Animal bioacoustics: [Fletcher 2007]

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27 January 2020

Plan

Optimized Communication

Hearing and Sound Production

Vibrational Communication

Insects

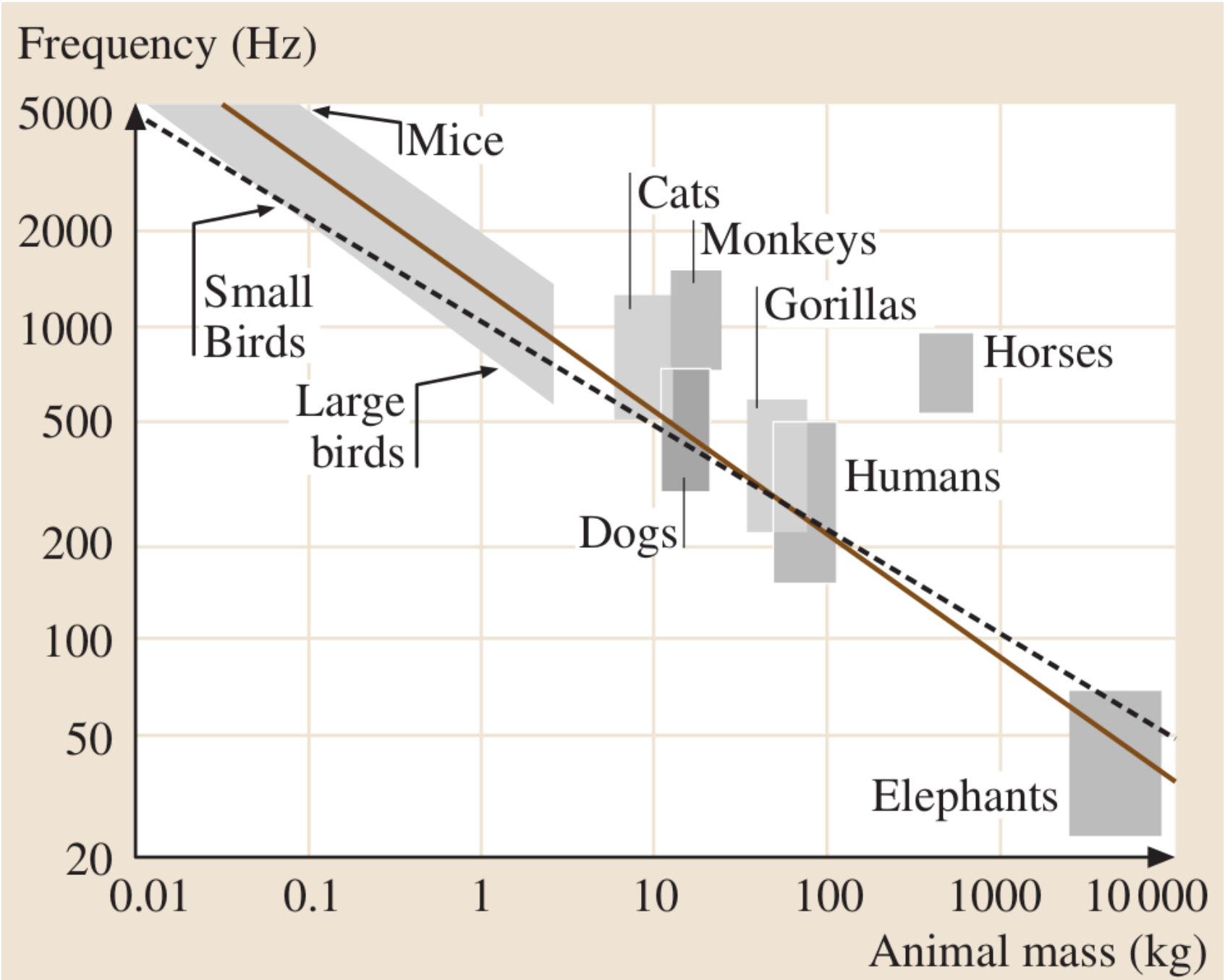
Land Vertebrates

Birds

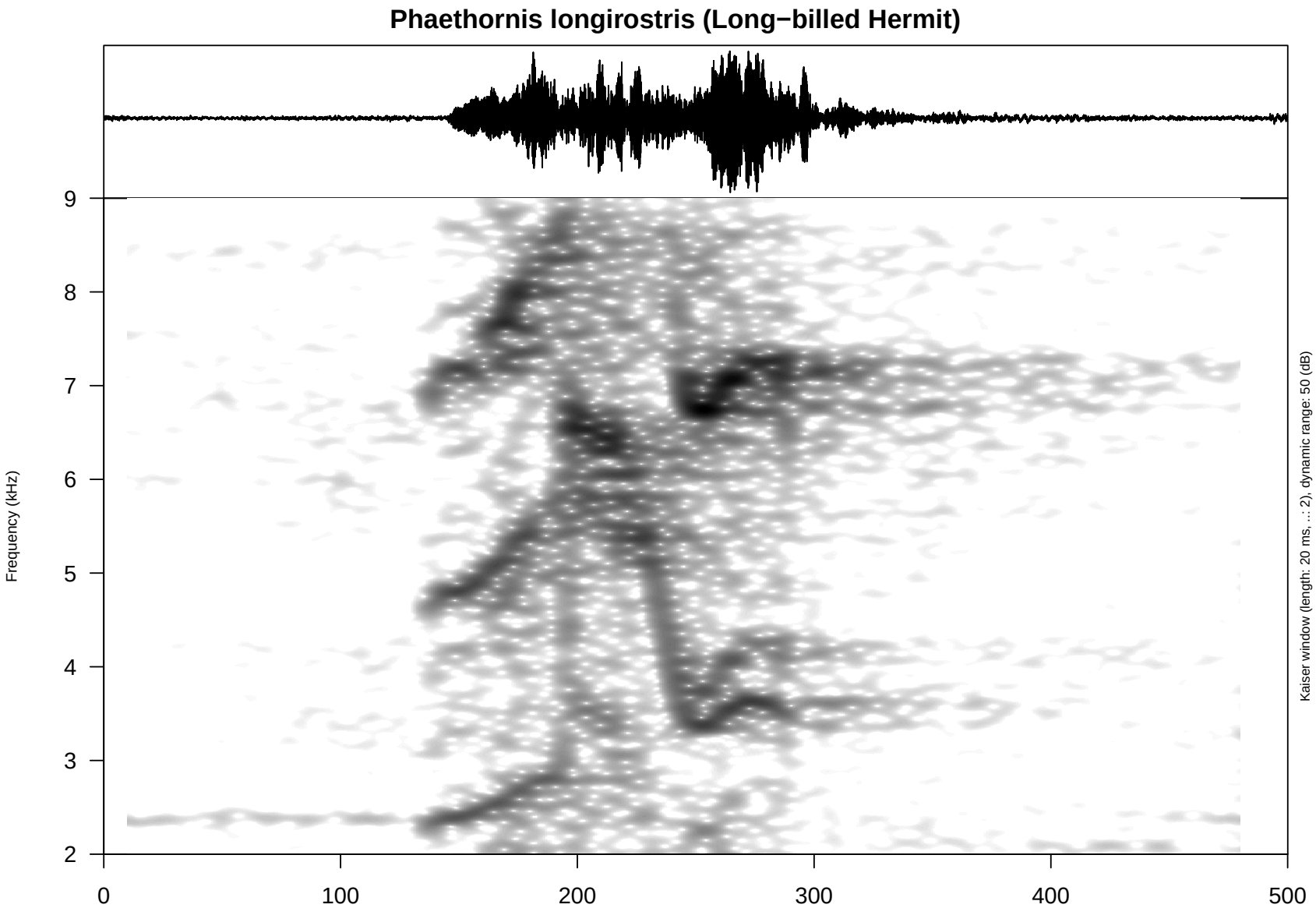
Bats

Aquatic Animals

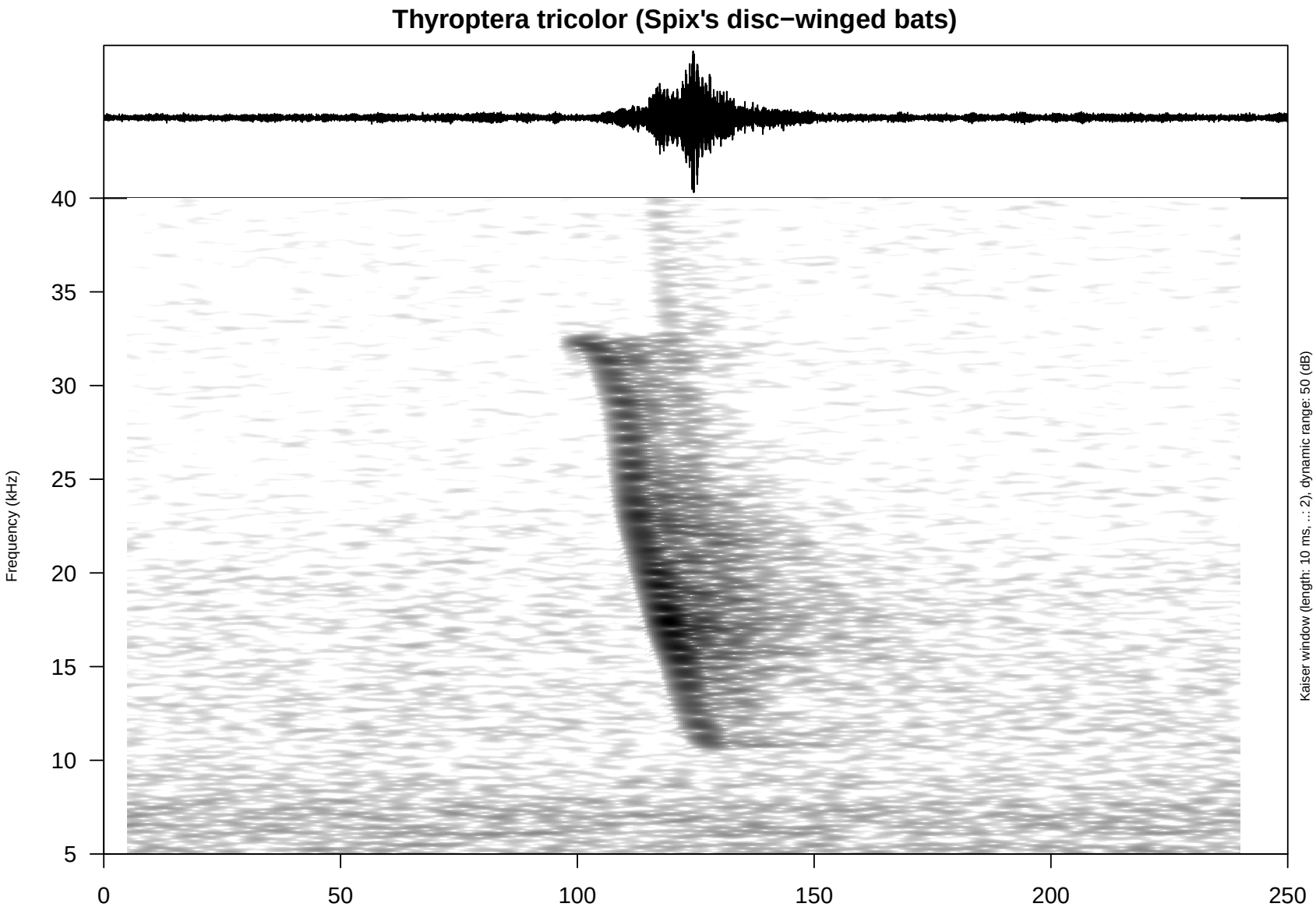
mass and frequency



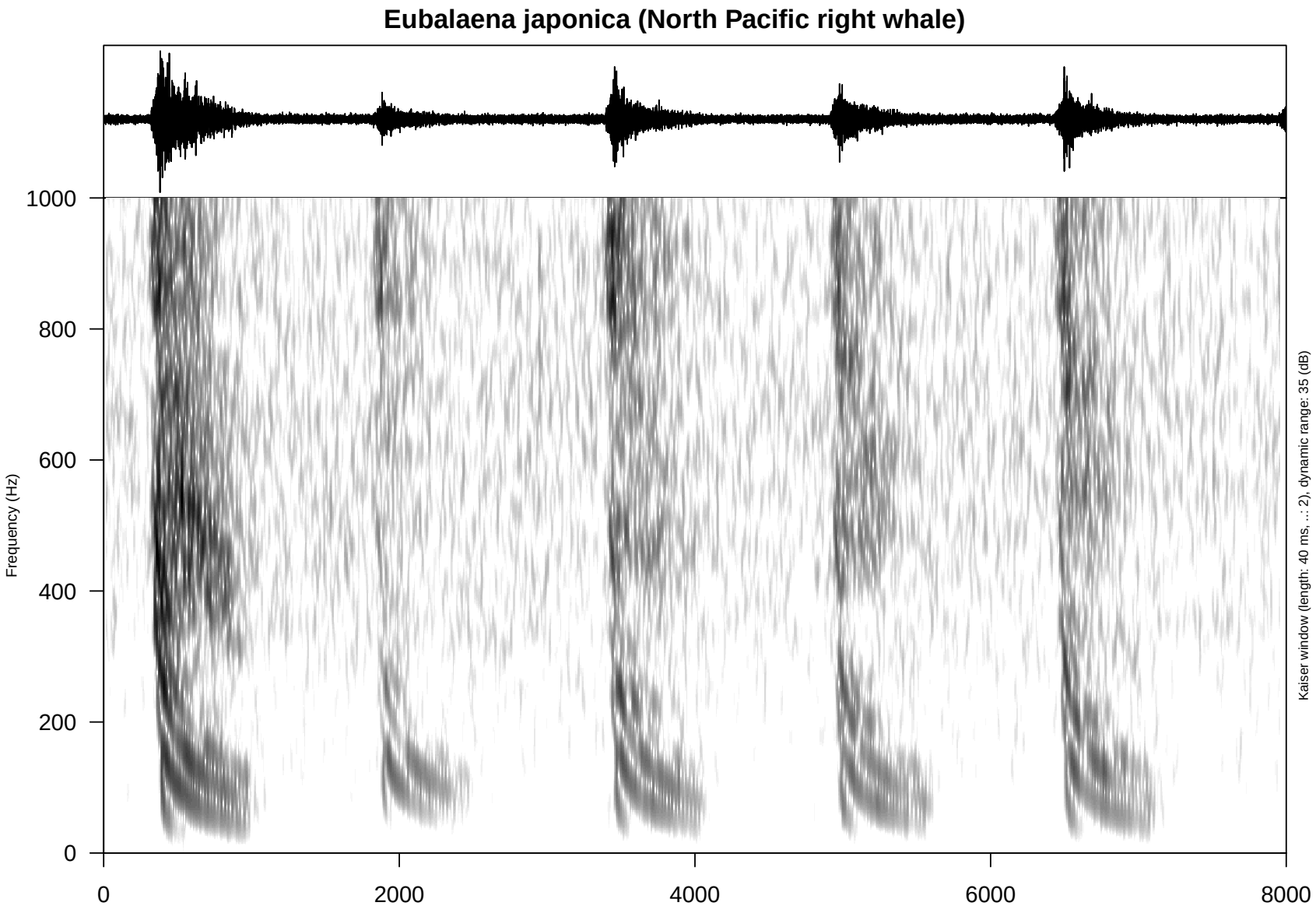
patterns are easier than human



patterns could be really fast



patterns could be really slow



but some animals use some tricks!

BBC, Earth's tropical Island – Borneo (20:47)

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Hearing and Sound Production

- Hearing is surprisingly simmilar
- Sound production of breathing animals:
  - non-aquatic mammals
    - exhalation through valve
  - aquatic mammals
    - moving are from one reservoir to another through the oscillating valve
- Sound production of non-breathing animals:
  - muscle-driven mechanical vibrations

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some animals communicate through vibration

- some animals communicate through vibration
- some animals do both: Владимир Динец (2015) Песни драконов

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insects

- external sensory hairs
- ribbed file on their legs, or wings

insects

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- some crickets have evolved the strategy of digging a horn-shaped burrow in the earth

insects

- external sensory hairs
- ribbed file on their legs, or wings
- some crickets have evolved the strategy of digging a horn-shaped burrow in the earth
- Tenrecs!

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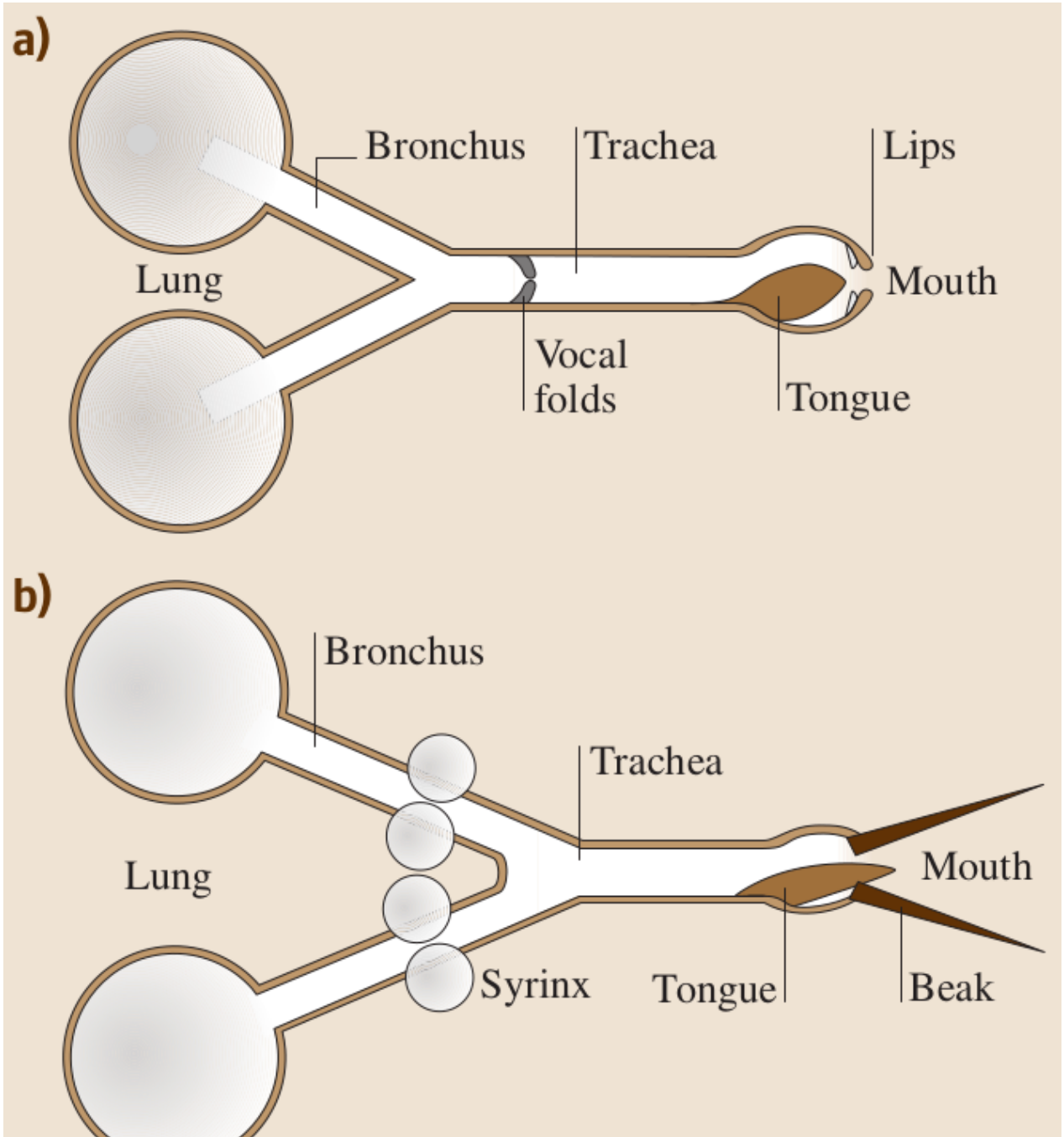
land vertebrates



land vertebrates

- Some animals adjust their vocal system so that the frequency of the vocal valve closely matches a major resonance of the upper vocal tract, usually that of lowest frequency but not necessarily so. Some species of frogs and birds achieve this by the incorporation of an inflatable sac in the upper vocal tract. (cf. air sacs in apes, e. g. [Hewitt et al. 2002])
- Some animals change their frequency range according to environment
- In most mammals and other large animals the auditory canal joining the two ears in birds and reptiles has generally degenerated in mammals to the extent that each ear functions nearly independently.

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birds

- Song birds have a syrinx consisting of dual inflated-membrane valves. These valves can be operated simultaneously and sometimes at different frequencies (see overtone singing), but more usually separately, and produce a pulsating air-flow rich in harmonics.
- Some birds have developed the ability to mimic others around them

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bats

- echo-location (cf. blind or visually impaired people)
- short calls
- huge range 40-80 kHz
- sound emitted through the nose rather than the mouth

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aquatic animals

- crustaceans – like insects – produce sound by rubbing a toothed leg-file against one of the plates covering their body
- fish species with swim-bladder – like other insects – membrane over the bladder, that oscilates by muscular effort
- different system of hearing (hair-cells, otolith)

References

Fletcher, N. (2007). Animal bioacoustics. In Rossing, T. D., editor, *Springer Handbook of Acoustics*, pages 785–804. Springer, New York.

Hewitt, G., MacLarnon, A., and Jones, K. E. (2002). The functions of laryngeal air sacs in primates: A new hypothesis. *Folia Primatologica*, 73(2-3):70–94.