"singing in the wild is not a simple process" Hans Slabbekoorn *in*: P. Marler and H. Slabbekoorn, 2004. *Nature's Music*. Elsevier Academic Press.

Vocal communication

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1522 - 1605
Ornithologiae 1599

Overview

- Physical characteristics of vocalizations
- How the syrinx produces sounds
- Functional aspects of communication
  - Information content of song
  - Species and individual recognition
  - Advantages of song variety and dialects
- Vocal mimicry
- Learning to sing

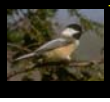
Terminology

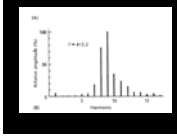
- Song
- Call
- Amplitude
- Frequency
- Oscillograph/gram
- Sonograph/gram
- Glissando
- Harmonic
- Modulation

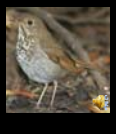
Song types

- Whistled songs
  - Nearly pure sinusoidal waveforms, no harmonics (Blackpoll Warbler)

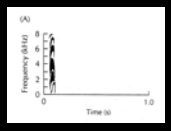
- Harmonic songs
  - Show multiples of fundamental frequency (Black-capped Chickadee)

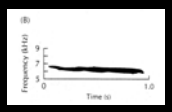






Sound characteristics



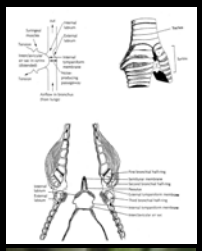


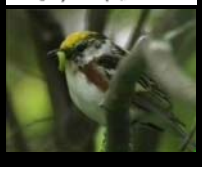
- (A) Contact calls: short duration, broad frequency range are easy to locate.
- (B) Alarm calls: long duration, narrow frequency range are difficult to locate.

- Simple calls penetrate vegetation, common in forest birds (Bellbird, Ovenbird)
- Low frequency sounds are best for long-distance communication (Bittern, Owls)
- Complex calls most effective in open habitats (Meadowlark)

Sound is produced by the syrinx

- Located in the body cavity at the junction of the trachea and the two primary bronchi
- Primary structures are vibrating tympaniform membranes, supporting cartilage, and controlling muscles
- Sound created by vibration of air passing through syrinx
- Movement of the bill is generally not important to sound production

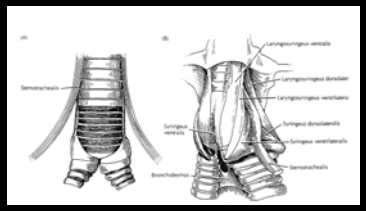




Syringeal musculature

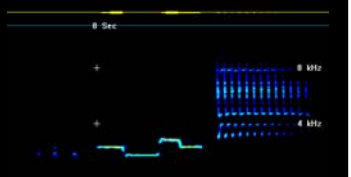
- Syringeal muscles control song production
- 2 – 6 pairs
- Lacking in ratites, storks, and New World vultures

Cassowary



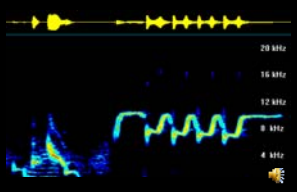
Birds have two voices

- The two halves of the syrinx are independent and can produce two distinct songs simultaneously

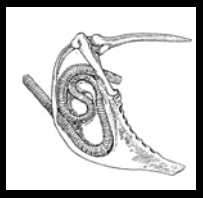


Complex modulation = complex song

- Rapid changes (modulation) in frequency and amplitude create complex songs



Whooping it up



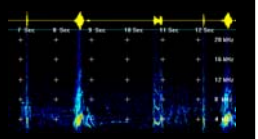
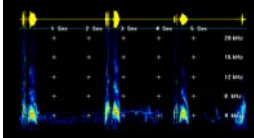
http://www.operationmigration.org/

Functions of songs and calls

- Reproductive
  - Define territory boundaries
  - Defend territory against rivals
  - Attract mates
  - Synchronize reproduction
  - Strengthen pair bond
- Social
  - Species identification
  - Warning calls
  - Information about food
  - Flock maintenance
  - Mobbing predators
- Individual
  - Individual recognition
  - Identify mates, offspring, parents, neighbors
  - Define territory boundaries

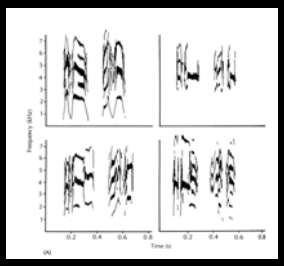
Songs convey important information about species




Songs convey important information about individuals

- Calls of four individual Least Terns

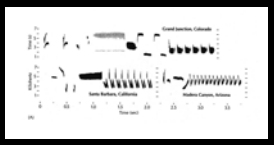



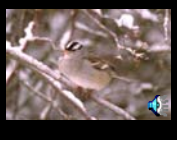
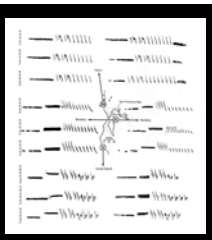
Song repertoires and mimicry

- Song repertoires and mimicry may represent sexual selection acting on song
  - Chestnut-sided Warblers (Kroodsma) and Swamp Sparrows with longer, more frequent, and more vigorous songs have higher reproductive success (Nowicki).
  - Northern Mockingbirds and Superb Lyrebirds with more diverse repertoires have higher mating and reproductive success


Song dialects

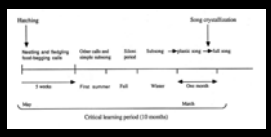
- Songs show variation at different geographic scales

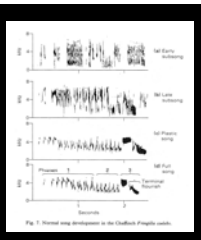


Four stages of song learning

- Early Development
  - First 2-3 months, begging calls and simple subsong
- Silent Period (Fall)
  - No vocalizations for up to several months
- Subsong Period (Winter)
  - Practice period, song is plastic, auditory feedback essential
- Song Crystallization (Spring)
  - Syllables dropped, final form of song becomes fixed





Non-vocal sounds

"Peeent!"