

**Lecture Notes**  
**Non-Radio Telemetry**  
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I) What is non-radio telemetry?

- a) the remote detection and measurement of a human or animal function, activity, or condition without the use of radio waves
  - i) same basic ideas radio telemetry
  - ii) collect very similar data
  - iii) may be able to collect different types of data

II) Why use non-radio telemetry?

- a) some attribute of your study makes use of radios impractical
  - i) environments
    - (1) salt water (high dissolved ions content)
    - (2) turbulent water (causes radio waves to attenuate)
    - (3) deep water (radio waves attenuate quickly)
  - ii) animal movements require different type of data collection
    - (1) highly migratory animals that you can't track easily with radios
      - (a) birds
      - (b) fish
      - (c) caribou
    - (2) marine mammals
      - (a) deep diving
    - (3) extremely small animals
      - (a) insects
      - (b) amphibians
  - iii) surroundings make it impossible
    - (1) electrical interference (urban areas)

III) What are the options?

- a) PIT tags
  - i) using mark-recapture
    - (1) mark in one location and recapture in another, determine distance and direction between two capture events
  - ii) ADV
    - (1) Relatively low cost
    - (2) Doesn't require continued monitoring of animals for relocations
    - (3) quick and easy to implant
  - iii) DISADV
    - (1) must recapture individuals
    - (2) only get relative movement rates and directions

- iv) Cost
  - (1) \$5/tag
  - (2) \$300+ for reader
  - (3) Minor for injecting
  
- b) Banding
  - i) Another type of mark-recapture
  - ii) Usually associated with waterfowl, but may include other birds
  - iii) Shows relative movements
  - iv) ADV
    - (1) Low cost
    - (2) Quick and painless for animal
    - (3) No specialized equipment required
  - v) DISADV
    - (1) Must recapture individual to track it
    - (2) Often receive bands through hunter returns (dead animal)
  - vi) Cost
    - (1) ~\$10/bird
  
- c) Sonic
  - i) mainly used in aqueous systems
  - ii) each transmitter has a unique code of beeps
    - (1) x-x,x,x-x,x,x,x,x (tag #135 or 513 or 351)
    - (2) will not have similarly coded tags in the system
    - (3) each tag beeps continuously
  - iii) very useful for marine fish
  - iv) Chicago sanitary and ship canal
    - (1) carp being tracked
  - v) ADV
    - (1) can get data very similar to radio-telemetry
    - (2) monitor species in limiting environments that radios can't
    - (3) duty cycles can be set up to maintain 5+ years of battery life
  - vi) DISADV
    - (1) you locate the tag by hearing it
      - (a) means you have to move extremely slow and listen for beeps
    - (2) may be difficult to differentiate multiple animals in one location
    - (3) equipment can be expensive and requires some level of skill
  - vii) Cost
    - (1) \$300/each
    - (2) \$1100/each setup- hydrophone, receiver, and data logger
  
- d) GPS/Satellite
  - i) use tags that transmit data via satellites
  - ii) gives more precise relocations than radio telemetry and can also transmit other data
  - iii) used on marine mammals and sea-turtles

- (1) animals that are difficult to continuously track
- iv) Cost
  - (1) If you have to ask, you can't afford them
- e) Harmonic radar
  - i) similar in theory to PIT tags
    - (1) put an unpowered tag on an animal
    - (2) use radar to energize and relocate the animal
  - ii) Used on insects and subterranean animals
    - (1) monitor movements of insects to determine crop damage
    - (2) relocate amphibians beneath the soil
  - iii) ADV
    - (1) Cheap and easy
    - (2) No battery to worry about
    - (3) Tiny transmitter allows use on wide variety of species
  - iv) DISADV
    - (1) Must be close to track animal
    - (2) Need a power source to find animal
  - v) Cost
    - (1) About 2 cents each
- f) Sonar
  - i) only used in aqueous systems
    - (1) mainly used on larger animals that can be positively identified through other means (ie-visually)
    - (2) basically echo-location
- g) Visible marks
  - i) paint, ear tags, implants
    - (1) may require recapture, but not always
    - (2) anything that can be identified from an unobtrusive distance
  - ii) requires good optics (eyes and scopes)
  - iii) clear differentiation between the tags
  - iv) ADV
    - (1) Cheap and easy
  - v) DISADV
    - (1) Must see animal to find it
    - (2) Can lose the mark
- h) Fluorescent powder
  - i) Different colored powder applied to animals
    - (1) Usually small herps
  - ii) Track by releasing animals and then following retracing and marking their path afterward
  - iii) ADV
    - (1) Cheap and easy

- iv) DISADV  
(1) Moisture can wash away  
(2) Only visible for a day or so

**References:**

- PIT tags: <http://www.ezidavid.com/Fisheries.htm>  
[http://www.cbr.washington.edu/dart/pit\\_adultdet.html](http://www.cbr.washington.edu/dart/pit_adultdet.html)
- Sonic transmitters project: <http://www.fadio.ird.fr/>  
<http://www.vemco.com/>
- Bird bands: [http://www.ec.gc.ca/science/sandejuly99/printversion/print1\\_e.html](http://www.ec.gc.ca/science/sandejuly99/printversion/print1_e.html)
- Cochran, W. W. 1980. Wildlife Telemetry. Pages 507-520 in S. D. Schemnitz, ed. Wildlife management techniques manual. Fourth ed., rev. The Wildlife Society, Washington, D. C.
- Hines, A.H., R.N. Lipcius, and A.M. Haddon. 1987. Population Dynamics and Habitat Partitioning by Size, Sex, and Molt Stage of Blue Crabs (*Callinectes sapidus*) in a Subestuary of Central Chesapeake Bay. Marine Ecology Progress Series 36:55-64.
- Jouventin, P., and H. Weimerskirch. 1990. Satellite tracking of wandering albatrosses. Nature 343:746-748.
- Mate, B. R., S. L. Nieuwkirk, and S. D. Kraus. 1997. Satellite-monitoring movements of the northern right whale. Journal of Wildlife Management 55:488-491.
- Moseley, K.R., and S.B. Castleberry. Internal Harmonic Radar Tags for Relocating *Ambystoma talpoideum*. Manuscript. 13p.
- Semlitsch, R.D. 1981. Terrestrial Activity and Summer Home Range of the Mole Salamander (*Ambystoma talpoideum*). Canadian Journal of Zoology 59:315-322.
- Wright, I.E., S.D. Wright, and J.M. Sweat. 1998. Use of Passive Integrated Transponder (PIT) Tags to Identify Manatees (*Trichechus manatus latirostris*). Marine Mammal Science 14:641-645.
- Zedel, L. 2003. Fish Schooling Behavior Inferred from Differences Between Backscatter Levels in Doppler Sonar Beams. Journal of the Acoustical Society of America 114:2375.