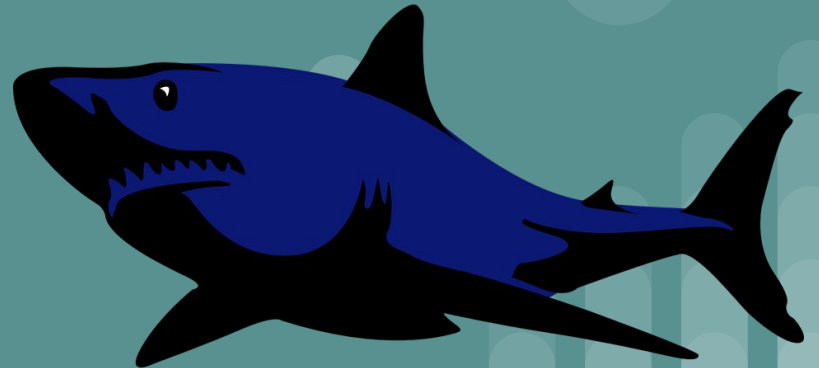# Predicting Shark Bites

Natalie Olivo DSI-6

The Data

About the data:

- Gender
- Age
- Provoked/Unprovoked
- Boat/Not Boat
- Activity
- Narrative
- Shark Species
- Fatal/Not Fatal
- Investigator
- Injury
- Narrative

ACTIVITY: Snorkeling
CASE: GSAF 2013.08.14
DATE: Wednesday August 14, 2013
LOCATION: The attack took place in the Pacific Ocean at Palauea Beach Park (aka White Rock), Makena, Maui, Hawaii, USA.

NAME: Jana Lutteropp
DESCRIPTION: She was a 20-year-old female, fair-skinned, blond and wearing a bikini, mask, fins and snorkel. She was a visitor from Germany.

BACKGROUND
WEATHER: At 16h54, Maui recorded partly cloudy skies and 10-mile visibility. The air temperature was 84°F, dew point 68°F, humidity 58%, sea level pressure 29.95 inches and wind direction was NE at 23 mph.
MOON PHASE: First Quarter, August 14, 2013
SEA CONDITIONS: The water was choppy with limited visibility.
ENVIRONMENT: DLNR education and outreach coordinator Laura Stevens had said that spear fishermen were reporting "increasing boldness of large sharks encountered in Maui waters." Tiger shark attacks are the most common species, and is considered the most aggressive shark in Hawaii's waters. Palauea Beach has shallow caves and crevices, and lava arches. Turtles are often present and sharks come close to shore in the area.
DISTANCE FROM SHORE: 50 yards
DEPTH OF WATER: 15 to 20 feet
TIME: 16h30

INJURY: Lacerations to right foot and right arm severed below the shoulder," Fire Department Chief Lee Mainaga reported. He also said the limb had not been recovered.

FIRST AID: Rick Moore, 57-year-old, physical education teacher swam toward shore with her. His friend, 61-year-old Nicholas Grisaffi. stood in neck-high water, took her from Moore and carried her from the water. They put her in a bystander's kayak, using it as a stretcher to bring her up a trail leading to the street where Moore performed CPR. A police officer placed a tourniquet as the woman was going in and out of consciousness. The woman was rushed to Maui Memorial Medical Center by ambulance in critical condition. On August 18, 2013, the hospital reported she was in very critical condition and was on life support. She succumbed to her injuries on August 21, 2013.

County officials closed a two-mile stretch of shoreline from Makena Beach Resort to Mana

Sea Disasters

Boat

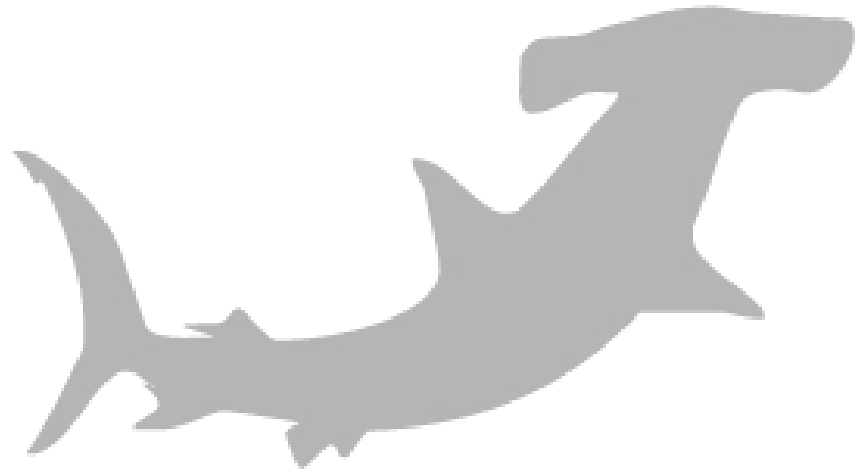**Invalid**

Provoked

Sea Disasters

Boat

Invalid

Provoked

- Accounted for 10 incidents since 2007, (Our data goes back to BC, though.)
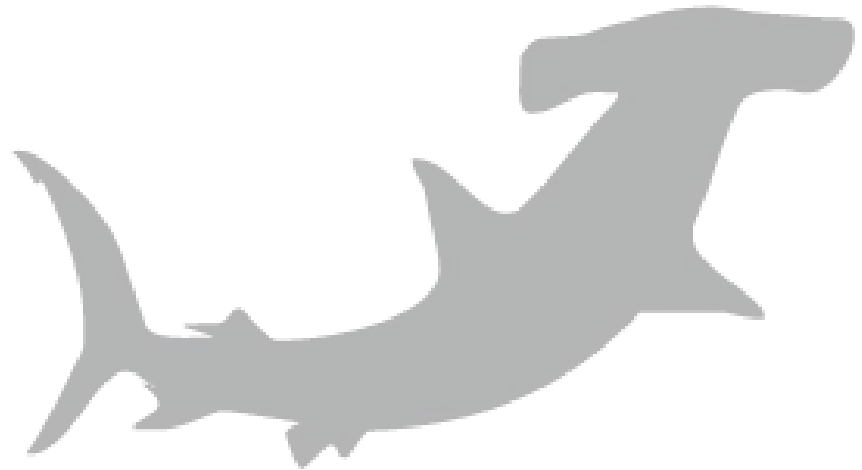   - Shipwreck (7)
    - Plane Crash (1)
    - Refugees (2)

Sea Disasters

Boat

Invalid

Provoked

- Incidents where the shark bites or bumps a boat (smaller vessels) are recorded
- 74 records since 2007

Sea Disasters

Boat

Invalid

Provoked

- Incidents where it's maybe rumored or claimed that sharks were involved, but they were not.
- 108 records
    - Non-bitten body washes up on shore later
    - Shark involvement prior to death not confirmed
    - Bite has some shared characteristics of a shark bite, but something is off and specimen was not identified.
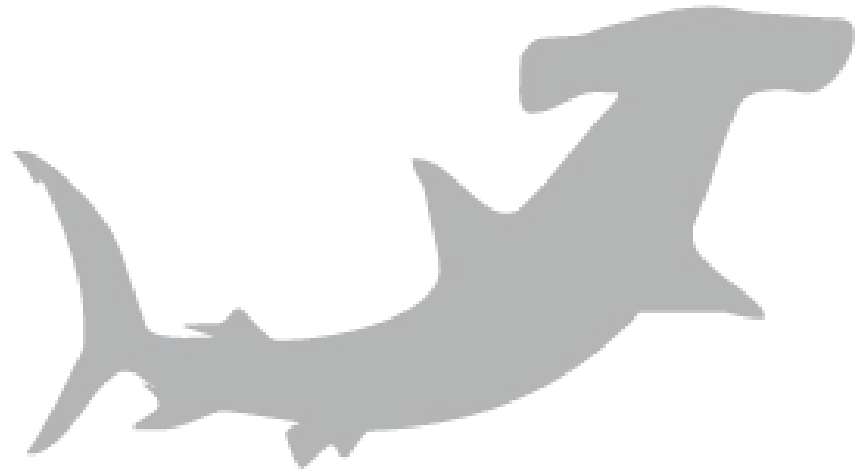   - Publicity stunt
    - Hoax
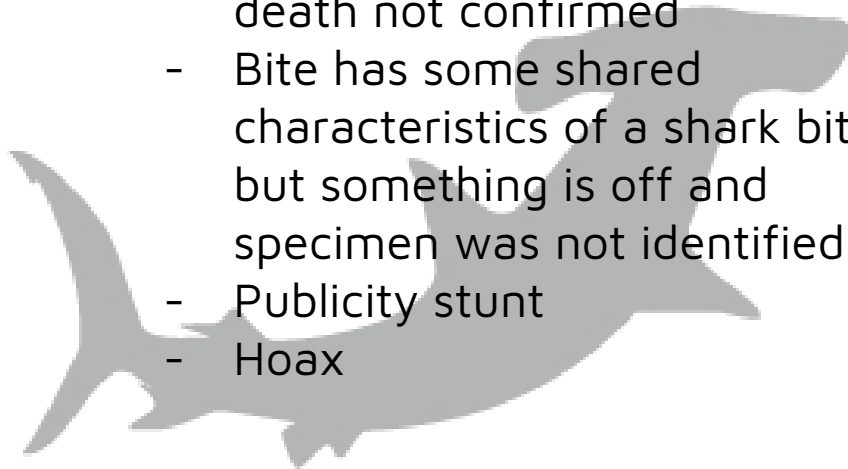
Sea Disasters

Boat

Invalid

Provoked
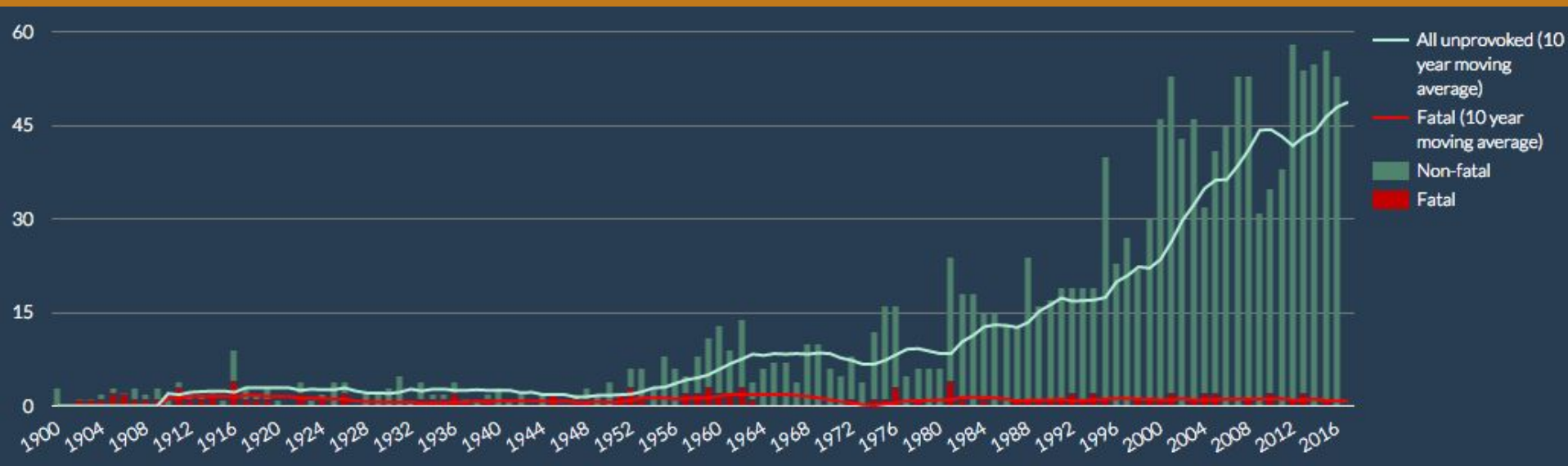
- 111 Records since 2007
    - Research
    - Taunting (Grabbing a shark's tail while diving)
    - Captive Shark handling
    - Touching a shark that 'looks dead'

The facts:
Unprovoked shark bites occur.
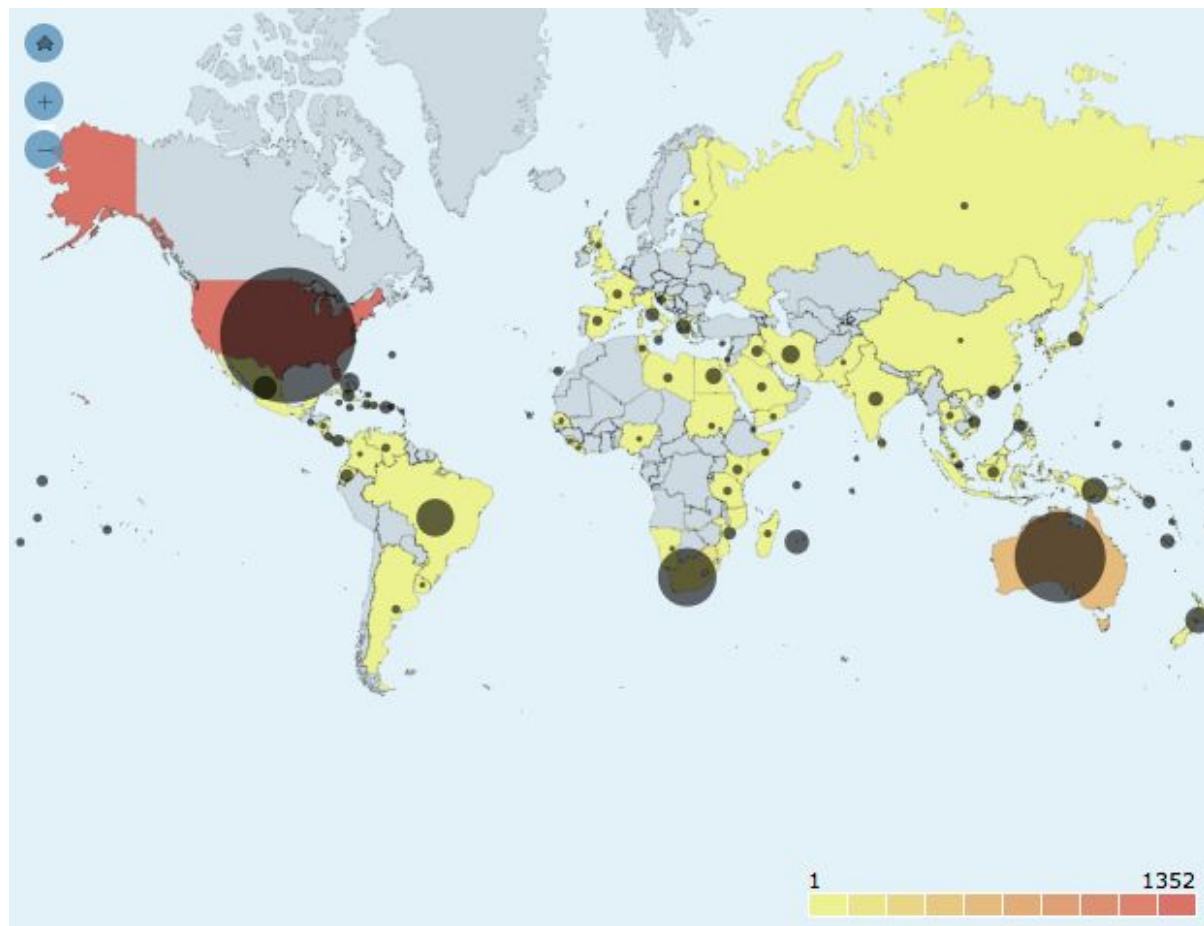
Unprovoked bites in the US since 1900

Number of Shark Bites Worldwide

2016: 54 in the USA
None were fatal

Worldwide, 5
unprovoked bites
were fatal in 2016

100 - 273 million
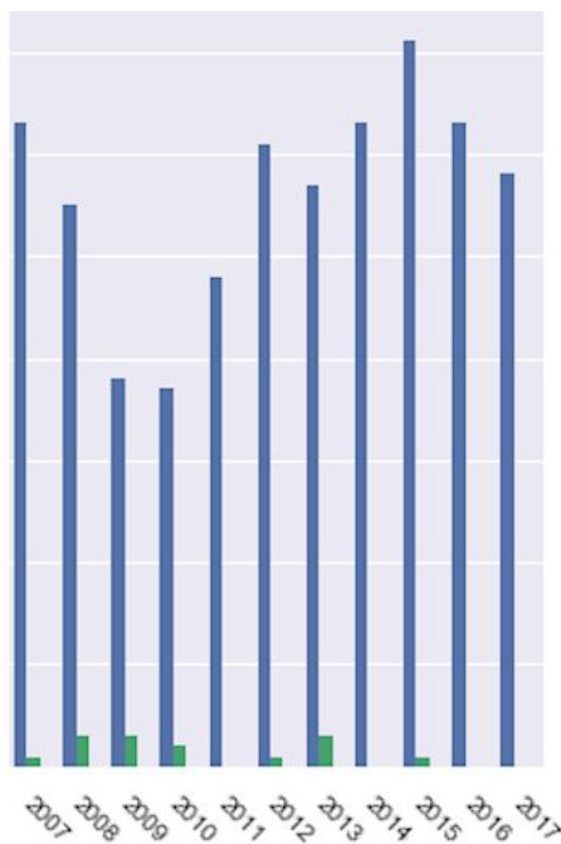sharks are killed by
humans annually

| 1 | | | | | | | | 1352 |

https://www.floridamuseum.ufl.edu/fish/isaf/shark-attacks-maps-data/world/

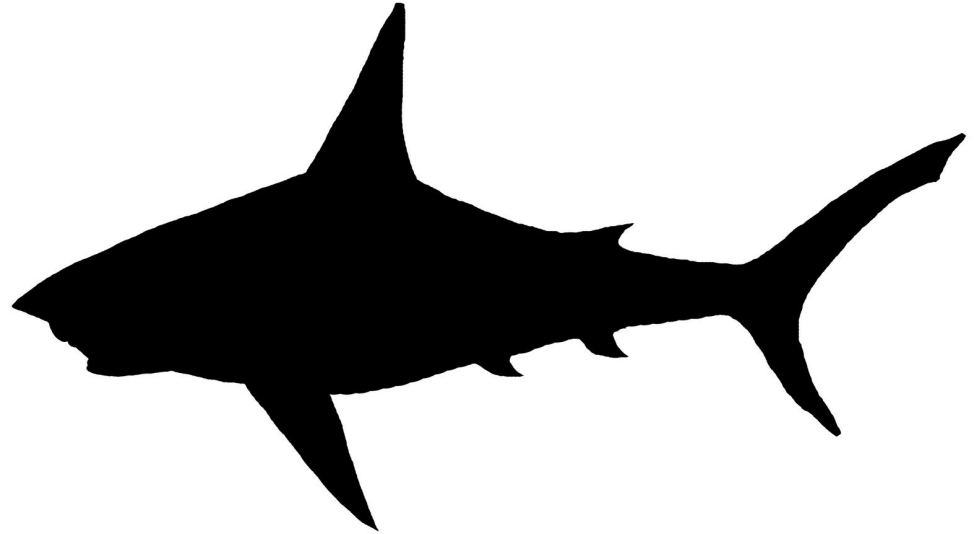# So, in numbers: Australia, USA and South Africa
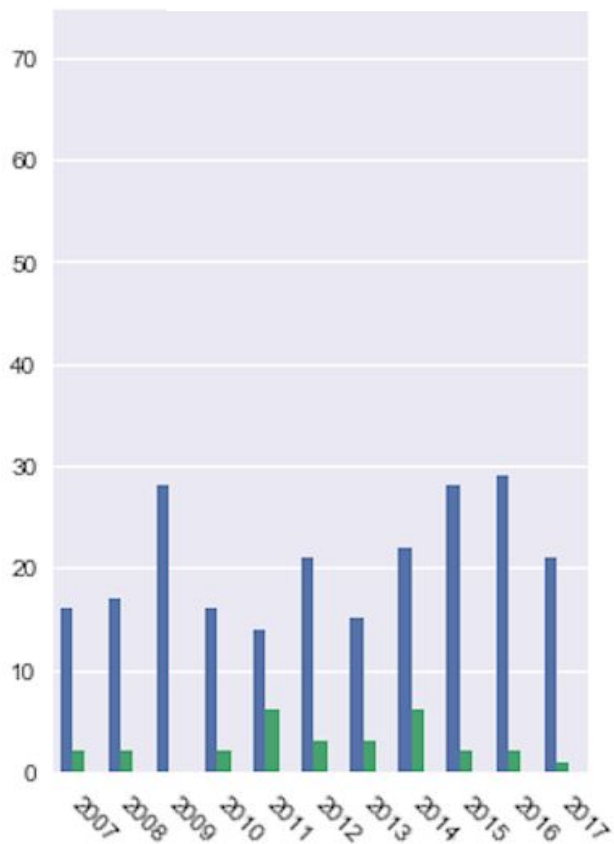
What influences incidence of shark bites?

- Recreational coastlines
- Human population
- Overfishing
- Longer summer season

- Moon phase
- Policy

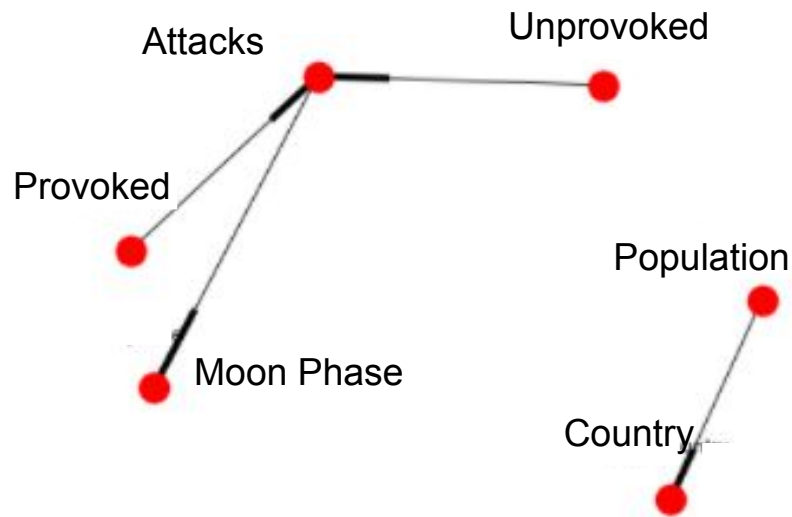# Predicting using a Bayesian Network

Why Bayesian Network?

Directed Acyclic Graph (DAG) Construction:

- Given the set of conditional independencies in a probability distribution, we try to find a DAG for which the Markov condition entails all and only those conditional independencies.
- (Test for conditional independence using the Chi-squared test)

Bayseian Network of Shark Attacks per Country-Year-Month

Bayseian Network of Shark Attacks per Country-Year-Month

attack	phi(attack)
attack_0	0.9323
attack_1	0.0446
attack_2	0.0079
attack_3	0.0049
attack_4	0.0026
attack_5	0.0021
attack_6	0.0017
attack_7	0.0011
attack_8	0.0008
attack_9	0.0003
attack_10	0.0003
attack_11	0.0001
attack_12	0.0003
attack_13	0.0009
attack_14	0.0001
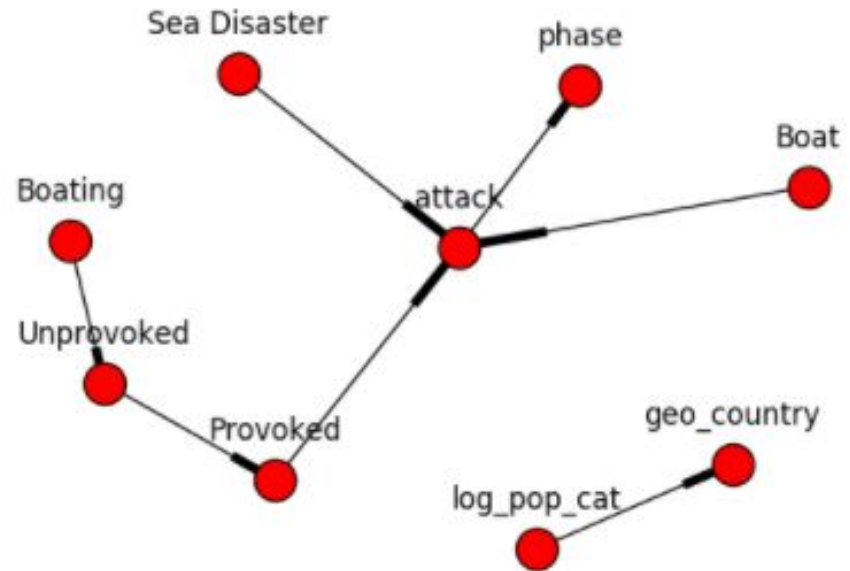
Results:

1. A model that can predict number of attacks per year given type
2. A model that can predict type of attacks given number of attacks

2018 - better or worse outlook for Unprovoked Bites?

If you remember my slide where we reviewed what influences shark attacks, only a few of those can very well be accounted for with data.