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Observations on abundance of bluntnose sixgill sharks, Hexanchus griseus, in an urban waterway in the Salish Sea, 2003-2012

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Sixgill Shark Research Program

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Sixgills in the Salish Sea

- This rarely studied “deep water” shark is found in the relatively shallow, inland waters of the Salish Sea.
- Its presence was known in local waters by scientists, local divers and commercial fishing communities.
- General public was mostly unaware of this large shark.
- Seattle Aquarium began studying sixgills in Puget Sound in 2003.
Where?

Georgia basin
Puget sound
Sixgill diver sighting & catch areas

Elliott Bay Diver sighting locations
Project goals: To identify individual animals, movement patterns, gender ratio, local abundance, and population boundaries in Puget Sound.

1. visual tagging
2. genetic fingerprinting
3. acoustic monitoring
Research Partners

- Washington Department of Fish and Wildlife (WDFW)
- National Marine Fisheries Service (NMFS), NOAA
Methods

- Bait attracts sixgills to the research site.
- Divers insert visual marker tags and take tissue samples.
- Video is recorded for 12 hours per night.
- Individual sixgills are identified by visual marker tag or natural markings.
Methods


  – 2012: Aquarium renovations.
Individual identification methods

Floy VM69
Visible Marker Tag

VEMCO V32P
Acoustic Tag

Pneudart Biopsy Dart
Identification via markings
RESULTS: Observations 2003-2005

The mean daily sightings of sixgill sharks at Seattle Aquarium (by month from January 2003 to May 2005) were higher in June, July, and August. Then research was halted for Aquarium renovations (2006-2007) …
Mean Daily Sixgill Sightings at Seattle Aquarium (by Month; Mar. 2008 - Nov. 2011)
Mean Daily Sixgill Sightings at Seattle Aquarium (by Season; 2003-2011)

- Winter (Nov-Mar)
- Summer (Apr-Nov)

Season and Year

Mean Number of Sharks per Research Day

Sixgill observations

2003-2005

• 45 sixgills received visual tags. 17 of those sharks returned 31 times.
• 197 sightings of untagged sixgills; some may be resightings.
• Total observations = 273
• Daily counts: 0-30 identifiable sharks.
• Mark/recapture statistical software: estimated 27-98 identifiable sharks/event.
Sixgill observations

2008-2011

- None of the previously tagged sixgills returned (with a tag).
- Only one opportunity to implant a new visual marker tag (failed).
- Some days we had a single, “clean” shark.
- Daily counts ranged from 0-3 identifiable sharks.
Summary - Abundance

2003-2005: high abundance of identifiable sharks sighted at SA research station.

2008-2011: much lower abundance. (Mann Whitney: p-value=0; z=-5.5158 at p=.01)

What do we think happened? We think the majority of sixgills we were observing left.
2006-2009: NOAA observed 19 of 34 acoustically tagged sharks leaving Puget Sound. 3 females subsequently returned.

A corresponding decrease in recreational diver/shark sightings.
Sighting Reports by Year and Season
(Citizen Sightings; Puget Sound; 2000-2013)

* 2000: Reporting begins in June.
* 2007-2008: May be impacted by web site problems.
• We know that some sixgill females give birth in Puget Sound because more than 1 female washed ashore in the process.

• Majority of sixgills documented in Puget Sound were sub-adults.

• The subadults were found in cohort groups.

• Perhaps the cohort group that used Puget Sound as a nursery left during 2006-2008 for the open ocean as suggested by the acoustically tagged sharks.

• We continue to monitor for (but have yet to see) evidence of another successful recruitment in Puget Sound.

• Similar patterns of apparent high abundance followed by a large decline were reported in Barkley Sound, BC and Flora Islet, BC during earlier time periods.

• Why do we see these patterns?