Tracking fish with passive acoustic telemetry

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What is fish acoustic telemetry?

- Tagging system to monitor the movements and activity of fishes
- Transmitters emit unique coded ultrasonic ‘pings’ (69 – 180 kHz) at defined time interval
- Transmitters come in many sizes and functionalities (depth, temperature, acceleration)
- Listen for ‘pings’ with acoustic receivers

Images: https://www.innovasea.com/fish-tracking/

American shad (*Alosa sapidissima*)

Striped bass (*Morone saxatilis*)

Bluefin tuna (*Thunnus thynnus*)

Shortfin mako (*Isurus oxyrinchus*)
How do we track fish movements with acoustic transmitters?

Receiver detection range = 100 to 1000 m
What does it help scientists do?

- Understand how, why, for how long species use specific areas
- Monitor environmental or anthropogenic impacts in areas
- Understand how fish are impacted by catch and release

Black sea bass (*Centropristis striata*)  
Zemeckis et al. (2020) *Fishery Bulletin*
A bit of extra sound does a lot of good for many fishes

- Acoustic telemetry has led to:
  - Hundreds of scientific papers on fish ecology, behavior, habitat preferences, population structure, and survival
  - New fishing regulations that promote more responsible catch and release practices
  - Spawning area closures
  - Identification of Essential Fish Habitat
  - Endangered Species Research and Conservation
  - Improved understand of the need for and effectiveness of Marine Protected Areas
Objective: Monitor juvenile sand tiger shark presence in Massachusetts (USA)

- 70 – 90% decline in U.S. Atlantic population since 1970’s
  (Source: Musick et al., 1993; 2000)
- Prohibited in U.S. federal (1997) and east coast state (2009) waters
- Must be released if caught by a fisherman

Photo credit: John Chisholm

Historically rare
Presently common

Historically common

Prohibited!!

two large dorsal fins with no spines
large thin teeth
dusky spots on side and tail

Plymouth Bay
Cape Cod
Key findings....
1) Juvenile sand tigers stayed in the bay June to October
2) Sharks inhabited the bay every year
3) Numerous individuals returned for up to 3 years

Kneebone et al. (2012) *Marine Ecological Progress Series*
Plymouth Bay = sand tiger nursery habitat

The facts:

Only juveniles present

Present each year

Same sharks coming back

Using same areas each year

Stay in those areas indefinitely
Sharing is caring: We can learn A LOT more by sharing telemetry data

Since the sand tiger project started in 2008....
> 200,000 receiver detections
> 700 locations (receivers)
Individuals tracked for up to 3,650 days (10 yrs)!

Ages: 0 – 1
Length: ~1 m

Babies

Ages: 3 – 5
Length: ~2 m

Teenagers

Ages: 8 – 11
Length: ~3 m

Adults

https://sites.google.com/site/cooperativetelemetry/
https://matos.asascience.com/
Coming Soon to Southern New England... Offshore Wind
2021 Acoustic receiver array

Note: Map depicts a potential receiver configuration in Equinor and Mayflower leases. Final locations are TBD.
Glider missions to support monitoring efforts in some areas?

Photo: Chris McGuire, The Nature Conservancy
Thank you, and…

Study collaborators

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