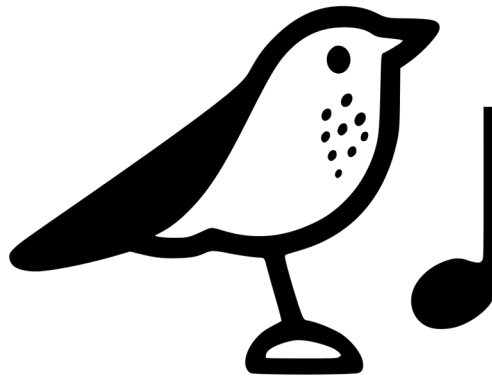


# **User's Guide**

## **CallSeeker v2.0**

### **CallSeeker**



**September 2020**

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# 1. How to use CallSeeker

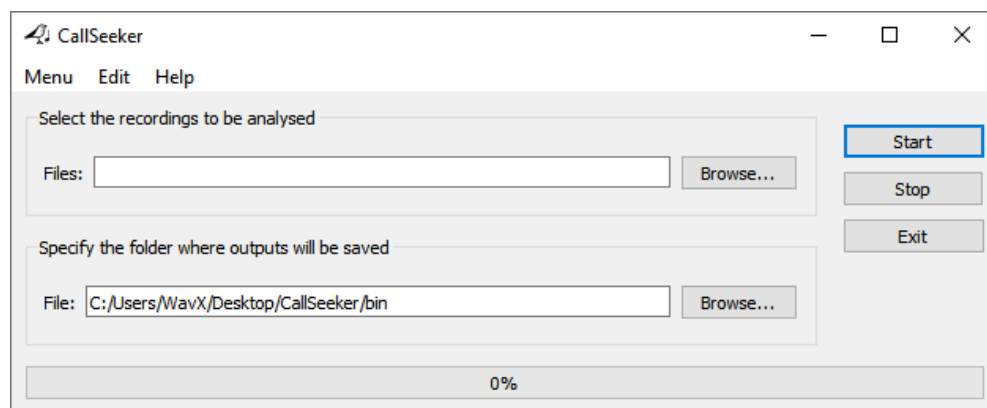
It is important to consider that CallSeeker is in constant development and is not infallible software. Its primary function is to save a considerable amount of time in the analysis of audio recordings containing the calls and songs of Bicknell's Thrushes and Grey-cheeked Thrushes. The results of the analyses should always be validated by an expert familiar with the identification of vocalizations of these species, in order to rule out cases of false positives (i.e. vocalizations wrongly identified as Bicknell's Thrush or Grey-cheeked Thrush).

CallSeeker is an application developed for Windows 64-bit and 32-bit versions are not supported. Only audio files in WAV format are supported by the CallSeeker application.

CallSeeker analyzes the recordings in segments or analysis windows of approximately 2 seconds, so the identification results are reported per analysis window. Note that the duration of these analysis windows is fixed and does not adjust to the duration of the identified vocalizations.

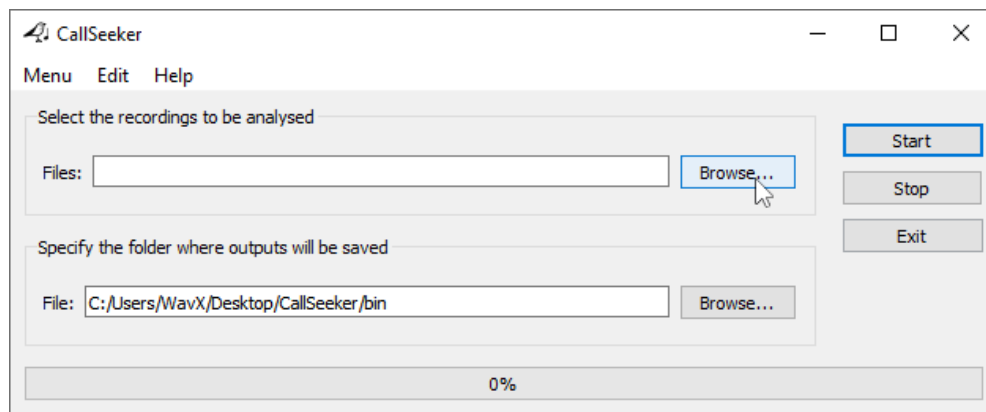
The latest version of CallSeeker is available in compressed ZIP format (~70 MB) for free download on the [WavX server](#). It is also advised to download the latest version of the free and open source software [Audacity](#) in addition to CallSeeker in order to validate identifications more easily.

After installing the CallSeeker application, and clicking on the “CallSeeker.exe” executable, the following window should appear on your screen:

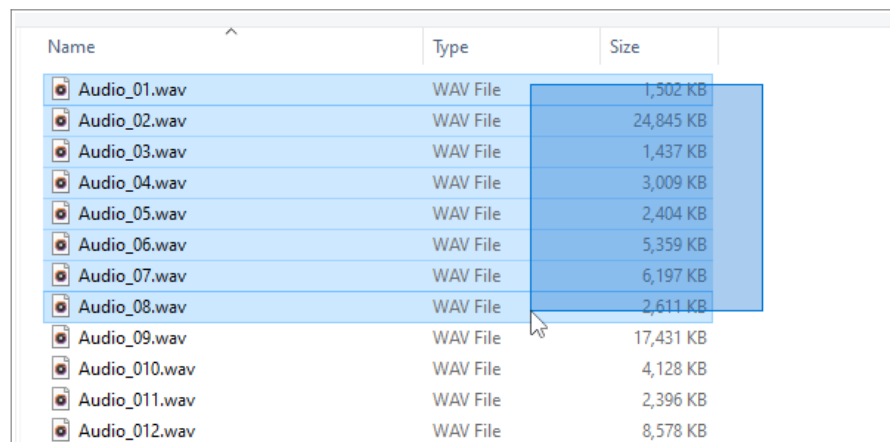


## 1.1. Loading audio files (.wav)

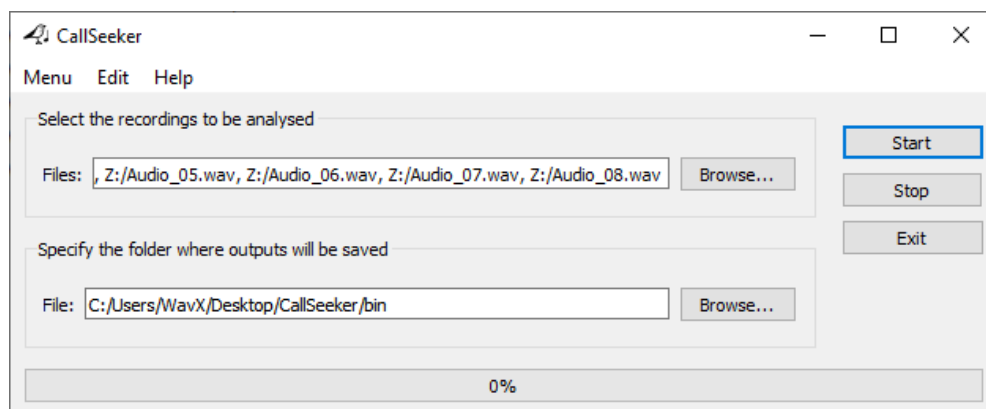
The WAV audio file(s) to be analyzed can be loaded by clicking “Browse”,



and selecting the files to be scanned from the window that opens :



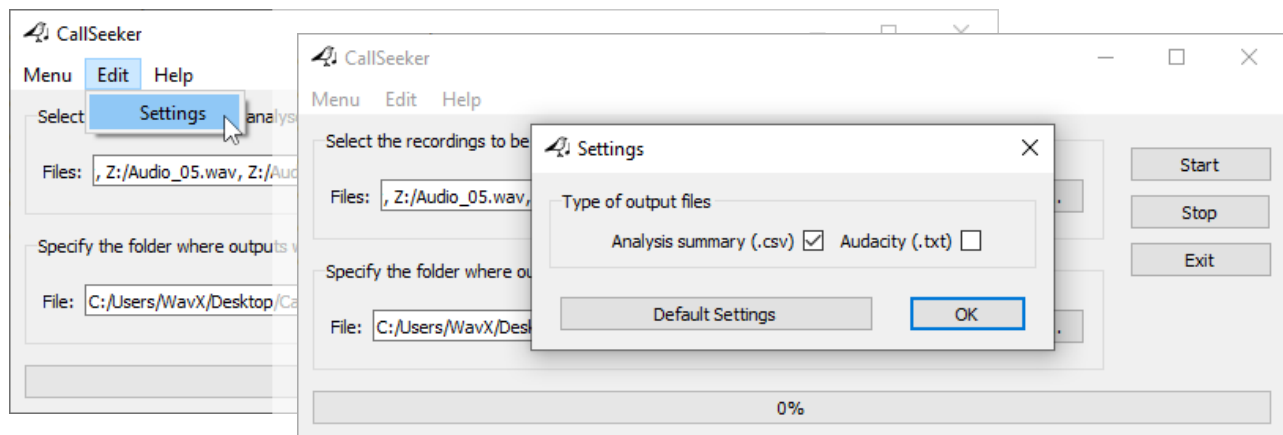
The list of selected files appears in the field to the left of the “Browse” button.



You must then specify the directory where the results of the analyzes will be saved by clicking on the “Browse...” button at the bottom. By default, the results are saved in the folder where the executable “CallSeeker.exe” is located.

## 1.2. Parameters and options

You can access the window to modify the parameters of the application by clicking on the “Edit” menu and then on the “Settings” tab.



The available settings and options are as follows:

- **Identifications summary spreadsheet**

By default, CallSeeker produces a results spreadsheet in CSV format presenting several information for each identification such as the species identified, the start and end positions of the corresponding analysis window as well as the path to the audio file which has been analyzed. The detailed description of the results is provided in section 2. The “Analysis summary (.csv)” option can be disabled by unchecking the corresponding box if the user does not want a results file in CSV format to be generated during analysis.

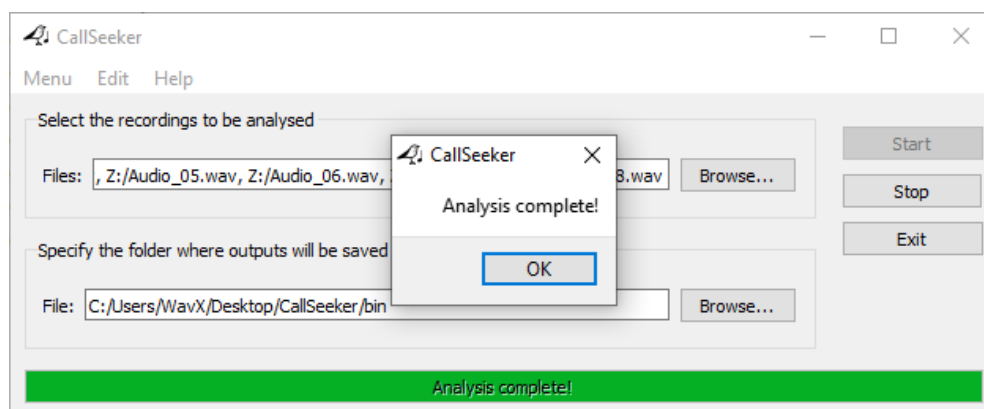
- **Validation with Audacity**

Audacity software allows you to play, view and tag audio recordings. It can be used in conjunction with CallSeeker to validate scan results. To this end, check the “Audacity (.txt)” option so that a label file in TXT format is generated for each analyzed WAV file where at least one Bicknell's Thrush or Gray-cheeked call or song has been identified by CallSeeker. Label files in TXT format can be played back with Audacity and allow you to place labels directly on audio recordings for viewing. An example label file is provided in section 2.2. Section 4 describes how the produced label files can be used with Audacity.

Note that the default values of the parameters and options can be restored at any time by clicking on the “Default Settings” button.

## 1.3. Launching the analysis

After selecting the audio file (s) and the location of the results, start the analysis by clicking on the “Start” button. Analyzes begin with playing the WAV file, looking for vocalizations in the recording, and ending with identifying vocalizations. An hour-long file should be analyzed in just a few minutes. An informational window appears in the middle of the main window to notify the user that the scan is complete.



Note that at any time the scan can be stopped by clicking on the “Stop” button. Also note that the result files (in CSV and / or TXT format) are not created at the end of the analysis but rather when CallSeeker performs its first detection. Thus, if the analysis is stopped prematurely by the user using the “Stop” button, it is possible that the results files have already been created.

## 2. Visualize the results

### 2.1. Identification spreadsheet

CallSeeker generates by default a spreadsheet in CSV format. The spreadsheet is named in the following format: “CallSeeker20\_Analysis\_yyyymmdd hhmmss.csv” according to the date (yyymmdd) and time (hhmmss) the analysis was started.

To display the CSV files properly in Microsoft Excel, you must convert them beforehand with the appropriate delimiter by following the following procedure: after having imported the CSV file into Microsoft Excel, go to the “Data” tab, then click on the “Text with columns” icon.

To display the CSV files properly in LibreOffice Calc, only use the comma in the delimiter options when you open the CSV file.

Here is an example of the scan results you may get:

	A	B	C	D	E
1	Filename	Chunk start (HMS.ms)	Chunk end (HMS.ms)	Class	Confidence
2	Z:/Audio_01.wav	00:00:00.000	00:00:01.996	CATBIC_CALL	0.999821
3	Z:/Audio_01.wav	00:00:01.996	00:00:03.992	CATBIC_CALL	0.999828
4	Z:/Audio_01.wav	00:00:03.992	00:00:05.988	CATBIC_CALL	0.999845
5	Z:/Audio_01.wav	00:00:05.988	00:00:07.984	CATBIC_CALL	0.999954
6	Z:/Audio_01.wav	00:00:07.984	00:00:09.980	CATBIC_SONG	0.999962
7	Z:/Audio_01.wav	00:00:09.980	00:00:11.977	CATBIC_CALL	0.999932
8	Z:/Audio_01.wav	00:00:13.973	00:00:15.969	CATBIC_CALL	0.999993
9	Z:/Audio_01.wav	00:00:15.969	00:00:17.965	CATBIC_CALL	0.999912
10	Z:/Audio_01.wav	00:00:19.961	00:00:21.958	CATBIC_CALL	0.999914

The first column “Filepath” contains the paths of the analyzed audio files.

The second “Chunk start (HMS.ms)” and third “Chunk end (HMS.ms)” columns indicate the start and end positions of the analysis windows (approximately 2 seconds) in the format “hh:mm:ss.ms” for which CallSeeker has identified at least one call or song of Bicknell's or Gray-cheeked Thrushes.

The fourth column “Class” contains the classification results for the species. Four classes are currently offered with the current classifier: CATBIC\_CALL, CATBIC\_SONG, CATMIN\_CALL and CATMIN\_SONG. The meaning of these classes and the interpretation of the results are provided in section 3.

The fifth and last column “Confidence” indicates the confidence probabilities associated with the identifications.

## 2.2. Audacity label files (.txt)

If the Audacity option was checked, CallSeeker produces a label file in TXT format describing the identifications generated for each of the WAV files where at least one Bicknell's or Gray-cheeked call or song has been identified. Here's an example of a file with labels you may get:

```
0      1.99619 CATBIC_CALL (1)
1.99619 3.99238 CATBIC_CALL (0.99)
3.99238 5.98857 CATBIC_CALL (1)
5.98857 7.98476 CATBIC_CALL (1)
7.98476 9.98095 CATBIC_SONG (1)
9.98095 11.9771 CATBIC_CALL (1)
13.9733 15.9695 CATBIC_CALL (1)
15.9695 17.9657 CATBIC_CALL (1)
19.9619 21.9581 CATBIC_CALL (1)
21.9581 23.9543 CATBIC_CALL (1)
```

The first column indicates the start position of the label while the second column indicates the end position of the label. Positions are expressed in seconds. The third column indicates for each

identification the predicted class and the associated confidence probability (in brackets). Section 4 describes how the produced label files can be used with Audacity.

## **3. Interpreting CallSeeker's results**

### **3.1. Description of the classes**

The classifier currently offers four classes:

- CATBIC\_CALL, to identify the presence of one or more Bicknell's Thrush calls in the analyzed segment.
- CATBIC\_SONG, to identify the presence of one or more Bicknell's Thrush songs in the analyzed segment.
- CATMIN\_CALL, to identify the presence of one or more calls of Gray-cheeked Thrush in the analyzed segment.
- CATMIN\_SONG, to identify the presence of one or more Gray-cheeked Thrush songs in the analyzed segment.

Note that the species is designated by a 6-letter code created from the scientific name of the species (first 3 letters of the genus and first 3 letters of the species).

### **3.2. Confidence probability associated with identification**

The probability of confidence associated with an identification varies between 0 and 1. However, only the identifications with a probability of confidence greater than or equal to 0.5 appear in the results. The higher the value of the confidence probability, the more it indicates that the classifier has confidence in his identification. This does not mean, however, that the accuracy of the identification increases with the probability of confidence, and the user should not blindly rely on this value to judge the reliability of the results. The confidence probabilities depend directly on the variety of examples provided to the classifier during his training phase. The greater this diversity, the more realistic the estimate of the probability of confidence associated with an identification. This is one of the reasons why CallSeeker is a software in constant development whose reliability of the results will gradually increase with the addition of new examples in the training database (see sections 4 and 5 for how to contribute to the software improvement).

CallSeeker is not foolproof software and may miss identifications (false negatives) or mistakenly identify vocalizations from other species such as calls or songs of Bicknell's or Gray-cheeked Thrushes (false positives). Most of these errors occur when unknown vocalizations or sound signals are presented to the classifier (eg, new species not included in the learning database). In the case of false negatives, it may be a variation of a cry or song never encountered before or recorded in a soundscape unknown to the classifier (e.g. with strong background noise or when several species vocalize at the same time). In the case of false positives, these are predominantly species whose vocalizations



naturally overlap with calls and songs of Bicknell's or Gray-cheeked Thrush in terms of acoustic parameters.

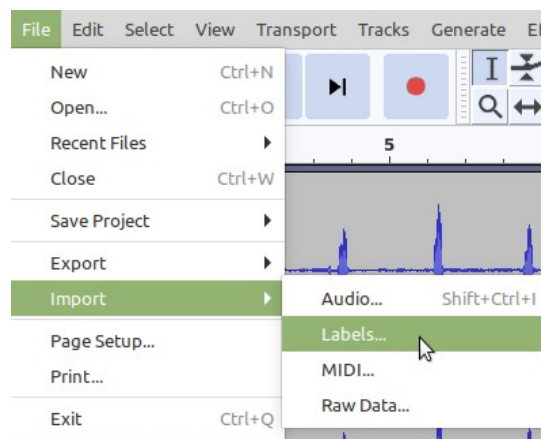
As of the creation of this manual (September 2020), the error rate has been estimated to be less than X% for false negatives and XX% for false positives for records entered into the validation database. However, these rates could be much higher for recordings made in soundscapes different from those used to train the classifier (new geographic region, seasonality or vocalization).

## 4. Manual validation of identifications

An important step in the acoustic species identification process is the final validation of the identifications by an expert. This validation should be systematic since CallSeeker is not foolproof software and rather suggests than certifies the presence of calls or songs of Bicknell's Thrushes or Gray Cheeks. The main advantage of CallSeeker is that it saves a considerable amount of time analyzing audio recordings for calls and songs of Bicknell's Thrush and Gray Cheek. Thus, the expert only has to validate the segments identified by CallSeeker, instead of having to listen to all the recordings in full.

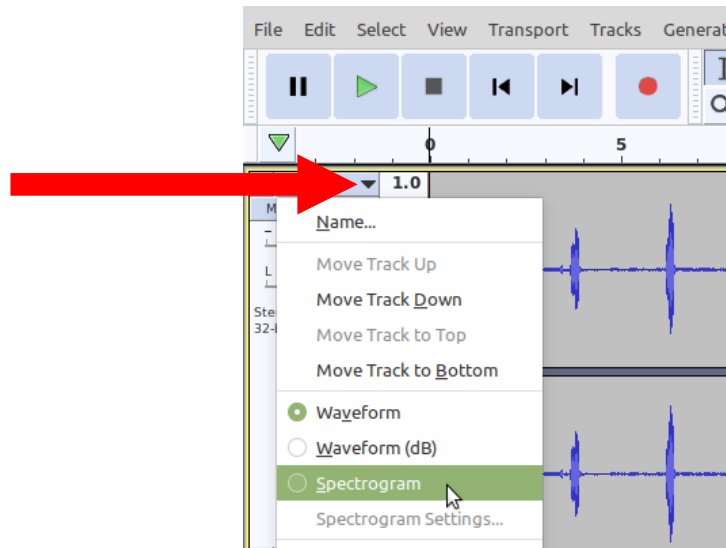
In order to facilitate the auditory and / or visual validation work, the segments identified by CallSeeker can be viewed from third party software such as Audacity (free and open source software). The latest version of Audacity is available at the following address: <https://www.audacityteam.org/download/>.

After installing and opening Audacity, one way to import a WAV file is to drag and drop the audio recording (.wav) into the main software window. You must then go to the “File” menu, “Import” tab, then “Labels” in order to import in turn the text file (.txt) containing the labels describing the identifications by CallSeeker:



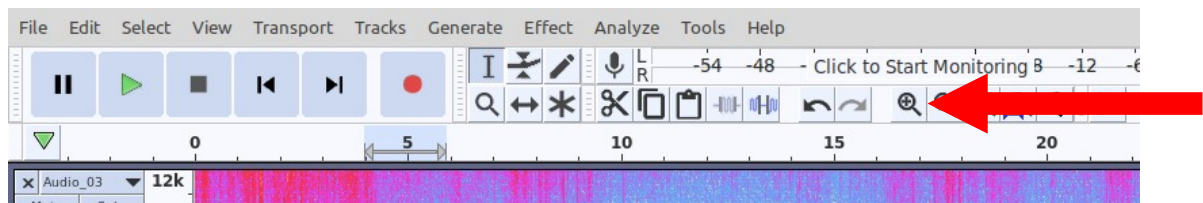
After importing the text file in TXT format generated by CallSeeker corresponding to the .wav file imported for audition, it is possible (1) to directly listen to the segments identified by CallSeeker or (2) to view the recording in the frequency domain (in the form of spectrograms) where frequencies rather than amplitude variations are visualized as a function of time. To do this, open the audio recording

menu symbolized by a small black triangle on the left (indicated in the image below by a red arrow), then select the “Spectrogram” option:

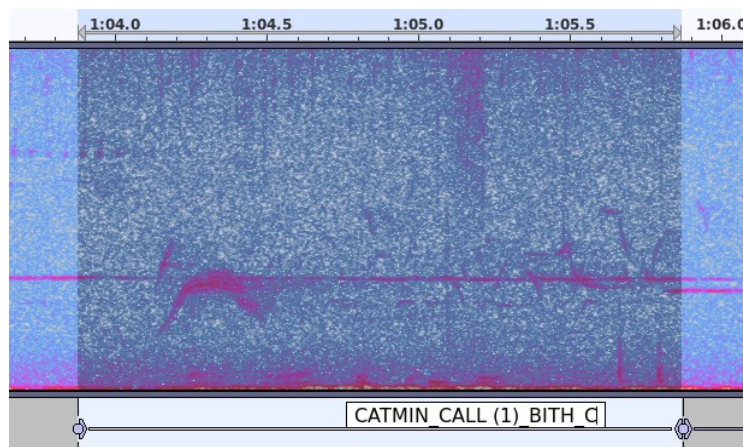


If there is any doubt about an identification, it is recommended to perform an auditory and visual validation, as well as to possibly search for similar vocalizations before and after the segment.

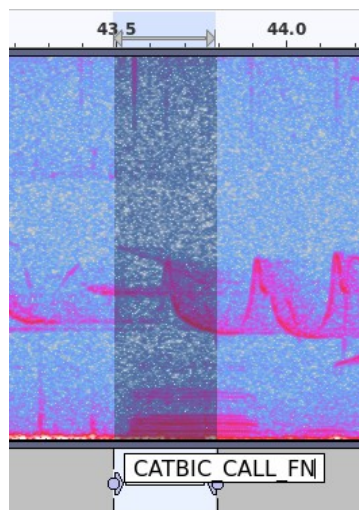
It is then possible to zoom (see red arrow below) on the recording in order to better visualize the identifications proposed by CallSeeker:



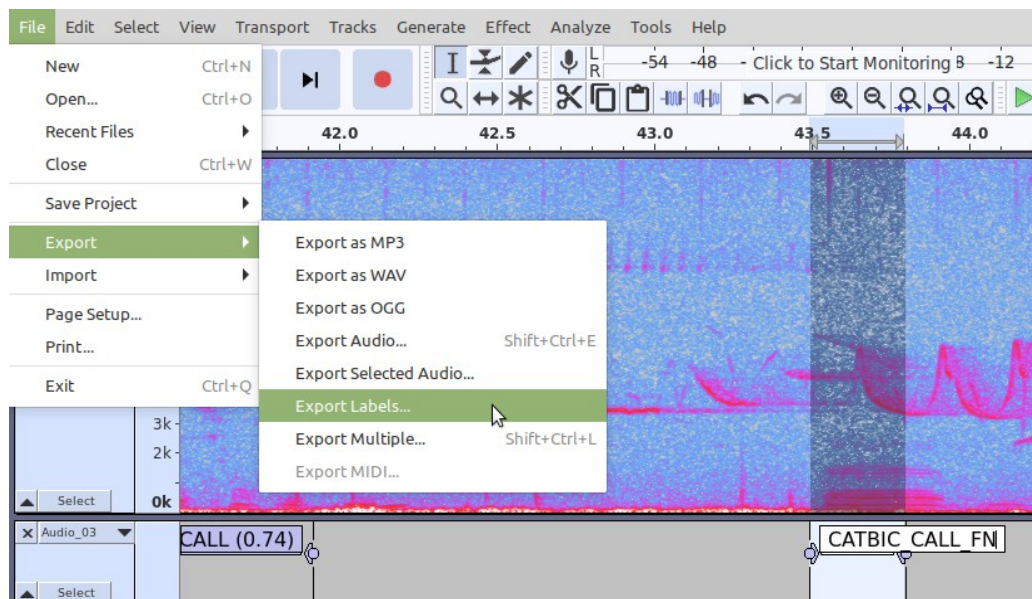
You can easily navigate between labels using the keyboard shortcuts “TAB” or “ALT + LEFT” and “SHIFT + TAB” or “ALT + RIGHT”. To modify the labels offered by CallSeeker, all you have to do is manually edit the content of the labels (with a left mouse click on the label and then using the keyboard):



We can also create new labels by selecting a part of the recording and using the keyboard shortcut “CTRL + B” then for example writing “CATBIC\_CALL” for a call of Bicknell's Thrush, and for example in the case of a false negative, add the suffix “\_FN”:



Once modified, the labels can be saved with the corresponding audio file in the form of an Audacity project or individually by going to the “File” menu, “Export” tab, then “Export labels” (see figure below). Note that these labels can be sent with the corresponding audio file to the WavX team in order to consolidate the learning database and thus improve the performance of the classifier for the benefit of all users.



## 5. Improve the performance of CallSeeker (for your use)

Remember that, in cases where CallSeeker is used in contexts or soundscapes still unknown to the classifier (new geographic region, seasonality or vocalization), these performances could deteriorate significantly.

In order to improve the performance of the classifier, users of the CallSeeker software can forward to the [WavX team](#) (1) the original false positive and false negative cases and (2) corrected by an expert in the form of labels (text file in TXT or CSV format). These labels must be provided with (3) the corresponding audio recordings. This information can then be incorporated into the classifier learning process and benefit everyone in future updates.

Please contact WavX Technical Support at [info@wavx.ca](mailto:info@wavx.ca) for any query, information, or bug report. Happy using!