Risk Assessment: Temporal Risk Overview

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NOAA Fisheries, Southwest Fisheries Science Center

Review of NOAA Fisheries’ Science on Marine Mammals & Turtles
Southwest and Northwest Fisheries Science Centers
27-31 July 2015
La Jolla, CA
Links with Mandates, Needs of Regulatory Partners

- **ESA**
  - Status reviews, identifying threats to recovery, prioritization of mitigation actions, critical habitat

- **MMPA**
  - Human induced mortality for Stock Assessment Reports, ecosystem expertise

- **NOAA**
  - CetMap, Ocean Noise Strategy, CINMS shipping working group, processing shipping data

- **IWC/IUCN**
  - Human induced mortality, ship strike workshop
  - Parameters used in IUCN Red List criteria
Risk Assessment

Temporal—cumulative risk of extinction

Spatial—combine species distributions with the distributions, magnitudes, and consequences of threats
Biological Review Teams with MMTD participation

- Loggerhead Turtles
- Green Turtles
- Southern Resident Killer Whales
- Hawaiian Insular False Killer Whales
- Black Abalone
- Humpback Whales
- Ribbon Seals
- Bearded Seals
- Harbor Seals of Iliamna Lake
- White Sharks
- Gulf of Mexico Bryde’s Whales
Endangered species: “any species which is in danger of extinction throughout all or a significant portion of its range ...”

Threatened species: “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.”

The process of status reviews continually improves.

Each team struggles with how to quantify risk for decision makers.
Can we use past listing decisions to develop standards based on clear reference points that will help ensure that listing decisions are “transparent, consistent, and scientifically and legally defensible”?

DeMaster et al. 2004 Report by the Quantitative Listing Criteria Group

Post-doctoral research by Tracey Regan performance testing different types of decision rules

Post-doctoral research by Charlotte Boyd on a retrospective analysis
What is the probability of falling below Q mature individuals within Z years?

- **Endangered**
  - Probability of < 50 mature individuals in 50 years: 17.2%

- **Threatened**
  - Probability of < 50 mature individuals in 50 years: 12.5%

- **Not Warranted**
  - Probability of < 50 mature individuals in 50 years: 1.8%
What is the probability of falling below $Q$ mature individuals within $Z$ years?

Critically-low population size or densities

50 mature individuals?
250 mature individuals?
500 mature individuals?
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From retrospective analysis: cases with < 250 mature

**Marine mammals:**
southern resident killer whale (EN)
MHI insular false killer whale (EN)
N Atlantic right whale (EN)
N Pacific right whale (EN)
Cook Inlet beluga (EN)
Saimaa seal (EN)
western gray whale (EN)
Mediterranean monk seal (EN)

**Sharks and rays:**
largetooth sawfish (US range)? (EN)

**Salmonids:**
Snake River sockeye (EN)

**Other ray-finned fishes:**
Puget Sound bocaccio? (EN)

**Seabirds:**
Amsterdam albatross (EN)
Mascerene black petrel (EN)
Bermuda petrel (EN)
Fiji petrel (EN)
freira (EN)
Magenta petrel (EN)

**Molluscs:**
white abalone (EN)
black abalone (EN)
Conclusions

- Standards based on past listing decisions could be used to guide future decisions to ensure that they are “transparent, consistent, and scientifically and legally defensible”.

Risk Assessment: Spatial Risk Overview

Dr. Jessica V. Redfern
Leader, Marine Mammal Spatial Habitat and Risk Program,
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How many individuals are impacted?
Major Activities

**Habitat**
- Predict species distributions
- Quantify spatial and temporal variability
- Identify critical habitat

**Spatially Explicit Risk Assessment**
- Single and cumulative impacts
  - Examples: Shipping
  - Bycatch
  - Ocean noise

**Human Use**
- Quantify distribution and magnitude
- Quantify spatial and temporal variability
Major Activities

**Habitat**

Predict species distributions

Quantify spatial and temporal variability

Identify critical habitat

**Spatially Explicit Risk Assessment**

Single and cumulative impacts

Examples: Shipping, Bycatch, Ocean noise

**Human Use**

Quantify distribution and magnitude

Quantify spatial and temporal variability
Predict Species Distributions

Starting point: low spatial and temporal resolution stratified density estimates

Finest stratification scale is two orders of magnitude too large
Predict Species Distributions

How many individuals are impacted?
Habitat modeling provides finer resolution predictions
Quantify Variability

- Improve habitat variables
  - Quantify oceanographic variability
  - Use new data sources to enable forecasting, capture mechanisms that concentrate prey, and reflect upwelling locations and strength

Selected Publications


Quantify Variability

• Merge multiple types of marine mammal data
  – Systematically and non-systematically collected data
Major Activities

**Habitat**

- Predict species distributions
- Quantify spatial and temporal variability
- Identify critical habitat

**Human Use**

- Quantify distribution and magnitude
- Quantify spatial and temporal variability

**Spatially Explicit Risk Assessment**

- Single and cumulative impacts
- Examples: Shipping, Bycatch, Ocean noise
Human Use

Key questions

• What are the uses?
• Where do they occur?
• How does use change through time?
• What is the overlap among uses?
Quantify Use and Variability

- **Shipping traffic**
  - Use AIS (Automatic identification systems) data (2008-present) to estimate cumulative distance traveled and speed in 1km x 1km grids
  - Ship-strike risk: effects of regulations on shipping traffic
  - Oil spill risk: Use of recommended shipping lanes between Monterey and San Francisco
  - Noise risk to acoustic habitats: Inputs to noise propagation models for southern California waters
Major Activities

**Habitat**

Predict species distributions
Quantify spatial and temporal variability
Identify critical habitat

**Human Use**

Quantify distribution and magnitude
Quantify spatial and temporal variability

**Spatially Explicit Risk Assessment**

Single and cumulative impacts
Examples: Shipping, Bycatch, Ocean noise
Assessing the risk of ships striking large whales in marine spatial planning

Jessica V. Redfern, Megan F. McKenna, Thomas J. Moore, John Calambokidis, Monica L. DeAngelis, Elizabeth A. Becker, Paul C. Fiedler, Jay Barlow, Karin A. Forney, Susan J. Chivers

CARB Rule

California Air Resources Board
Ocean-going Vessel Fuel Rule

Goal: reduce air pollution by requiring large, commercial ships to use cleaner fuels when traveling within 24 nmi of the coast

Philip DiResta
http://mymaritimeblog.wordpress.com/2006/10/28/huge-cargo-ship
CARB Rule

Effects on shipping traffic

Before implementation

After implementation

CARB Rule

U.S. Coast Guard conducted a port access routing study for Los Angeles and Long Beach

Primary concerns in public comments:
• amount of ship traffic through military ranges
• risk of ships striking large whales
Fin and humpback whales have opposing hot spots.
Blue whales are more evenly distributed throughout the area.
Assessing Risk

Assume risk is proportional to the number of whales in each route

Risk is highest in areas where the co-occurrence of whales and ships is high
Assessing Risk

Percent change in risk before and after implementation of the CARB Rule
Assessing Risk

How did the CARB rule affect risk?

Risk for fin whales increased following implementation of the rule

– In 20 years of California stranding records, 2009 had the second highest number of fin whale ship strikes
Bycatch Risk

- Estimating bycatch
  - Mandates and methods
- Reducing bycatch
- Estimating bycatch limits

- Modeling interactions between species and fisheries
  - Spatial and temporal predictions of leatherback turtles on the U.S. West Coast
Strengths

• Leaders in developing the science needed to support ESA and MMPA mandates
• Expertise in Status Reviews for petitioned and listed ESA species
• Expertise in developing tools to assess the impacts of marine mammal and turtle bycatch on population dynamics
• Expertise in developing tools to assess spatial risks
  • Predicting cetacean distributions
  • Analyzing human use data
  • Spatially explicit risk assessment
• Collaboration with multiple stakeholders
Challenges

• Long-term support for staff recruitment and retention
  • Need new analytical tools to address management questions at the required spatial and temporal resolutions
  • Most work to predict species distributions has been funded by outside sources (e.g., Navy)

• Meeting mandates
  • Staffing shortages limit our ability to complete the analyses needed to meet core mandates
  • Partnering with managers to ensure science meets mandates
  • ESA status reviews require considerable time commitments with limited advance notice
    • ESA status reviews could be more efficient with standards for different risk levels (e.g. a species is at high risk if there are fewer than X mature individuals)

• Maintaining collaborations
Strategies

- Strategic thinking
  - Continued work on quantitative standards to improve efficiency, transparency and repeatability of risk categories in status reviews for listing petitions
  - Expand into high need areas
    - Spatially explicit risk assessment (ship strikes, renewable energy, noise, critical habitat, etc.)

- Coping
  - Repurposing existing PI’s to the extent possible
    - Inefficient
    - Leaves previous duties unfulfilled
  - Bringing in outside funds
    - Funding streams are short-term and unpredictable, making it hard to build and sustain longer-term research programs
    - Meeting core mandates becomes a lower priority than meeting external deadlines