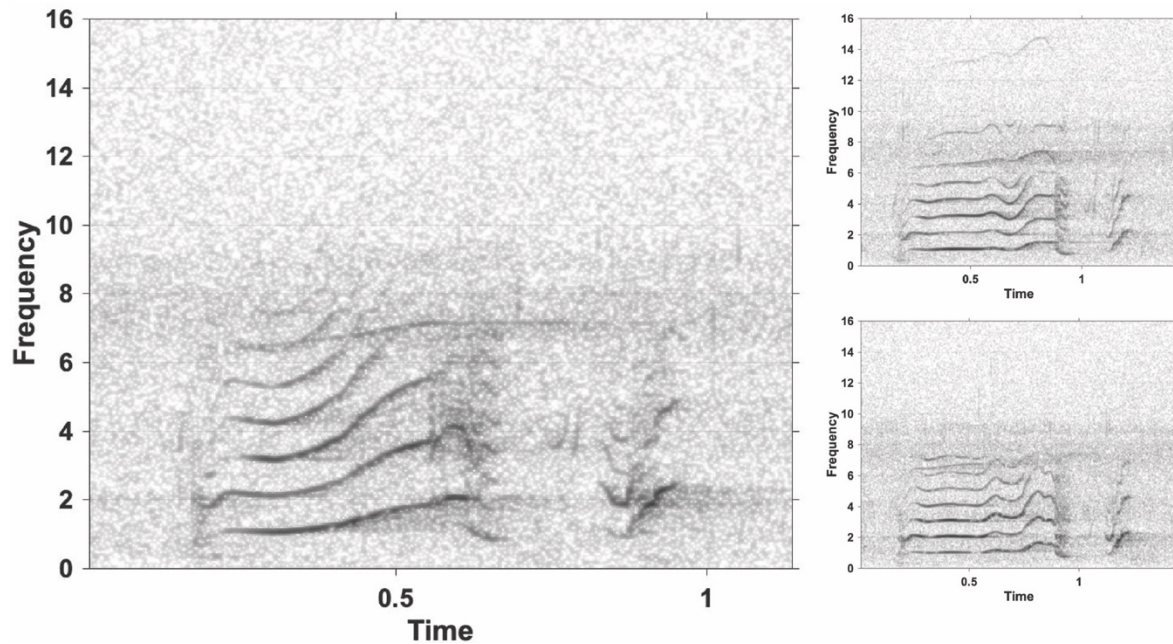
Call type I74.2

Table 72: Summary of measurements of call type I74.2. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	6	0.98	29.29	0.73	1.50
Start frequency	6	0.84	13.24	0.63	0.97
End frequency	6	2.35	6.33	2.12	2.52
Mid frequency	6	1.52	31.66	1.07	2.17
Minimum frequency	6	0.82	14.10	0.60	0.91
Maximum frequency	6	2.36	4.53	2.25	2.50
Total number of calls	7				
Recording events	1				

Call type I74.2 has both a LFC and a HFC. The call type has two parts. The first part including the HFC is very similar to subtype I74.1. The second part is a short upsweep sound separated by a short pause.

Measurements were taken only of the first part of the call.

Call type I75

Table 73: Summary of measurements of call type I75. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	11	0.55	18.72	0.41	0.75
Start frequency	9	0.48	35.56	0.22	0.71
End frequency	11	0.79	20.35	0.63	1.11
Mid frequency	11	0.67	19.17	0.49	0.90
Minimum frequency	9	0.45	32.09	0.24	0.65
Maximum frequency	11	0.79	20.01	0.64	1.13
Total number of calls	12				
Recording events	2				

Call type I75 has a LFC only. The call type starts with a series of clicks, which is followed by a relatively flat, often slightly upsweep contour.
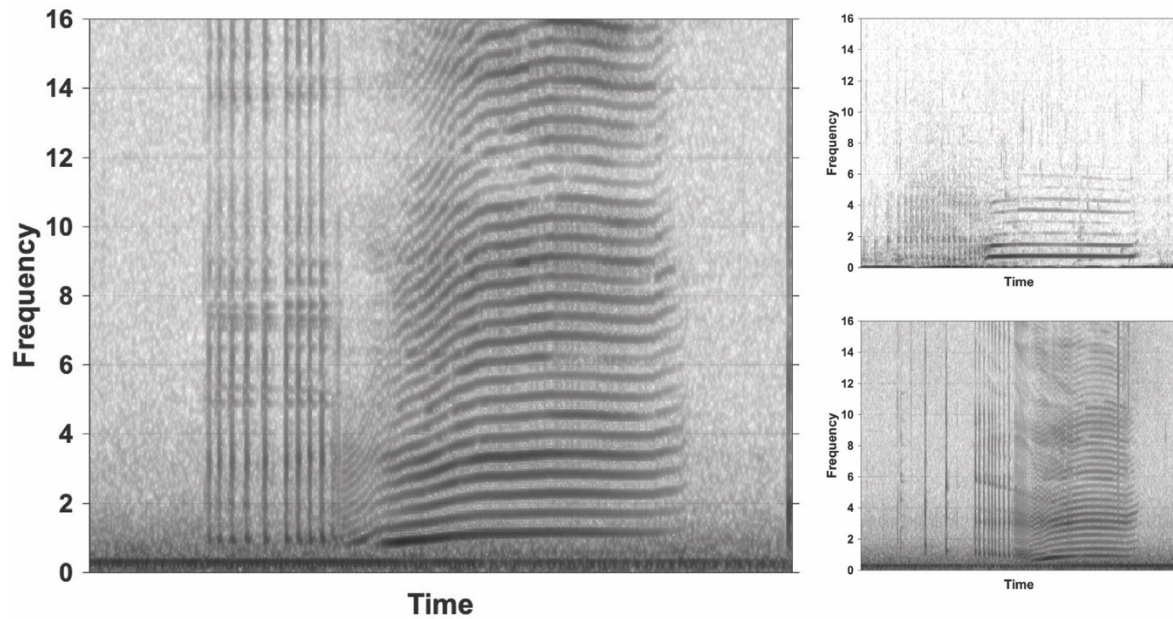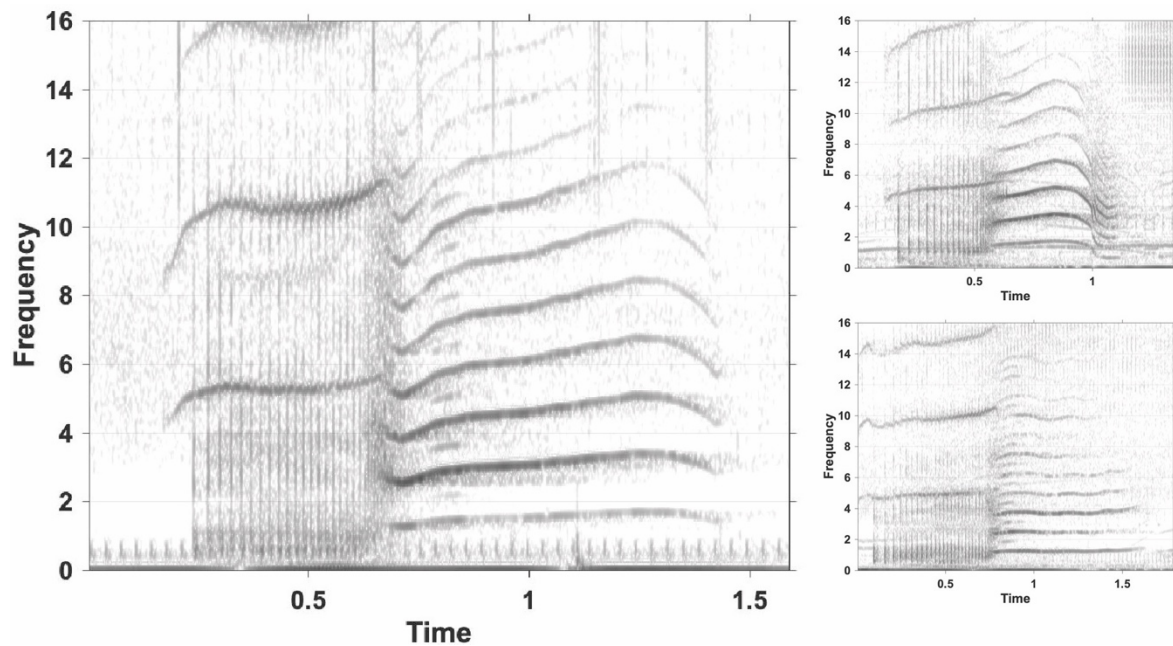
Call type I76

Table 74: Summary of measurements of call type I76. N indicates the number of samples from which measurements were possible, CV is the coefficient of variation expressed as a percentage, Min and Max show the minimum and maximum values measured. Duration is in seconds, frequencies are shown in kHz. The total number of calls indicates how many examples of the call type were found in the recordings and recording events indicates in how many different encounter days the call type was recorded.

Measurement	N	Mean	CV	Min	Max
Duration	-	-	-	-	-
Start frequency	-	-	-	-	-
End frequency	-	-	-	-	-
Mid frequency	-	-	-	-	-
Minimum frequency	-	-	-	-	-
Maximum frequency	-	-	-	-	-
Total number of calls	11				
Recording events	2				

Call type I76 appears to have a LFC and HFC. The call type starts with a series of clicks that appear overlapped by a HFC. This is followed by a relatively flat contour that often sweeps down at the end.

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