Transmitter types and attachment methods for fish and wildlife

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Tag Types

- **Radio Frequency**
  - energy is magnetic
  - frequency 30 MHz to 225 MHz
- **Sonic**
  - energy is mechanical
  - frequency 30 kHz to 200 kHz
- **Satellite**
  - works on the Doppler principle

Radio Tags

- Advantages
  - works well in water that is shallow
  - very good for long range tracking
  - signal passes through snow and ice
  - signal is not very affected by material in water or by thermoclines
- Disadvantages
  - attenuation of signal is a function of depth
  - attenuation of signal is a function of conductivity

Sonic Tags

- Advantages
  - conductivity high through salt water
  - position locations very accurate
  - can pick up signal in deep water (>~10m)
- Disadvantages
  - signal doesn't pass from water to air
  - hydrophone must be stationary and submerged
  - waters that are turbulent create noise decreasing range
  - thermoclines create different water densities that can refract the signal
  - algae and vegetation, and particulate matter can decrease range

Transmitter Antennas

- Transfers energy from tag to media
  - **Whip antenna**
    - linear antenna joined at one end to a transmitter
    - most frequently used
    - Advantages
      - omni-directional
      - more efficient signal radiators than loop antennas

        - Disadvantage
            - potentially susceptible to breakage
    - **Loop antennas**
        - Used for body implants with an internal antenna
        - Advantages
            - Minimally affected by implantation
            - Lack of projecting antenna
        - Disadvantages
            - generally less range
            - can be difficult to install

METHODS FOR ATTACHMENT

AVIAN

- 3 % of total body weight
- Consider
    - how weight is distributed
    - behavioral affects
    - feeding
    - flushing
    - predator avoidance

Pendant or Necklace

- antenna exits the neck loop at the back of the neck and is oriented to lie down the bird's back.
- smaller birds: body loop fitted at the bottom of the transmitter, passing behind the wings and tied around the antenna.
- larger birds: only a neck loop is required
- birds will preen both the transmitter and antenna
- bird may be snagged on a branch or catch its foot

Backpacks

- **Dwyer harness**
    - ratio of the neck loop to the body loop determines the location of the package on the back of the bird.
    - can be scaled down to accommodate passerines
- **figure-eight pattern**
    - neck and body loop meet at the breast
    - position of the package can be varied by changing the ratio of the neck loop to the body loop
    - used snow geese, raptors and on passerines
    - less restrictive than Dwyer harness

Leg Band Mount

- small tag (1g) can be fitted to leg bands
- otherwise aggressive birds seem to tolerate bands

Neck Band Mount

- tag can be mounted on plastic neck bands
- antenna is usually encapsulated inside collar

Tail Mount

- tag mounted on one or two tail feathers
- accepted by most raptors
- rough handling of feathers may trigger a moult and the tag will be lost in several days

Patagial Mount

- tags mounted on the leading edge of the wings
- will not be moulted and can be made to last years
- used on eagles, vultures and condors

Suture

- small transmitters fitted with tubes that can be sewn to the back of a bird
- not common practice for mammals due to the propensity towards infection

MAMMALS

- (package weight should be) b/w 3% and 5% of body weight
- ratio is appropriate for mammals up to 2-3 kg, but should be reduced as the size of the animal increases
- Conversely, some smaller animals can carry a transmitter that exceeds the 5% limit

Collars

- **Fixed**
- **Break-away**
    - rely on the decomposition of rubber or wire
    - designed to detach from the animal after a period of time
- **Expandable**
    - Foam rubber inserts and sewn pleats, which tear apart with expansion
    - accommodates the growth of young animals or a temporary neck expansion in rutting animals
- should not assume that these expansion and break-away designs always work reliably under varying environmental conditions

Intraperitoneal Implants

- have been used on many animals with few adverse effects
- If subcutaneous placement of the tag is possible, the trauma to the animal is reduced, as is the possibility of fatal infection.

Glue on

- Least invasive method of attachment
- Large animals: can last for many months
- Small animals: rarely lasts longer than 1-2 months
- Most widely used in bat research
- Lack of encumbering harness
- Assured removal of tag after short period of time
- Suitable for small passerines

MARINE MAMMALS

- 3 % of total body weight
- radio transmitter doesn't work in saltwater
- usually affixed with some sort of epoxy

Harness

- used on some mammals with head and neck shapes that will not retain a collar
- must accommodate for growth and other changes in body size and shape

FISH

- 2% of total body weight
- better range with an external antenna
- warm water can cause bacteria growth and infection to migrate up antenna
- **Internal Transmitters**
  - esophageal implant
  - body implant
  - cloacal implant
  - internal pectoral girdle harness

- **External Transmitters**
  - dorsal mount
  - saddle mount
  - dorsal fin mount

- **Comparison of transmitter attachment methods for fish**

Factor	External	Stomach	Implantation
Installation time	Moderate	Quick	Slow
Difficulty	Moderate	Low	Highest
Recovery time	Moderate	Quick	Longest
Balance problems	Greatest	Least	Least
Transmitter size	Smallest	Moderate	Largest
Infection potential	Moderate	Least	Highest
Snagging potential	Yes	No	No
Drag/resistance	Yes	No	No

AMPHIBIANS AND REPTILES

- 2-3% of total body weight
- terrestrial and aquatic
- usually implant or glue-on

Ingested Tags

- useful to obtain short term data
- may affect behavior

Surgical Implants

- can be used in long term studies

- possibility of infection
- recovery time

Ball and Chain

- belt that wraps around waist
- tag sits dorsally
- quick attachment
- may catch on vegetation
- can cause skin irritation

Harness belt

- soft tubing that fits around waist
- lightweight and inexpensive

Carapace mounts

- drill holes and wire
- epoxy

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