Merlin Bird ID App Tutorial

Howard County Bird Club

For those who are…

- New to birding and Merlin
- Birders new to Merlin
- Looking to learn more

You will learn…

- Several functions of Merlin Bird ID and how to use the them
  - Explore
  - Step-By-Step ID
  - Photo ID
  - Sound ID
- The limitations of, and common issues with Merlin
- Recommendations to mitigate biases and Merlin limitations
- Best practices for using Merlin

Materials

- Smartphone with Merlin Bird ID

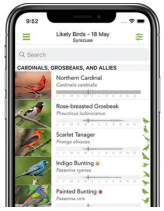
- AVR-X app (optional)

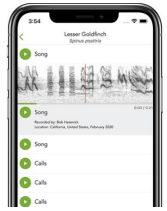
- Binoculars (optional)

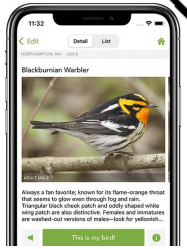
- Camera (optional)

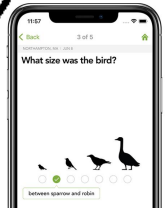
- Phone holder (optional)

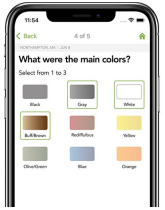
Agenda

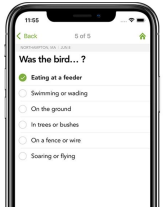












Then… a 30-minute hands-on field trip to practice!

Brought To You By…

Howard County Bird Club

John Harris

Four!

Has anyone seen the Swan?

Steve Luke

How many functions does Merlin have?

Gregg Petersen

Val Swan

I'm on it!

Think that's impressive? Just wait til you see what Merlin can do!

Lauren McDougle

What is Merlin?

Merlin is an app produced by the Cornell Lab of Ornithology that helps you find, learn about, identify, and report birds.

Benefits of Merlin

“We have learned new vocalizations for common birds which make a variety of sounds, like Tufted Titmouse, by hearing the bird, checking Merlin and then associating the sound with the bird that we see, ideally as it makes the sound.”

- Meg and John Harris

- Enhances and improves your bird watching, birding, and listing
- Merlin alerts us to unfamiliar sounds of familiar birds.
- Merlin is a huge benefit for anyone experiencing even mild hearing loss to total deafness.
- Merlin helps with birding "mindfulness," but can also still allow socializing.

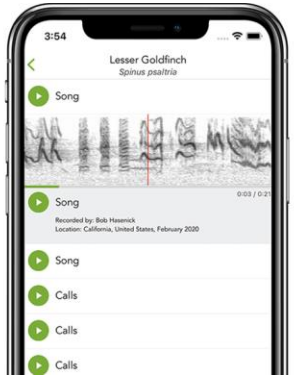
Overview

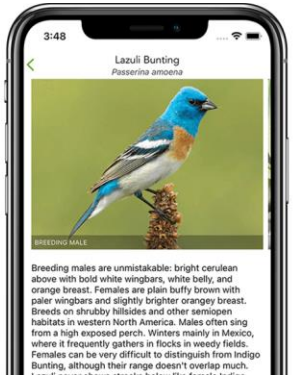
- Bird Watching, Birding, and Listing
- Cornell Lab of Ornithology, eBird, allaboutbirds
- Merlin is an app produced by the Cornell Lab of Ornithology
- It helps you find, learn about, identify, and report birds
- Connected eBird: customizes view, reports to eBird
- ID based on 5 questions (Step-By-Step ID)
- ID based on machine-learning
    - Data from eBird
    - Labeled by experts
    - Trained on images and spectrograms of sound recordings
    - Accuracy varies by species and other factors

Merlin ID: Explore Birds

Explore Birds

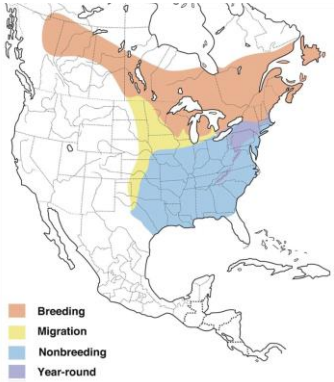
- Tap “Explore”
- Check Date and Location at top
- Tap Settings
  - **Likely Birds*** filters to just those likely at the location and date specified
  - Bird Packs shows all birds you have downloaded - use carefully!
  - Location: Search, **Current***, Map, Recents
  - Date: **Today***, Year-Round, Specified Date
  - Sort By: **Most Likely***, Family, Family-Most Likely, Alphabetic
  - Hide birds on life list (On / **Off***)
  - ***Recommended Settings**



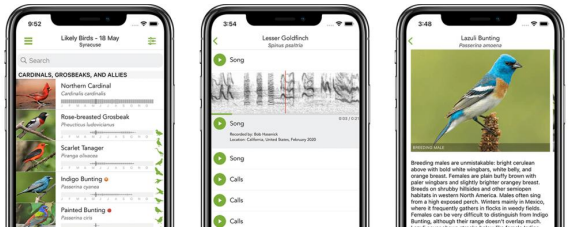


Explore Birds

- Tap Explore
- Photo, name, listed?, and prevalence over time shown for each species
- Tap species to see
  - More photos and ID info (description, habitat, behavior, field marks)
    - Augment with allaboutbirds “Similar Species” and other resources
  - Sounds: reference recordings of calls and songs
  - Map
    - “Breeding” -> Summer (red/orange is a “hot” color)
    - “Migration” -> Spring / Fall (Yellow is between red and blue)
    - “Nonbreeding” -> Winter (Blue is a “cool” color)
    - Year-round (purple is a combination of red summer and blue winter)



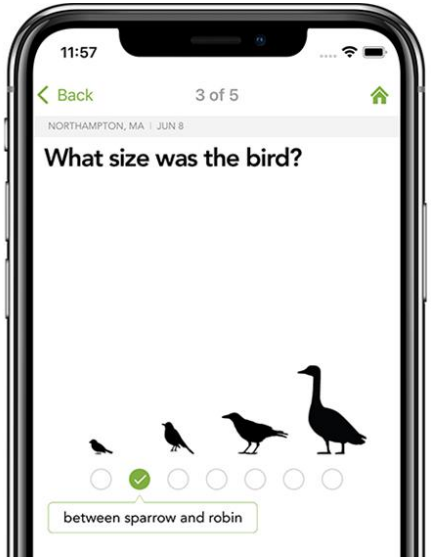
https://www.allaboutbirds.org/guide/Winter_Wren/maps-range

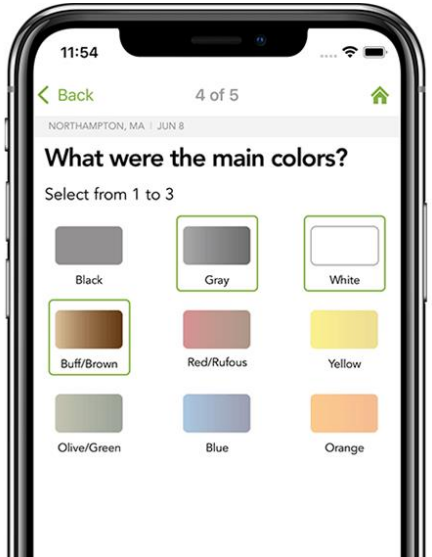


Merlin ID: Step by Step Identification

Step by Step ID

- Answer questions to narrow ID options
- Location & Date, Size, Color, Behavior
- Might get several options to consider
- Let’s try it together!





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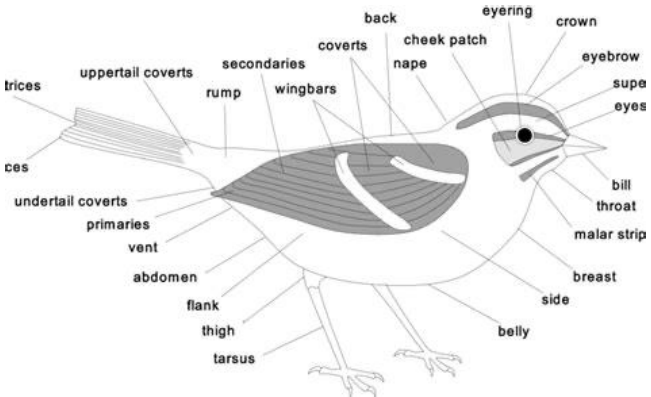
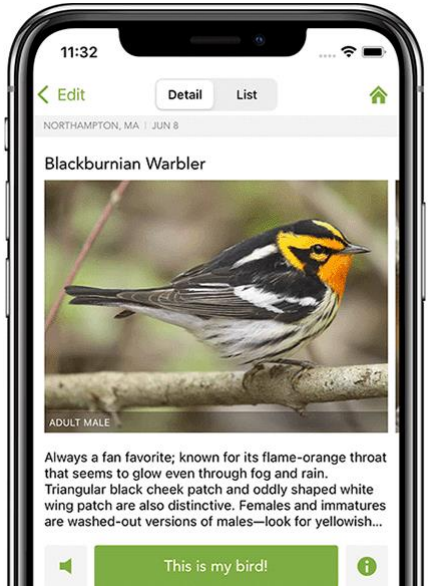
Merlin ID: Photo Identification

Photo ID

- Take a photo with Merlin, or (more often) choose an existing photo
- Crop the photo as needed in Merlin
- Merlin might provide multiple options to consider
- Consider
  - Lighting, angle
  - Plumage, Male/Female/Juvenile
- Let’s try it together!





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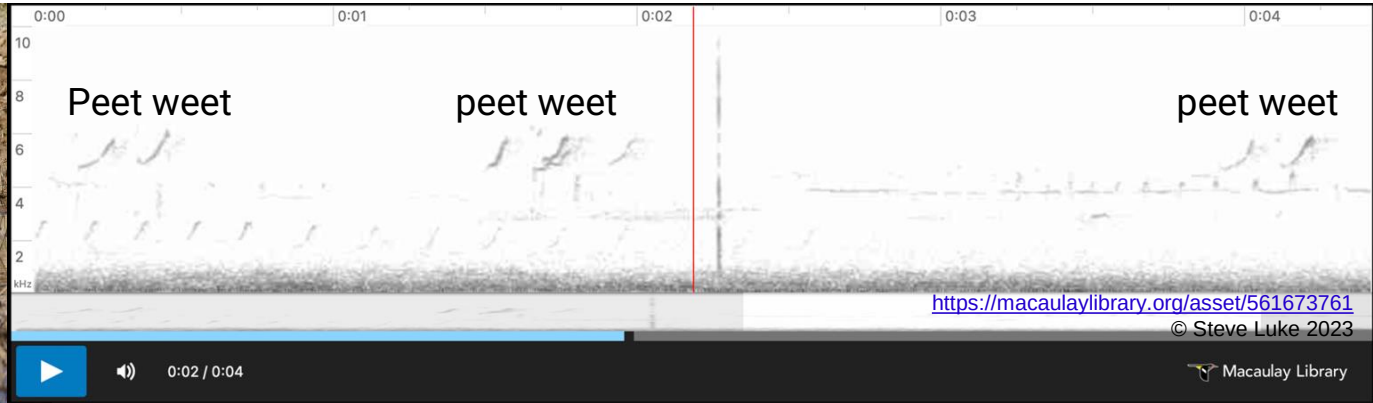
Merlin ID: Sound Identification

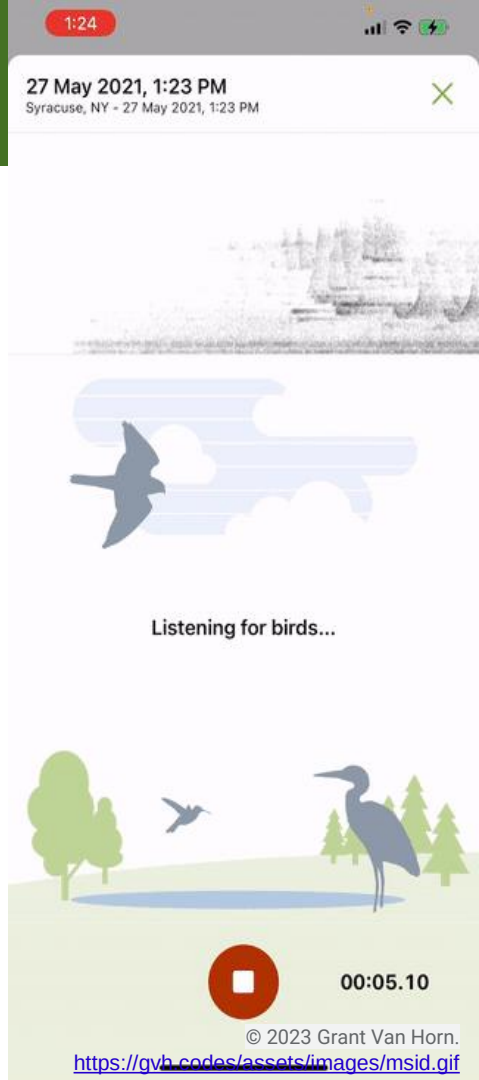
Identifying Birds By Sound

- Often, birds can be heard more easily than seen
- Bird species can have several different songs and calls
  - Songs of some species are “inherited” whereas others are learned
  - Learned songs can be confusing, and have more variability (like dialects)
- What is a spectrogram? Let’s explore: https://academy.allaboutbirds.org/birdsong/



Sound ID Recording

- Start
  - Home->Sound ID
  - OR Long-press app->Start Sound ID
- Record
  - Live spectrogram scrolls across the top
    - volume over time and frequency
  - Suggested species listed below
  - Point mic towards the sound, stay still and quiet
  - Shorter recordings recommended - do not have to save
- Stop
  - Cancel and “X” cancels quickly without saving
  - Red-circled white square stops and saves
  - Keep recordings short for best app performance
- Let’s try it together!

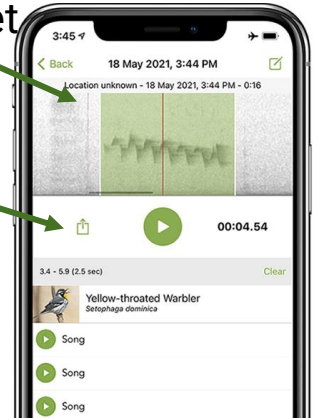


© 2023 Grant Van Horn.
https://gvh.codes/assets/images/msid.gif

Who am I?

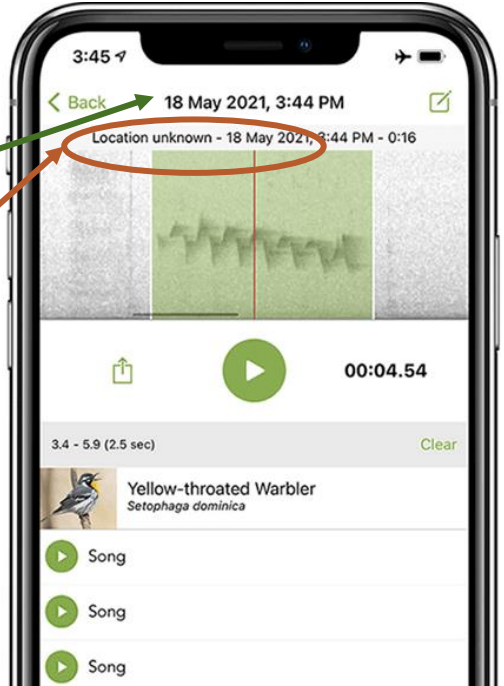
Sound ID Review, Editing, and Sharing

- Home->My Sound Recordings
  - List of recordings with Date, Time, Location, Identified species, Duration
  - Search by species to filter list
  - Tap recording to open
  - “…” provides options including import audio file
- Review
  - Click a species to scroll the spectrogram to the next time Merlin identified it
  - Click & drag to highlight a section and narrow IDs to just that snippet
  - Click down-arrow next to species to access reference recordings
  - Tap the Play/Pause button (or row) to play/pause that recording
- Optional: “Share” icon to save or send the recording
- Let’s try it together!

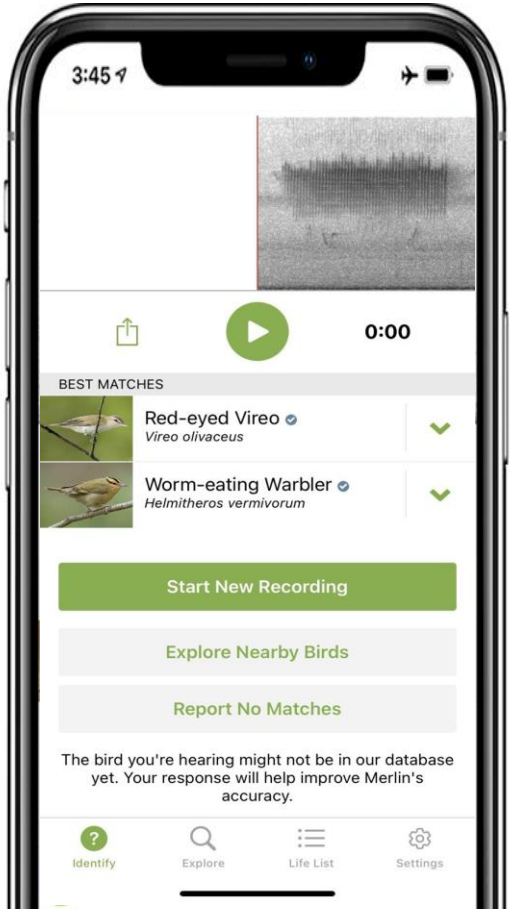


Sound ID Limitations

- Merlin performs image recognition on spectrograms
- Background noise, mimic birds, overlapping birdsongs, poor recording quality, insects, mammals, and other factors impact accuracy
- Correct the Location and Date
- Location & Date are important for accuracy
- https://merlinvision.macaulaylibrary.org/en/audio/world
- Merlin can have false positives and false negatives
- Let’s try it together!



False Positive and Negative Sound Examples



False Positive - Chipping Sparrow Called Worm-Eating Warbler

False Negative - Northern Flicker and Tufted Titmouse

TheCornellLab

Bird ID Trivia: Merlin vs Birders

Merlin

Multi-dimensional Birding

Definition: Using sound, appearance, habitat, and behavior to verify species identification.

Check Your Birds

“The difference between a beginning birder and an experienced one is that beginning birders have misidentified few birds. Experienced birders have misidentified thousands.” - *Pete Dunne on Bird Watching: The How-to, Where-to, and When-to of Birding*

- Gather more evidence
  - Compare the audio and photo examples provided by Merlin with your bird
  - Read the information under Details (same as Explore)
- Send the photo / audio to more experienced birders for help

Biases & Base Rate Fallacy

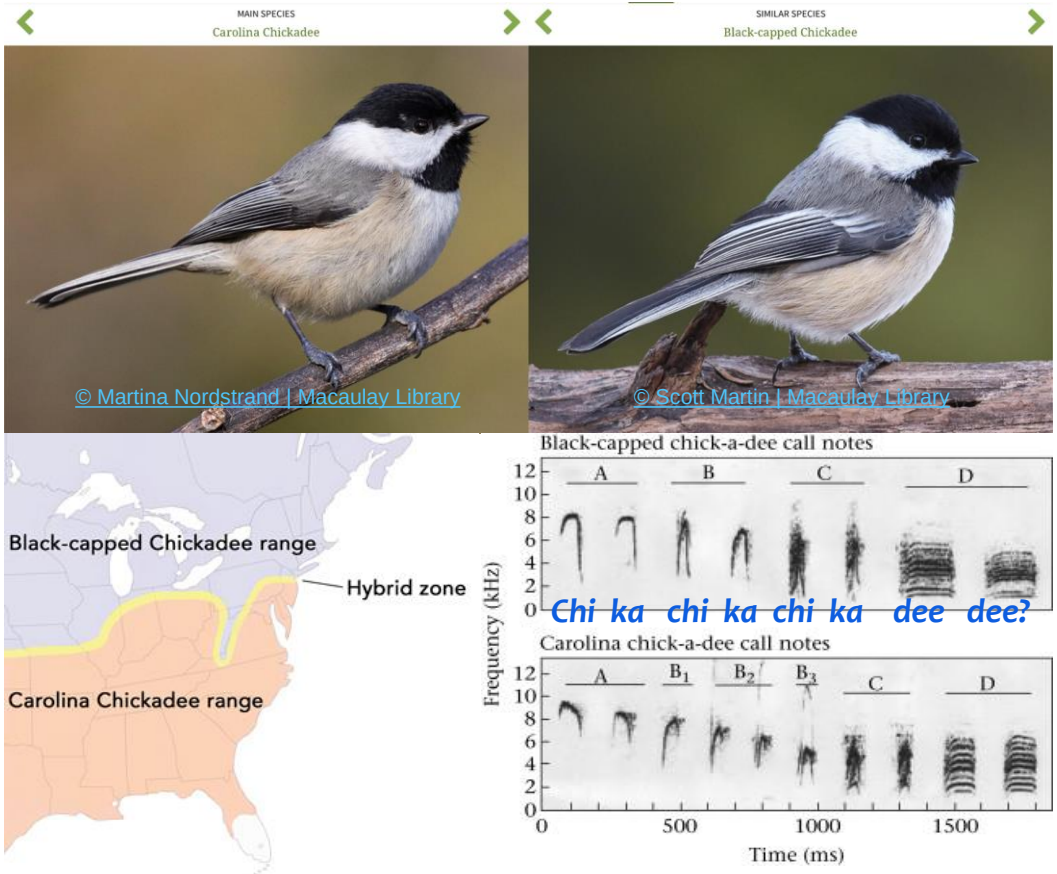
- Key Biases in birding
  - **Listing bias**: listing a species you “want” despite insufficient evidence
  - **Confirmation bias**: seeking confirming evidence, ignoring contradictory evidence
  - **Dunning-Kruger effect**: lack of expertise -> underappreciating nuances
- Base Rate Fallacy
  - If Merlin can ID CommonBird vs RareBird with **90% accuracy (Merlin average)**
  - And **the RareBird is only in the County 0.01% of the time**
  - **If Merlin identifies a RareBird, then…**
    - Either RareBird is here, and Merlin is right (0.01% * 90% = 0.009%)
    - OR, Merlin got it wrong (99.99% * 10% = 9.99%)
  - **There is a 99.91% chance it is wrong!**

https://en.wikipedia.org/wiki/Base_rate_fallacy

If you hear hoofbeats, think Horse before Zebra (unless you’re in Africa!)

Check Your Birds

- Both species learn their songs, sometimes from each other, hybridize, and we live near the range boundary!
- Black-capped Chickadee is more common in western Maryland in the mountains.
- 99.5% of all Chickadees listed in Howard County have been Carolina. In summer, 100% have been Carolina.



Multi-Dimensional Birding

MAIN SPECIES

Fish Crow

© Nathan Dubrow | Macaulay Library

SIMILAR SPECIES

American Crow

© Henry Burton | Macaulay Library

Very difficult to distinguish visually, but the characteristic “uh’ uh” call of the Fish Crow helps

Multi-Dimensional Birding

© Graham Gerdeman | Macaulay Library

© Evan Lipton | Macaulay Library

If Merlin Sound ID reports Worm-Eating… consider Chipping Sparrow. Visually easy to distinguish.

Best Year-Round HoCo Sound ID Accuracy

Species	Merlin Performance	HoCo Prevalence Weighted Probability
Northern Cardinal	88%	94%
American Crow	90%	91%
Carolina Wren	87%	89%
Mourning Dove	90%	89%
Red-bellied Woodpecker	89%	88%
Carolina Chickadee	89%	87%
Eastern Bluebird	93%	87%
White-breasted Nuthatch	92%	86%
Tufted Titmouse	86%	84%
Red-shouldered Hawk	94%	83%
Canada Goose	89%	82%

Worst Year-Round HoCo Sound ID Accuracy

Species	Merlin Performance	Best HoCo Prevalence Weighted Probability
Philadelphia Vireo	61%	4%
Yellow-breasted Chat	67%	13%
Bufflehead	65%	23%
Purple Finch	67%	23%
Cooper's Hawk	68%	24%
Northern Mockingbird	54%	48%
Baltimore Oriole	69%	49%
Dark-eyed Junco	69%	73%

Identification
Troubleshooting

Vireo Confusion - Visual

MAIN SPECIES

Philadelphia Vireo

© Mark Morse | Macaulay Library

SIMILAR SPECIES

Warbling Vireo

© Ryan O'Donnell | Macaulay Library

If Merlin Photo ID shows Philadelphia Vireo… consider Warbling Vireo with elaborate song, incomplete eyeline.

Vireo Confusion - Audio

MAIN SPECIES

Philadelphia Vireo

© Todd Fellenbaum | Macaulay Library

© Mark Morse | Macaulay Library

SIMILAR SPECIES

Red-eyed Vireo

© Jim Hully | Macaulay Library

Merlin Sound ID: Philadelphia or Yellow-Throated Vireo… maybe Red-eyed: darker cap & eyeline, white throat. Philadelphia Vireo is much less common, but sounds very similar, and sometimes imitates Red-eyed.

Alternative Cerulean / Parula song confusion

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© Ryan Schain | Macaulay Library

If Merlin Sound ID reports Cerulean Warbler… much more likely Northern Parula alternative song. Cerulean Warblers are very rare in Howard County and tend to stay very high in the canopy. Northern Parulas are much more common and forage and perch lower.

Best Practices

Recommendations

- Each time you use Merlin, check the Location and Date setting
- Stop recording every 2-5 minutes to keep recordings manageable
- Turn off screen to save battery
- Delete old or unwanted recordings to save storage space
- Confirm “special birds” with multi-dimensional birding - did you see it? Can you find matching audio examples? Matching photographs? Cornell Lab of Ornithology, eBird, allaboutbirds

Best Practices

- Try your own ID before looking at Merlin
- Treat the Merlin app like another birder
  - If Merlin identifies a species, it is as if another birder said: “oh, I think that was…”
  - Merlin might be wrong. Merlin is not you - you must identify the bird yourself.
- Check how common / rare the identified species is where & when you are
- Listen to the sections of audio Merlin identified as the species and judge for yourself. **It is *your* bird list, not Merlin’s.**
- Gather a holistic set of evidence (audio, visual, behavioral, habitat)

Studying

- Use other resources like Cornell Lab of Ornithology, eBird, allaboutbirds
- Get together with other people - share and discuss what you see and hear
- Look at pictures of the birds you might see
- Listen to recordings of birds that you think you might hear or would like to hear

Resonance, Pitch, Tempo, and Timbre

Multi-dimensional birding improves when you can describe vocalizations

Types of Birdsong

Song

- Simple, short
- 2 sections : 3 sections
- 2 syllables : 3 syllables
- 2 phrases : 3 phrases
- Mimics

Dawn Song

Flight Call

Alarm Call

Duet

Drumming*

Resonance and Volume

Thin - Nasal - Rich - Open

Loud - Medium - Soft

Crescendo - Decrescendo

Timbre

Clear - Breathy - Raspy - Growl

Hiss - Insect-like - Buzzy - Trill

Mechanical - Whinny - Bell-like - Liquid

Warbling - Whistling - Flute-like

+

Pitch

Low - Medium - High

Ascending - Descending - Up-slurs - Down-slurs

Flat - Rolling - Varied - Harmonic

Notes: 1 - 2 - 3 - 4 - Chip

Tempo and Duration

Slow - Medium - Fast

Sustained - Abrupt - Persistent - Intermittent

Countable - Uncountable

Decelerating - Steady - Accelerating

Mnemonics

Barred Owl - Who cooks for you?

Eastern Wood Pewee - Pe-WEEE!

Acadian Flycatcher - THAT'S IT! / Pizza!

Willow Flycatcher - Fitz-bew

Eastern Phoebe - Fee-BEE!

Yellow-throated Vireo - Three-eight. Three-eight.

White-eyed Vireo - CHICK! Burry-oh CHICK!

Red-eyed Vireo - Where are you? Here I am!

Carolina Chickadee - Chick-a dee dee dee!

Carolina Wren - Cheeseburger! Cheeseburger! Cheeseburger! Chee!

Wood Thrush - Ee-oh-lay!

American Robin - Cheerio, cheerily!

Eastern Towhee - Drink your tea; Towhee!

American Goldfinch - Potato Chip (flight call)

White-throated Sparrow - Old Sam Peabody Peabody; Oh Canada

Ovenbird - Teacher! Teacher! Teacher! Teacher!

Yellow Warbler - Sweet, sweet, sweet, I'm so sweet!

Scarlet Tanager - THANK you! or CHICK! Burr…

Supplemental Handout: Birdsong

Share Your Birds

Editing Audio with AVX-R and Listing

You will learn…

- To save, edit, and upload your recordings and photos
- How to connect to eBird
  - Customizes view
  - Reports to eBird
- Why you can trust (or distrust) ID based on machine-learning
  - Data from eBird
  - Labeled by experts
  - Trained on images and spectrograms of sound recordings
  - Accuracy varies by species and other factors

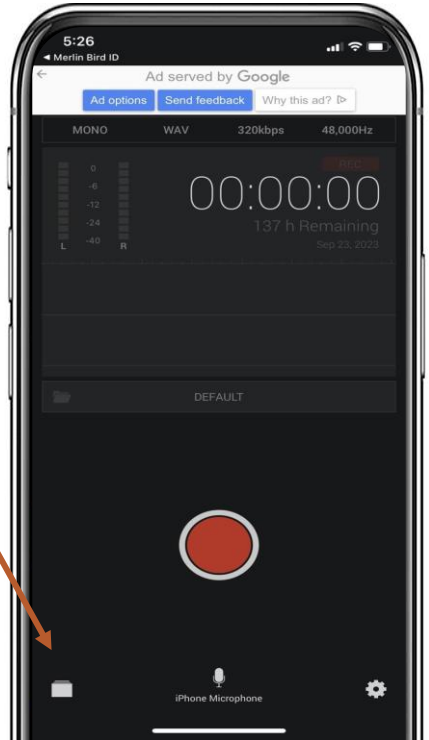
You Found the Bird

*Don't claim "Identified by Merlin?" What **should** I do?*

- Gather a holistic set of evidence (sound, appearance, behavior, habitat)
- Verify via multi-dimensional birding
  - Did you see it? Hear it?
  - Can you find matching audio examples? Matching photographs? Cornell Lab of Ornithology, eBird, allaboutbirds
- Write field notes (appearance, behavior, habitat)
- Submit your sound or photo to eBird

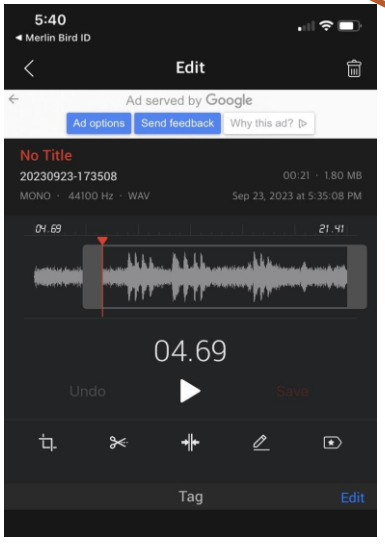
How to Save and Edit Your Audio

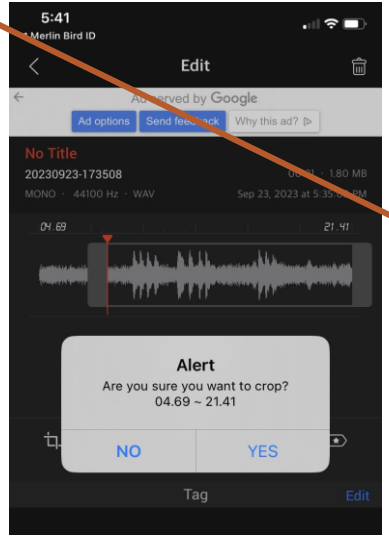
- Open the Merlin app and go to “My Sound Recordings”
- Select the file you’d like to edit or share
- Click ⬆ to save the file
  - Save to AVR-X**
  - Once saved, it will take you directly to the AVR-X app home screen
- Click the folder icon at the bottom left to locate the file you would like to edit → Imported → “No Title 2023 date”

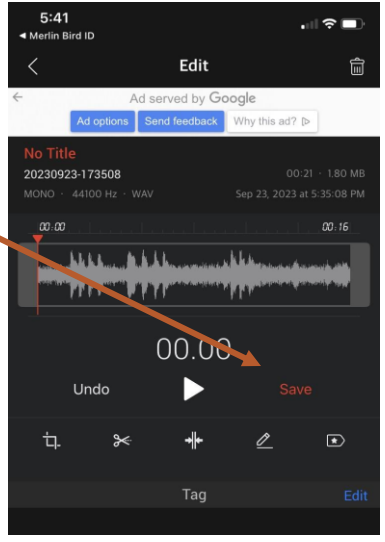


AVR-X Audio Editing

- Tap crop icon bottom-right
- Drag left and right bars to desired start and end times
- Tap crop icon bottom-left, Confirm “**Yes**”, Play to confirm correct crop
- Tap “**Save**” in red



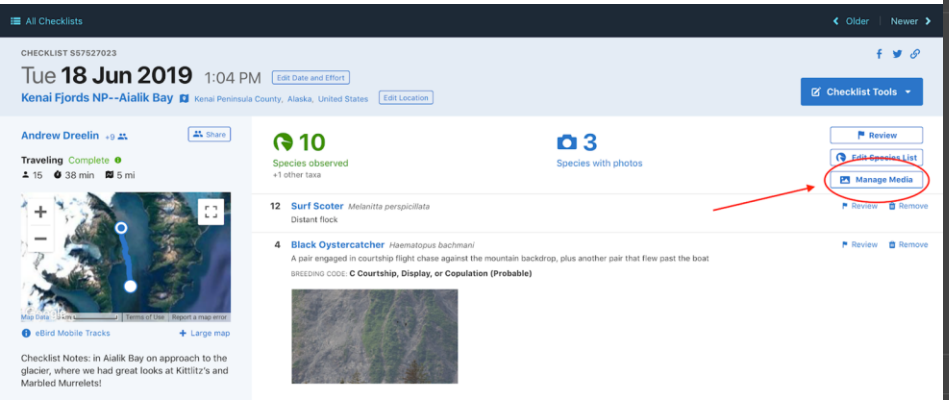


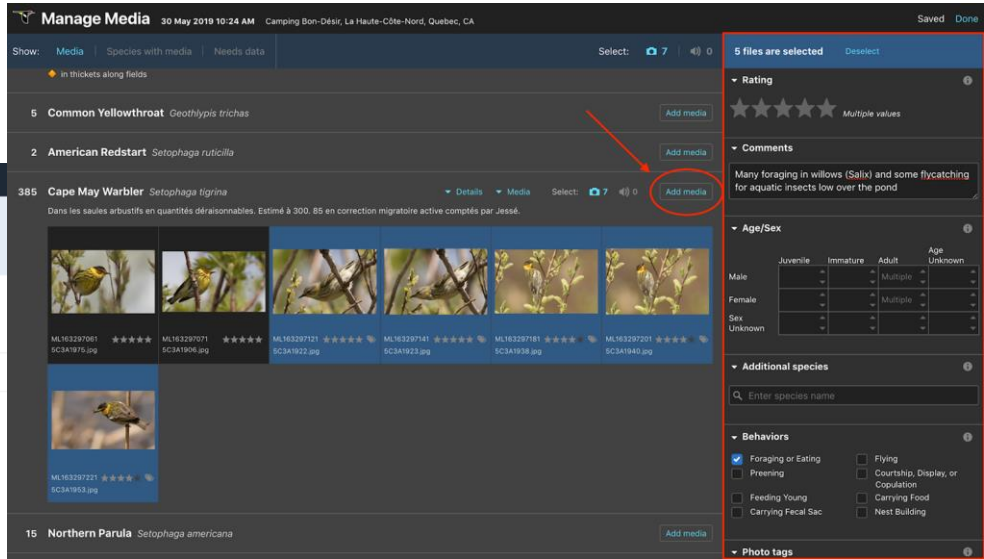


Merlin Bird ID Listing: Sharing on eBird

- In Merlin: Click “That’s My Bird” and follow prompts
- Open eBird in a browser, open your checklist
- Click “Manage Media”
- Click “Add Media” for the species
- Click “Done”
- Let’s try it together!

https://support.ebird.org/en/support/solutions/articles/48000825713-uploading-media





Merlin ID Listing: Sharing on eBird

eBird

Uploading your Media

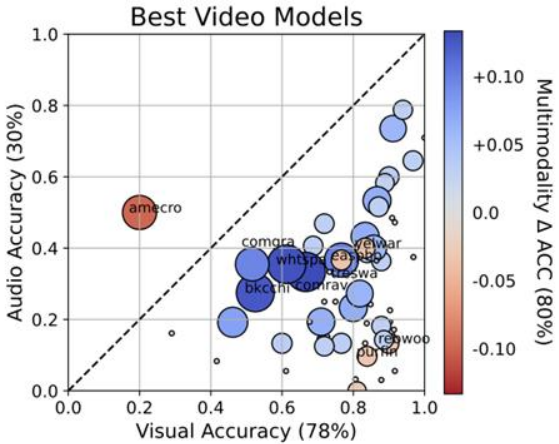
How Merlin Works

Your Assistant in the Field

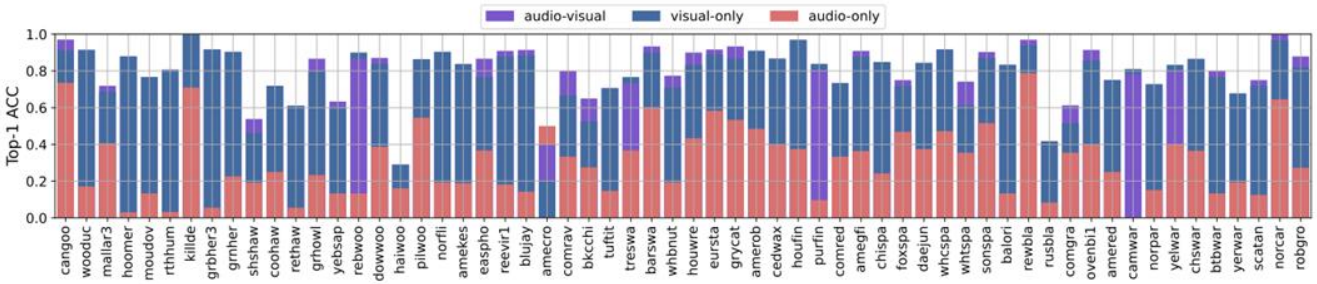
- Converts a sound file to a spectrogram (image)
- A programmed neural network reads the spectrogram
- This model uses 140 hours of audio containing the species to identify and predict
- A database of sounds for the species is assembled
- Using a gradient descent algorithm, the computer then “filters” through the sound to predict or identify the most likely (or exact) species
- Merlin utilizes feedback from users to continuously improve the model

Multi-Dimensional Birding

- Fusing Audio and Visual inputs typically improves accuracy ~10% points!
- Visual Alone Best: Red-Bellied Woodpecker, Eastern Phoebe, Purple Finch, Cape May Warbler, Yellow Warbler
- Audio is usually the least accurate, except American Crow
- E.g., audio FP=15%, visual FP=10% => Combined FP=1.5%!



Note: Merlin Sound ID accuracy is better than these audio-only stats



https://arxiv.org/pdf/2207.10664.pdf

Working with Merlin

Working with Merlin

- Check for obvious errors
  - Location and Date
  - Mockingbird, Brown Thrasher, or Gray Catbird nearby singing?
- Gather more evidence
  - Research similar species and look for distinguishing field marks
  - Take a photo, record audio, and take notes about the bird
  - **Be a “Multi-Dimensional” birder - sound, appearance, behavior, habitat**
- Listen to all of the clips of audio Merlin identifies as the species
  - Additional audio recordings (ideally high quality without background noise or songs)
  - Just one, or multiple? Is it a chip, or a song?
- Do you agree with Merlin?
  - Is there another species nearby that is similar and more likely?
  - Think: what else could this be? How could I tell the difference?
- Send the photo / audio to more experienced birders for help

Warblers are Coming!

https://www.audubon.org/news/how-tell-apart-sound-alike-warblers

Cape May Warbler vs. Bay-breasted Warbler

Photos from left: Cape May Warbler, Lorraine Minns/Audubon Photography Awards; Bay-breasted Warbler, Ray Hennessy/iStock

Carolina Wren vs. Kentucky Warbler

Photos from left: Carolina Wren, Jenny Burdette/Great Backyard Bird Count; Kentucky Warbler, Ray Hennessy/iStock

Magnolia Warbler vs. Hooded Warbler vs. American Redstart

From left: Magnolia Warbler; American Redstart; Hooded Warbler. Photos: Ray Hennessy/iStock

Cerulean Warbler vs. Northern Parula vs. Black-throated Blue Warbler

From left: Black-throated Blue Warbler; Northern Parula; Cerulean Warbler. Photos: Ray Hennessy/iStock

Chestnut-sided Warbler vs. Yellow Warbler

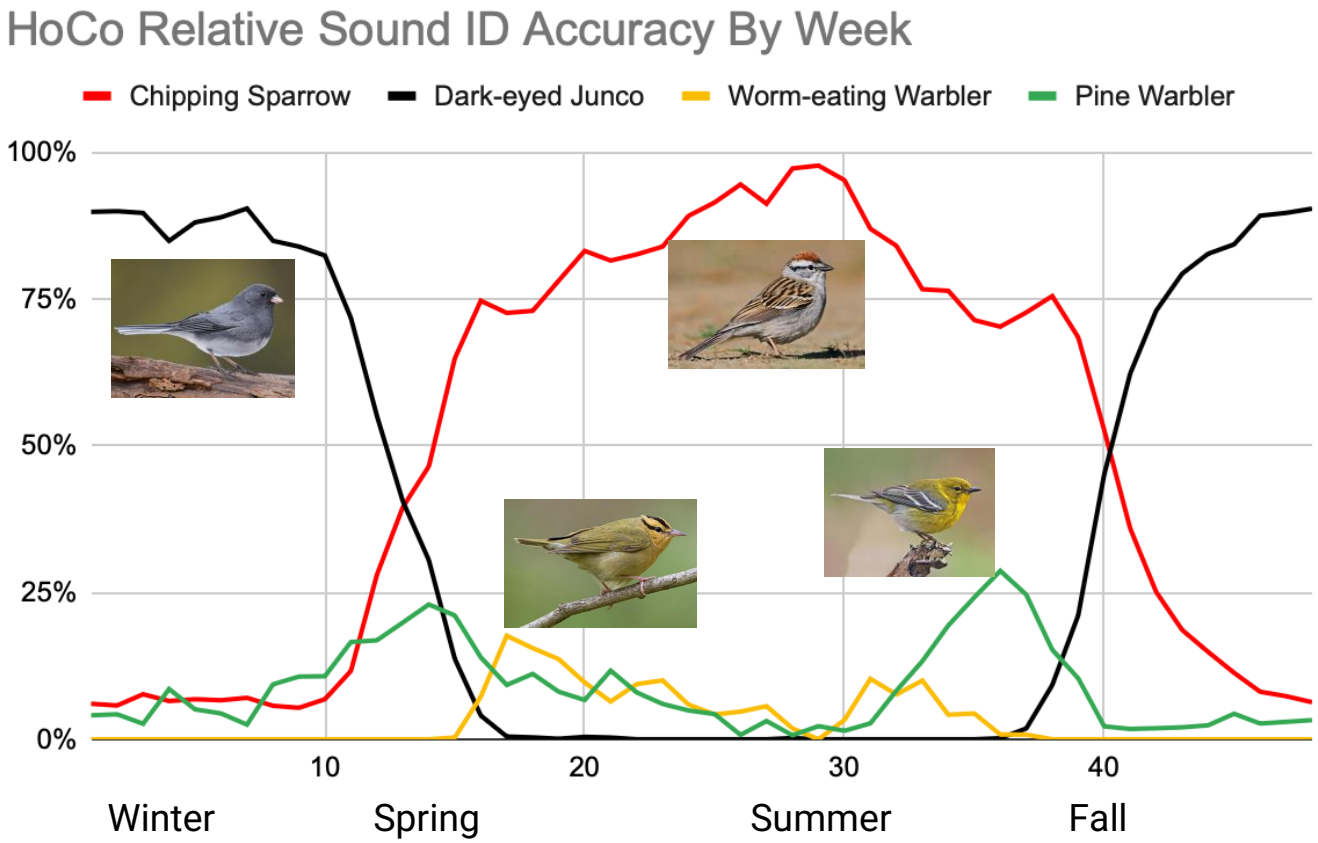
Photos from left: Yellow Warbler, Brian Collier/Audubon Photography Awards; Chestnut-sided Warbler, Ray Hennessy/iStock

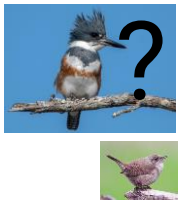
Commonly Mis-Identified by Merlin in Howard County

Merlin Says	More Likely	Check
Worm-Eating Warbler	Chipping Sparrow	Visual ID, habitat, season
Black-Capped Chickadee	Carolina Chickadee	Strongly contrasting colors
Philadelphia Vireo	Red-Eyed Vireo or Warbling Vireo	Throat color, eyeline, late Sept?
Cerulean Warbler	Northern Parula	Visual ID

If you hear hoofbeats, think Horse before Zebra (unless you're in Africa!)

Who's Trilling?





Check Your Knowledge

Let’s see how much you’ve learned!

Survey

Thank you for your feedback!

References

Merlin Screenshots on this slide and elsewhere in the presentation are from: https://merlin.allaboutbirds.org/

Thank you!

Backup / Bonus Slides

Sharing on GroupMe

- App for group texts used by HoCo birders to share real-time alerts
- Turn off “Focus sharing”
- Post if you have identified a species that many people would likely want to chase (rare for the county or otherwise difficult to find)
- Post
  - Current date and time (just in case the message delivery is delayed)
  - Location of bird (share location through the app better than text description)
  - Full species name (avoid 4 or 6 letter abbreviations)
  - Current status of bird: definitely still here, uncertain, definitely left the area
  - Description of how other birders could relocate the bird after arriving
- Use direct messaging for Q&A not relevant to entire group
- “Rare Birds” group: rare sightings only, “Discussion” group: broader chat
- Russ Ruffing, Joe Hanfman, and Gregg Petersen control membership

eBird

Trilling Confusion

Merlin Sound ID Identifies a trilling song in HoCo very briefly…

Species	Winter	Spring/Fall	Summer	Visual	Habitat
Chipping Sparrow	7%	75%-85%	90%-98%		Variety, often on ground
Dark-Eyed Junco	90%	4%-31%	0%		Variety, often in big flocks near ground
Worm-Eating Warbler	0%	7%-18%	1%-10%		Steep slope understory
Pine Warbler	2%	14%-29%	1%-8%		Pine Tree

Conditional HoCo Sound ID Accuracy

- Season / Time
  - Tundra Swan
    - Early March - up to 99% correct
    - May - ~0% correct
  - American Woodcock
    - Early March - up to 97% correct
    - Mid-July - ~0% correct
- Location / Habitat
  - Common Loon
    - Triadelphia Reservoir - up to 87% correct
    - MPEA perched on a tree - 0% correct

Rare “Common” Species (in HoCo)

- Common Gallinule
- Common Tern
- Common Redpoll
- Common Goldeneye