

Sharks on the Move

How migration, nursery habitat, and fisheries affect populations of an apex predator



Nbc6.net

Charles Bangley

Coastal Resources Management Program, East Carolina University

Presentation Outline

Reproductive Strategies of Marine Animals

Nursery Habitat Overview

Human Impacts on Marine Nursery Habitat

Sandbar Shark Ecology

ECU Tagging Research



Andy Murch (elasmodiver.com)

Reproductive Strategies of Marine Animals



David Seifert (reefresilience.org)

External fertilization

Broadcast Spawning – eggs and larvae released into plankton

High number of offspring with low energy cost to parents

Very few juveniles survive to adulthood – most die in earliest life stages

Most bony fishes, bivalves, barnacles, marine worms

Some parental care among external spawners – toadfish, jawfish

Reproductive Strategies of Marine Animals

Internal fertilization

Higher energy cost for parents, fewer but more developed offspring

Higher parental energy cost = higher offspring survival

Egg-laying without parental care – skates, some sharks, sea turtles, conchs

Egg-laying with parental care – crocodiles, sea birds



Live birth without parental care –
most coastal sharks, rays

Live birth with parental care – marine
mammals

Survivorship

3 basic types – classified by % of generation still alive over time

Type I – Low natural mortality, most individuals survive to old age

Large, long-lived animals with few predators (sharks, whales)

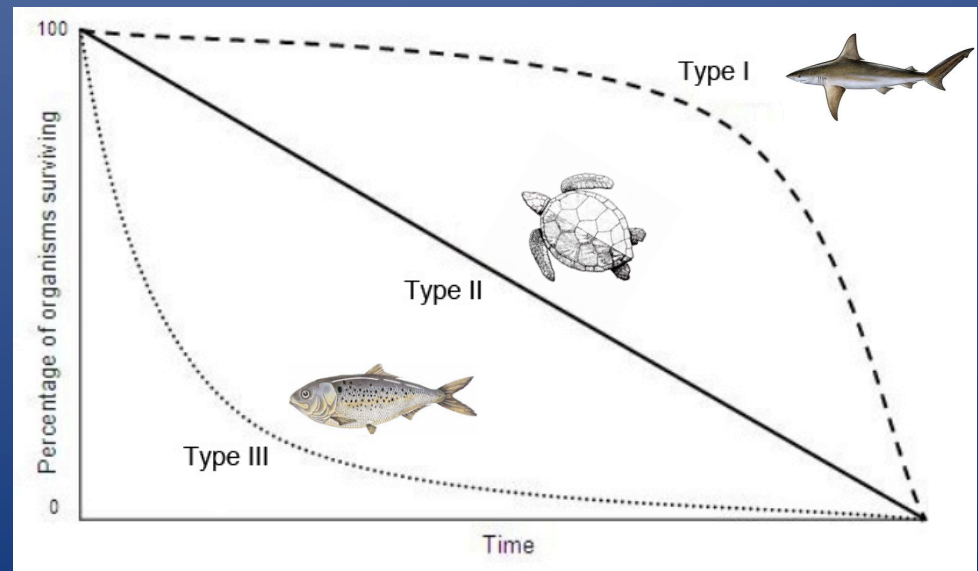
Type II – Natural mortality relatively constant with age

Medium-sized animals with natural predators (sea turtles, sea birds)

Type III – High natural mortality at early life stages

All broadcast spawners
(bony fishes, bivalves,
crustaceans)

Which Type is most vulnerable
to sudden changes in juvenile
survival?



Nursery Habitats

Areas that aid juvenile survival

Shelter from predators and access to food = increased juvenile survival

Primary Nursery – Area where birth or hatching occurs

Secondary Nursery – Area inhabited during juvenile life stages

Primary and Secondary Nurseries are not necessarily the same areas



Marine examples in NC – seagrass beds, oyster reefs, live bottom, wrecks

Human Impacts on Marine Nursery Habitats

Nursery habitats often nearshore or within estuaries, exposing them to human impacts

Coastal development – Disrupts or destroys waterfront and nearshore habitat, increases pollution

Pollution – urban and agricultural runoff can disrupt marine food webs by causing harmful algae blooms

Fisheries issues



Overharvest – removing a species faster than population can replace itself

Bycatch – catch of species not targeted by the fishery

Fisheries Management

Can't just close fisheries - highly important to coastal economies, local seafood often has lower environmental impact than imported

Methods for reducing fishery impacts

Size limits – only fish large enough to have reproduced can be kept

Total allowable catch (TAC), also known as quota – limit on total amount of a species (numbers or weight) that can be taken

Time/area closures – temporarily closing areas to protect nurseries, spawning habitat – fishing seasons can also be changed

Soak Time – amount of time gear is deployed to catch fish, can be adjusted to reduce mortality of bycatch

Bycatch reduction devices – gear modifications designed to allow bycatch species to avoid capture

The Sandbar Shark



Andy Murch (elasmodiver.com)

Carcharhinus plumbeus

Found worldwide – ranges from southern New England through the Gulf of Mexico in U.S. east coast waters

Born approximately 1 $\frac{3}{4}$ feet in length, grow to maximum length of 8 feet

Slow-growing with low reproductive output – females reproductively mature at 5 feet in length/13-15 years old, give birth every 2 years

Juveniles feed on crabs and fish, switch to mostly fish as they grow

Sandbar Shark Nurseries

U.S. east coast population

Primary Nurseries – Delaware and Chesapeake Bays, Bulls Bay (South Carolina), possibly Great Bay (New Jersey)

Secondary Nurseries – Coastal waters up to 20 miles from shore, southern Cape Cod to Cape Canaveral

Large numbers of juveniles overwinter off of Cape Hatteras – tracked from Delaware and Chesapeake Bays

Regularly enter North Carolina Sounds



Max Sang (chesapeakebay.net)

Challenges for Juvenile Sandbar Sharks

Natural mortality – preyed on by larger sharks

Interactions with humans

Popular with divers and recreational fishermen

Habitat degradation from development/
pollution – primary nurseries may have once
included New Jersey and Long Island salt ponds

Overfishing – juveniles targeted by gillnet fisheries centered around
Chesapeake Bay in the 1980s

Population may have declined as much as 80%

Now a protected species that must be released, may only be kept by
fishermen with special research permits



Newenglandsharks.com

East Carolina University Acoustic Telemetry Research



Project Overview

Telemetry – studies involving tagging and tracking of animals

Research conducted by Dr. Roger Rulifson's lab at ECU

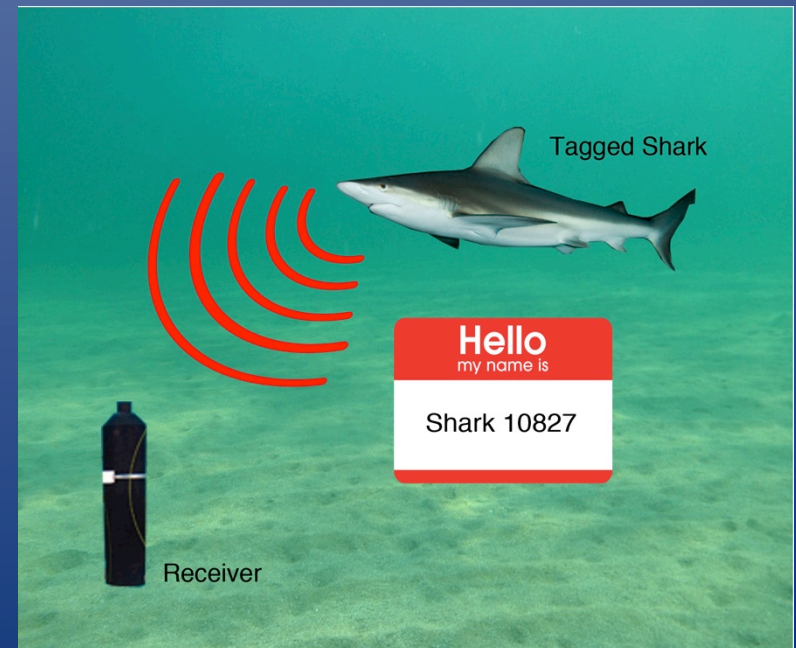
Sharks are fitted with acoustic transmitter tags – broadcast unique ID number

Shark ID, date, and time recorded by receiver whenever shark swims within detection range

Some tags also include temperature and depth sensors

Currently tracking sandbar, dusky, and spiny dogfish sharks

ECU maintains receivers off of Cape Hatteras, shares data with other arrays along east coast



What Information Can We Get?

Detections show areas sharks traveled through

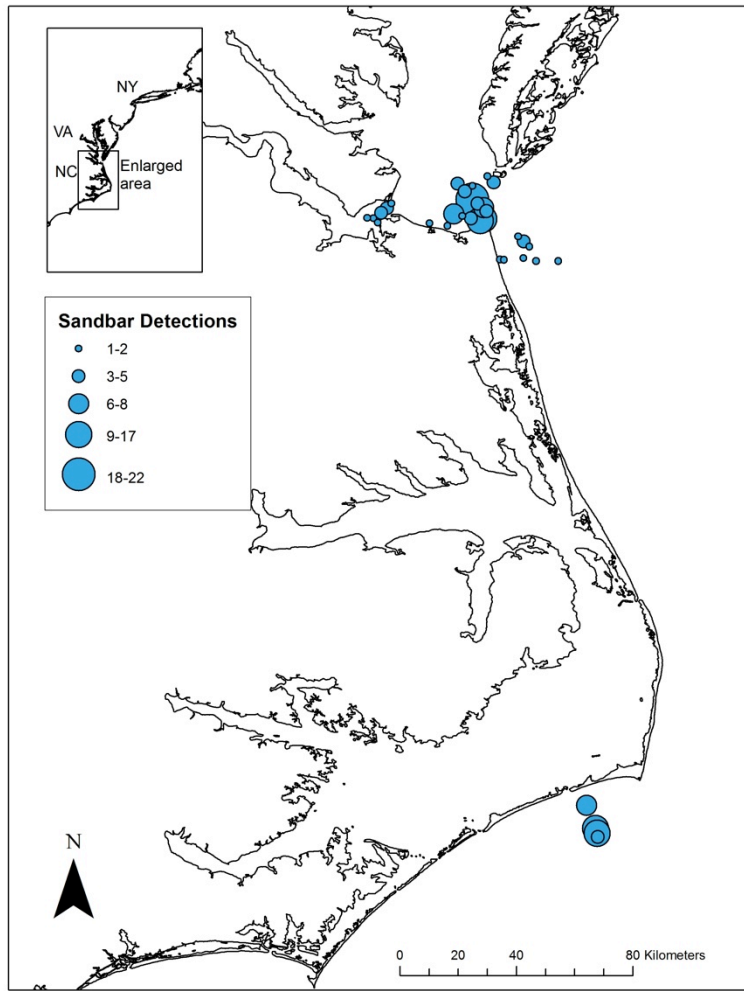
Timing of detections can describe migration patterns

Number of detections a function of time spent in area by sharks and number of different sharks detected - may indicate importance of area

High # of detections = sharks visited area repeatedly

Low # of detections = just passing through

Which areas look important on this map?



Data from Chesapeake array provided by Carter Watterson

Assignment – Fishery Management Plan for Juvenile Sandbar Sharks

Form 3-5 groups

Using information from this presentation and from student information packets, develop a fishery management plan that allows the sample fisheries to stay open while avoiding bycatch of juvenile sandbar sharks

In the next session, present your plan to the class

Presentations should include:

- Which information you used to develop your plan

- Correct use of fisheries science terms

- The potential drawbacks and advantages for both fishermen and sharks