Species – Specific Conservation

[Image of IUCN Red List website]

[Diagram showing species categories: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD), Not Evaluated (NE)]

[Box labeled CRITERIA with subcategories: Population reduction, Restricted geographic range, Small population size & decline, Very small or restricted population, Quantitative analysis]
Motivation: Extinction Risk in The Ocean

Myers & Ottensmeyer 2005

Direct / Indirect Fishery Impacts:

- Stock / catch declines
- Loss of local stocks

**Figure 5.2.** Estimates of biomass (± s.e.) for haddock from research surveys of the Southern Grand Bank and St. Pierre Bank for the years 1951 to 1995. Open circles indicate that no haddock were caught. These estimates are from an analysis of all research surveys conducted in the region since 1951, and represent the longest series of research surveys in the Western Atlantic. These estimates are part of the M.Sc. thesis of Jill Casey (2000).
Conservation planning and the IUCN Red List


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ABSTRACT: Systematic conservation planning aims to identify comprehensive protected area networks that together will minimize biodiversity loss. Importantly, conservation planners seek to determine where to allocate limited resources first, particularly given the uneven spread of, and threats to, biodiversity. The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species incorporates data not only on threats to species, but also on species distributions and ecological requirements. These temporal and spatial attributes, when combined with other datasets, have proven useful for determining the most urgent priority areas for conserving biodiversity, from the global level down to the scale of individual sites. Although many challenges remain, the increasing reliability and comprehensiveness of the IUCN Red List suggests that its role as a source of biodiversity data in systematic conservation planning is certain to expand dramatically.

KEY WORDS: IUCN Red List · Conservation planning · Threatened species · Biodiversity conservation · Protected areas
Systematic Conservation Planning (IUCN)

A progression towards extinction… with built-in uncertainties.

Fig. 2. The IUCN Red List categories (adapted, with permission, from IUCN 2001)
### Systematic Conservation Planning (IUCN)

**Table 1. Simplified overview of the IUCN Red List criteria (adapted, with permission, from Butchart et al. 2004) (see IUCN 2001, Standard and Petitions Working Group 2006).**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Critically Endangered (CR)</th>
<th>Endangered (EN)</th>
<th>Vulnerable (VU)</th>
<th>Qualifiers and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1: reduction in population size</td>
<td>≥90%</td>
<td>≥70%</td>
<td>≥50%</td>
<td>Over 10 yr/3 generations* in the past, where causes of the reduction are clearly reversible AND understood AND have ceased</td>
</tr>
<tr>
<td>A2–4: reduction in population size</td>
<td>≥80%</td>
<td>≥50%</td>
<td>≥30%</td>
<td>Over 10 yr/3 generations* in past, future or combination</td>
</tr>
<tr>
<td>B1: small range (EOO)</td>
<td>&lt;100 km²</td>
<td>&lt;5000 km²</td>
<td>&lt;20 000 km²</td>
<td>Plus 2 of (1) severe fragmentation/few locations (1, ≤5, ≤10), (2) continuing decline, (3) extreme fluctuation</td>
</tr>
<tr>
<td>B2: small range (AOO)</td>
<td>&lt;10 km²</td>
<td>&lt;500 km²</td>
<td>&lt;2000 km²</td>
<td>Plus 2 of (1) severe fragmentation/few locations (1, ≤5, ≤10), (2) continuing decline, (3) extreme fluctuation</td>
</tr>
<tr>
<td>C: small and declining population</td>
<td>&lt;250</td>
<td>&lt;2500</td>
<td>&lt;10 000</td>
<td>Mature individuals. Continuing decline either (1) over specified rates and time periods or (2) with (a) specified population structure or (b) extreme fluctuation</td>
</tr>
<tr>
<td>D1: very small population</td>
<td>&lt;50</td>
<td>&lt;250</td>
<td>&lt;1000</td>
<td>Mature individuals</td>
</tr>
<tr>
<td>D2: very restricted population</td>
<td>na</td>
<td>na</td>
<td>&lt;20 km² AOO or ≤5 locations</td>
<td>Capable of becoming Critically Endangered or even Extinct within a very short time frame</td>
</tr>
<tr>
<td>E: quantitative analysis</td>
<td>≥50% in 10 yr/3 generations*</td>
<td>≥20% in 10 yr/5 generations*</td>
<td>≥10% in 100 yr</td>
<td>Estimated extinction-risk using quantitative models (e.g. population viability analysis)</td>
</tr>
</tbody>
</table>

*Whichever is longer

These criteria designed with mitigating circumstances.
Six groups have been assessed completely for the first time (as of 2008):

- Sharks and Rays
- Groupers
- Reef-building Corals
- Seabirds
- Marine Mammals
- Marine Turtles
Assessing Biodiversity Trends
(Vie et al. 2008)

Defining Hotspots of Biodiversity
(Polidoro et al. 2008)

Number of Coral Species

Proportion of coral species in protected categories
Limitations of the IUCN Red List
(Hoffmann et al. 2008)

Species Definitions:
Taxonomy / Knowledge impact
species definitions - priorities

Abundance / Trend Data:
Systematic conservation planning
sensitive to errors in species data.

Knowledge Varies Across Taxa / Regions:
What to do with Data Deficient Species?

Capacity and Coverage:
Biases in assessments: taxa / regions

Regional vs Global Priorities:
Inherent bias in regional Red Lists towards
locally rare, but globally widespread species
(particularly those at edges of their ranges)

(Chapter 5 –
Myers &
Ottensmeyer 2005)
Challenges of assessing cetacean population recovery and conservation status

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ABSTRACT: This paper examines the extent to which depleted whale populations have recovered (or not) and their perceived current conservation status and prognosis for continued survival, as represented in the International Union for Conservation of Nature and Natural Resources (IUCN) Red Lists. It is concluded that current hypothetical and untested predictions of extinction risk, while in many cases drawing attention to justifiable conservation needs, may seriously undervalue the resilience of species that have evolved to live in a dynamic and ever-changing reality including centuries of heavy exploitation by humankind. The paper questions the appropriateness of Red Listing criteria for long-lived highly mobile ocean-dwelling species that are scarcely affected by the principal threats upon terrestrial or aquatic species living in relatively restricted areas subject to habitat fragmentation and/or loss. This analysis draws attention to the problems associated with objectively assessing the conservation status of charismatic species and the value conflicts that may override evidence-based scientific conservation assessments.

KEY WORDS: Whales · Whaling · Conservation · Population recovery · Predicting extinction · Red Listing · Charismatic species
Conservation of Marine Mammals

Life History Attributes

Long-lived
Far-ranging
Complex social systems

Sociological Issues

Common Property Resources
Commercial Value of Products
Societal Value (beyond consumption)
Current Threats to Marine Mammals

Harvesting

Fisheries by-catch
Fisheries interactions

Habitat loss and degradation

Disease outbreaks
Climate change
Extinct Marine Mammals

Steller’s Sea Cow  *Hydrodamalis gigas*

Caribbean Monk Seal  *Monachus tropicalis*

Japanese Sea Lion  *Zalophus californianus japonicus*

Atlantic Gray Whale  *Eschrichtius robustus*

NE Atlantic Right Whale  *Eubalaena borealis*
Applying IUCN Criteria to Marine Mammals
(Freeman 2008)

Table 4. Major current and/or future threats used to justify Red Listing of commercially hunted whales. Population estimates vary from reasonable certainty (for the common minke) to highly uncertain (for the sperm and sei whales). An extensive web-based search suggested that the sources given in footnotes a to e provided estimates within the range of those available from many available sources. LR/NT: Lower Risk/Near Threatened (close to ‘vulnerable’); LR/CD: Lower Risk/Conservation Dependent (subject to a conservation program, the ending of which would qualify the taxon for a Vulnerable, Endangered or Critically Endangered listing)

<table>
<thead>
<tr>
<th>Species</th>
<th>Population estimate</th>
<th>Listing category</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common minke</td>
<td>209 800(^a)</td>
<td>LR/NT</td>
<td>Harvesting (hunting/gathering) – food – subnational/national/regional/ international trade (past &amp; ongoing), Cultural/scientific/leisure activities</td>
</tr>
<tr>
<td><em>Balaenoptera acutorostrata</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antarctic minke</td>
<td>&gt;600 000(^b)</td>
<td>LR/CD</td>
<td>Harvesting (hunting/gathering) – food – subnational/national/regional/ international trade (past &amp; ongoing), Cultural/scientific/leisure activities</td>
</tr>
<tr>
<td><em>Balaenoptera bonaerensis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sei whale</td>
<td>S. Hemisphere 24 000(^c)</td>
<td>EN</td>
<td>Accidental mortalities: bycatch – fisheries-related (ongoing)</td>
</tr>
<tr>
<td><em>Balaenoptera borealis</em></td>
<td>N. Atlantic 10 000</td>
<td></td>
<td>Harvesting (hunting/gathering) – food – regional/international trade (past)</td>
</tr>
<tr>
<td></td>
<td>N. Pacific 22 000 – 37 000</td>
<td>A1abd</td>
<td></td>
</tr>
<tr>
<td>Sperm whale</td>
<td>200 000 – 1.5 Million(^d)</td>
<td>VU</td>
<td>Harvesting (hunting/gathering) – food – regional/international trade (past). Accidental mortalities: bycatch – fisheries-related – entanglement (ongoing). Intrinsic factors: poor recruitment/ reproduction/regeneration (present, future) – other (present, future)</td>
</tr>
<tr>
<td><em>Physeter macrocephalus</em></td>
<td>350 000(^e)</td>
<td>A1bd</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)www.iwcoffice.org/conservation/estimate.htm; \(^b\)www.70south.com/information/antarctic-animals/whales;
\(^c\)www.antarcticconnection.com/antarctic/wildlife/whales/sei.shtml; \(^d\)www.nmfs.noaa.gov/pr/species/mammals/cetaceans/sperrnwhale.htm; \(^e\)www.acsonline.org/factpack/index.html
Habitat Degradation in Marine Mammals

Vaquita
*Phocoena sinus*

Baiji
*Lipotes vexillifer*

Mediterranean monk seal
*Monachus monachus*
Applying IUCN Criteria to Marine Mammals
(Freeman 2008)

Paper questions appropriateness of Red List criteria for highly mobile oceanic species that are not affected by threats impacting species with restricted distributions

Table 2. Red List of endangered cetaceans (2007). For classification abbreviations see Table 1

<table>
<thead>
<tr>
<th>Species</th>
<th>Classification</th>
<th>Occurrence</th>
<th>Population estimate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaquita</td>
<td>CR</td>
<td>Local, riverine</td>
<td>&lt;1000</td>
<td>WWF*</td>
</tr>
<tr>
<td>Phocoena sinus</td>
<td>CR</td>
<td>Local, riverine</td>
<td>&lt;100</td>
<td>WWF*</td>
</tr>
<tr>
<td>Yangtze river dolphin</td>
<td>CR</td>
<td>Local, riverine</td>
<td>ca. 1000</td>
<td>Martin (1990)</td>
</tr>
<tr>
<td>Leporinus vexillifer</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 1000</td>
<td>WWF*</td>
</tr>
<tr>
<td>Indus river dolphin</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 7400</td>
<td>WWF*</td>
</tr>
<tr>
<td>Planista minor</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 1000</td>
<td>WWF*</td>
</tr>
<tr>
<td>Ganges river dolphin</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 1000</td>
<td>WWF*</td>
</tr>
<tr>
<td>Planista gangetica</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 1000</td>
<td>WWF*</td>
</tr>
<tr>
<td>Hector's dolphin</td>
<td>EN</td>
<td>NZ coastal waters</td>
<td>ca. 350</td>
<td>IUCN*</td>
</tr>
<tr>
<td>Cephalorhynchus hectori</td>
<td>EN</td>
<td>Local, riverine</td>
<td>ca. 50</td>
<td>WWF*</td>
</tr>
<tr>
<td>Amazon river dolphin</td>
<td>EN</td>
<td>Low-10s of thousands</td>
<td></td>
<td>IUCN*</td>
</tr>
<tr>
<td>Harbor porpoise</td>
<td>VU</td>
<td>Wide-ranging coastal</td>
<td>&gt;600000</td>
<td>IUCN*</td>
</tr>
<tr>
<td>Phocoena phocoena</td>
<td>VU</td>
<td>Wide-ranging coastal</td>
<td>&gt;200000</td>
<td>ACS*</td>
</tr>
<tr>
<td>Beaufort</td>
<td>EN</td>
<td>Localized, coastal</td>
<td>ca. 100</td>
<td>IUCN*</td>
</tr>
<tr>
<td>Eubalaena japonica</td>
<td>EN</td>
<td>Localized, coastal</td>
<td>ca. 350</td>
<td>WWF*</td>
</tr>
<tr>
<td>Pacific right whale</td>
<td>EN</td>
<td>Localized, coastal</td>
<td>ca. 350</td>
<td>WWF*</td>
</tr>
<tr>
<td>Balaenoptera musculus</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Blainville's whale</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Blue whale</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Balaenoptera mysticetus</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Fin whale</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Balaenoptera physalus</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Sei whale</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Balaenoptera borealis</td>
<td>EN</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Sperm whale</td>
<td>VU</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Physarum macrocephalus</td>
<td>VU</td>
<td>Wide-ranging, oceanic</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Humpback whale</td>
<td>VU</td>
<td>Wide-ranging, coastal - offshore</td>
<td></td>
<td>WWF*</td>
</tr>
<tr>
<td>Megaptera novaeanglia</td>
<td>VU</td>
<td>Wide-ranging, coastal - offshore</td>
<td></td>
<td>WWF*</td>
</tr>
</tbody>
</table>

*World Wildlife Fund: www.panda.org/about_wwf/what_we_do/species/about_species/species_factsheets/
*International Union for Conservation of Nature and Natural Resources: www.iucnredlist.org/search-basic
*American Cetacean Society: www.acsonline.org/factpack/

Are marine mammals subject to habitat fragmentation and loss?
Coastal Example: Florida Manatees

**Status:** Listed as *Endangered* under the ESA

Current minimum population estimate ~ 2,600

Population trends vary with location

**Primary threats:**

**Acute:** Collisions with watercraft

Loss of warm water refuges

Periodic epizootics (*e.g.* 1996 & 2002)

Entanglement in fishing gear

**Chronic:** Habitat degradation & loss
Habitat Degradation

Management Actions:

Slow speed areas (time-area)
Oceanic Example: North Atlantic Right Whales

Status: Listed as ‘Endangered’ under ESA

Current minimum population estimate: ~ 300 photo-ID

Decreasing population trend

Primary threats:

Acute:

Entanglement in fishing gear

Collisions with large vessels
Habitat Fragmentation

Management Actions:

Shifting shipping lanes away from high-use areas

Real-time adaptive measures: sightings

Acoustic array for detection and avoidance

(www.listenforwhales.org, NOAA)
Applying IUCN Criteria to Marine Mammals - Why Not?
(Dizon et al. 1992)

Stocks not defined correctly for effective management – need ESUs

Suggest expanding definition to include behavioral criteria:

1. Distribution
2. Population response
3. Phenotypic variation
4. Genotypic variation

**Distribution:**
- Range
- Habitats
- Migrations
- Overlap with threats
  - bycatch
  - pollutants
  - parasites

**Population Response:**
- Social system
- Communication
- Diet
- Growth rate
- Reproductive biology
Applying IUCN Criteria to Marine Mammals – Why Not?
(Freeman 2008)

Sociological issues weigh too heavily in marine mammal management

<table>
<thead>
<tr>
<th>PLUSES</th>
<th>MINUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem-Based Management</td>
<td>Assessments Without Having Good Data</td>
</tr>
<tr>
<td>Precautionary Principle</td>
<td>Charismatic / Iconic Taxa</td>
</tr>
</tbody>
</table>

I love Whales
Defining Stocks of Highly-Migratory Species
Bluefin Tuna: Some Statistics

- Giant bluefin are the largest of the tuna, reaching up to 10 feet in length and 1500 lbs (680 kg)
- Bluefin's lifespan over 20 years
- Bluefin burst swim speeds up to 55 miles / hour (88.6 km / hour)
- Migrate up to 5000 miles (8000 km) in 50 days
- A bluefin tuna can fetch $5,000 to $30,000 at the dock, with prices from $3 - $12 per lb
- In 1991, record price of $68,503 paid for single bluefin tuna, almost $100 per lb
Bluefin Tuna: Population Ranges

- Northern / Southern bluefin tuna are cosmopolitan
- Range from warm tropical waters (~ 30 deg. C. SST) to cool subarctic regions (~ 10 deg. C. SST)
Bluefin Tuna: Surface Fisheries

- Fisheries use pelagic longlines and purse seines to catch bluefin tuna in international waters
- Few artisanal coastal fisheries (harpoon, almadraba)
- Sport fishers
Bluefin Tuna: ICCAT Management

- International Council for Conservation of Atlantic Tuna (ICCAT) responsible for bluefin tuna management

- According to ICCAT, north Atlantic bluefin population has declined by 70-80% during last 20 years

- Bluefin subject to strict international quotas in the Western Atlantic, and NMFS considers species depleted

- Essential to know where bluefin tuna go, which fisheries they overlap with, and where they reproduce

- ICCAT management based on assumption of two distinct eastern and western north Atlantic populations

- ICCAT management heavily influenced by politics (within nations and across nations) (Safina 1993)
Bluefin Tuna: Tagging Studies

- 17 / 20 tagged fish released (late Jan - late July)
- 12 tags reporting during spawning period (May-July) located north of 33° N latitude, in the mid-Atlantic

(Lutcavage et al., 1999)
Bluefin Tuna: Tagging Studies

Track of bluefin tuna # 408
Size upon release: 203 cm FL
Age upon release: 8.4 years

Release
Date: March 3, 1997
Location: 35.09N, 75.26W

Recapture
Date: June 15, 2000
Location: 35.37N 12.53E

(Block et al., 2001)
Tagged fish spent 3 years in the western Atlantic (1997-2000) prior to trans-Atlantic crossing into western Mediterranean Sea.

The fish moved each year between the Carolinas (winter) and Gulf of Maine / Cape Cod (summer) (Block et al., 2001)

Track of a bluefin tuna tagged off Hatteras N.C. on March 3, 1997, recaptured off Sicily on June 15, 2000
Immature western resident bluefin tuna shows western residency pattern:

Bathymetrically constrained diving on shallow Carolina shelf in early spring, deeper diving off-shelf in Gulf Stream and constrained diving when on the New England shelf in summer.

Fish returns to 40 m Carolina shelf in winter / spring following tagging.

This pattern of high fidelity to North American continental shelf is evident in many of the immature tagged fish.

(Block et al., 2001)
Bluefin Tuna: Diving Behavior

Immature (~ 7 years), Western Atlantic Migration

Shallow diving on the Carolina shelf (40 m)

Deeper diving off-shelf in the Gulf Stream

Shallow diving on the New England shelf in summer
A mature fish shows different pattern

Vertical excursions into deep water more frequent

Summertime spawning characterized by shallow dives
Bluefin Tuna: SST Habitats

Temperature / pressure sampled every 2 minutes

Maximum daily SST recorded at surface (0-2 m depth)

Proposed western stock breeding period season depicted by the cross-hatched area: located in the Gulf of Mexico
Bluefin Tuna: New Insights

Otolith (ear bone) chemistry provides clues of fish origin

d$^{13}$C and d$^{18}$O values for yearling Atlantic bluefin tuna from 1999 to 2004 captured in two areas ($n = 113$):

eastern Atlantic / Med (blue)

western Atlantic Ocean (red)

(Rooker et al., 2008)
Bluefin Tuna: New Isotopic Insights

In continental shelf waters of the U.S. Atlantic Ocean, schooling yearlings (S) collected from Maryland to Massachusetts over 6-year period (n = 81)

Adults (G) show high rates of natal homing to both eastern and western spawning areas.

Trans-Atlantic movement (E-W) size-dependent: M & G Mediterranean fish mix with western stock in U.S. waters.

(Rooker et al., 2008)
<table>
<thead>
<tr>
<th><strong>PLUSES</strong></th>
<th><strong>MINUSES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Planning: allocate finite resources</td>
<td>Ecology inhibits assessments: (scant taxonomic information, large ranges, mobile species)</td>
</tr>
<tr>
<td>Map areas of risk / diversity – multi-species priorities</td>
<td>Criteria not adequate for marine species (range, abundance, trends) (Need ESU-level analysis)</td>
</tr>
<tr>
<td>Allows objective assessments: trends and recovery</td>
<td>Sociological / Economic issues inhibit objective decision-making</td>
</tr>
</tbody>
</table>
Want to Learn More?

http://endoftheline.com/