False Killer Whale Take Reduction Team

Orientation Meeting

February 17, 2010 - Honolulu, Hawaii

Marine Mammal Stock Assessments - Overview

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Stock Assessment Overview

- Marine Mammal Protection Act
- Structure of Stock Assessment Reports (SARs)
- PBR (Potential Biological Removal)
- Assessment Research Methods
- Overview of 2009 False Killer Whale SAR

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MMPA Amendments of 1994

Taylor et al. 2000, Conservation Biology 14: 1243-1252

- MMPA of 1972 required extensive data that could not be obtained for most stocks.
- 1988: Congress recognized that system not working
- 1994 amendments work with the type of data we can actually get.
- Designed to account for uncertainty in assessment data
- Potential Biological Removal (PBR) approach identifies stocks that may have unsustainable human-caused impacts (='strategic' stocks)
- Allows management to identify potential problems and focus on species & fisheries with greatest likelihood of adverse impacts.
- Marine Mammal Stock Assessment Reports published annually

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MMPA, Sec. 117– Stock Assessment Reports

Sec. 117. (a) Each draft stock assessment, based on the best scientific information available, shall—

(1) describe the geographic range…

(2) provide the minimum population estimate, net productivity rates, and current population trend…

(3) estimate the annual human-caused mortality and serious injury of the stock by source and, for a strategic stock, other factors …including effects on marine mammal habitat and prey;

(4) describe commercial fisheries that interact with the stock,…

(5) categorize the status of the stock … [Strategic/not strategic]

(6) estimate the potential biological removal level for the stock…

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MMPA, Definitions

The term "potential biological removal level" means the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

The potential biological removal level is the product of the following factors:

(A) The minimum population estimate of the stock.

(B) One-half the maximum theoretical or estimated net productivity rate of the stock at a small population size.

(C) A recovery factor of between 0. 1 and 1. 0.

$$PBR = N_{min} * \tfrac{1}{2} R_{max} * F_r$$

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Working out the details…

- June 1994: PBR Workshop (*Barlow et al. 1995, NOAA Tech Memo NMFS-OPR-95-6; Wade 1998, Marine Mammal Science; Taylor et al. 2000, Conservation Biology)*
- April 1996: Guidelines for Assessing Marine Mammal Stocks (GAMMS) Workshop *(Wade and Angliss 1997, NOAA Tech Memo NMFS-OPR-12)*
- September 2003: Guidelines for Assessing Marine Mammal Stocks II (GAMMS II) Workshop *(NMFS 2005, 70 FR 35397 June 20, 2005)*

Revisions to Guidelines for Assessing Marine Mammal Stocks (GAMMS II)

NMFS 20005

Available at:
http://www.nmfs.noaa.gov/pr/pdfs/sars/gamms2005.pdf

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$PBR = N_{min} * \frac{1}{2} R_{max} * F_r$

Population Size (N_{min})

The MMPA…

… defines the minimum abundance estimate as "…an estimate of the number of animals in a stock that—

(A) is based on the best available scientific information on abundance, incorporating the precision and variability associated with such information; and

(B) provides reasonable assurance that the stock size is equal to or greater than the estimate."

The Stock Assessment Guidelines…

…define the minimum abundance estimate (N_{min}) as either

- a direct count (e.g. seals on land), or
- the lower 20th percentile of a statistical abundance estimate

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$PBR = N_{min} * \frac{1}{2} R_{max} * F_r$

Net Productivity Rate (R_{max})

The MMPA…

… defines the population growth rate, or net productivity rate as "…the annual per capita rate of increase in a stock resulting from additions due to reproduction, less losses due to mortality."

The Stock Assessment Guidelines:

In the absence of stock-specific measured values, use defaults for the net productivity rate (R_{max}) :

4% for whales, dolphins, porpoises, and manatees

12% for seals, sea lions, and sea otters

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$PBR = N_{min} * \frac{1}{2} R_{max} * F_r$

Recovery Factor (F_r)

The MMPA…

… defines the recovery factor as "between 0.1 to 1.0"

The intent of Congress was to ensure the recovery of populations to their optimum levels, and to ensure that the time necessary for populations listed as endangered, threatened, and depleted to recover was not significantly increased.

The Stock Assessment Guidelines:

Set the default recovery factors as follows:

0.1-0.3 for endangered species or stocks known to be declining

0.4-0.5 for threatened or depleted species, and for stocks of unknown status

up to 1.0 for stocks known to be at optimum levels, or of unknown status but known to be increasing

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Stock Assessment

The MMPA…

… requires comparison of estimated human-caused mortality and serious injury (M&SI) to the PBR.

To reduce variation in annual estimates, guidelines suggest comparing 5-yr average annual M&SI.

PBR = Potential Biological Removal

$N_{min} * \frac{1}{2} R_{max} * F_r$

If M&SI > PBR → Strategic stock

If M&SI <= PBR → Not a strategic stock

Example: PBR = 5000 * 0.02 * 0.5 = 50 animals per year

Estimated M&SI: 12 animals per year

→ Not strategic

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Established Stock Assessment Process

- Designed to achieve MMPA goals using the type and quality of data we can obtain.
- Provides default values for estimates that are difficult or impossible to obtain (R_{max})
- Takes into account uncertainties in data (e.g. inaccurate or imprecise estimates of abundance, mortality)
- Provides incentive to obtain better data
- Mechanism (TRT) for finding collaborative solutions when takes are unsustainable

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Questions?

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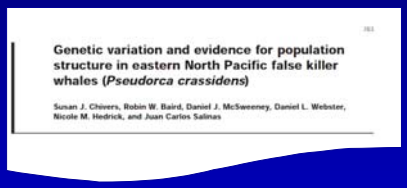
Assessment Research Methods

- Abundance & Trends

- Stock Structure



- Human-caused mortality and serious injury

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Abundance and Trends:
Common methods of monitoring marine mammal populations

Shipboard visual & acoustic line-transect surveys

Aerial line-transect surveys

Small boat based photo-identification studies

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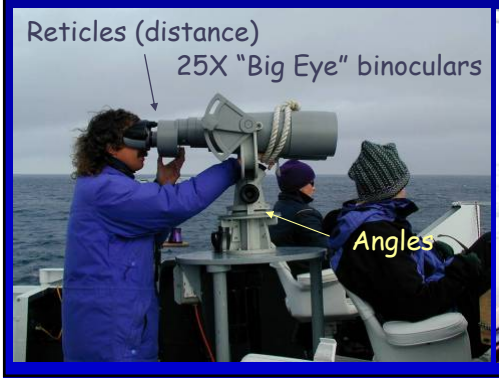
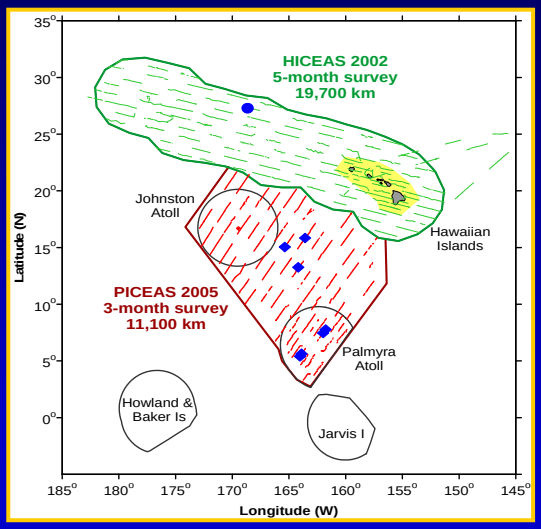
Ship-based, Visual Line-transect Survey



Transect Surveys

- Established survey methods (since 1986).
- Advanced analytical techniques including correction for missed animals.
- Peer-reviewed and published in scientific journals and reports.



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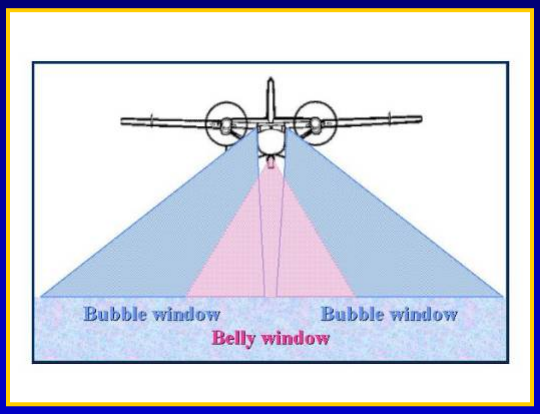
Aerial Survey Methods



- Distance sampling (line/strip transect)
- Good to fair weather conditions (BF0-4, mostly clear skies)

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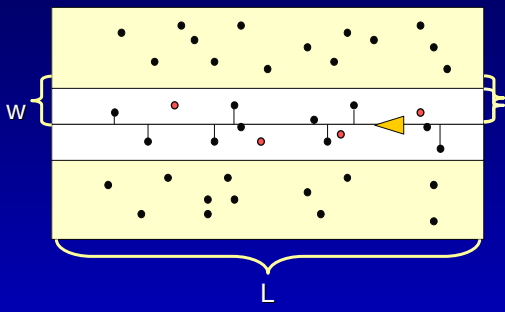
Transect Surveys



Strip Transect
→Seabirds

Line Transect
→ Marine Mammals

$$D = \frac{n * s}{L * 2w}$$

D = Density
n = number of sightings
s = average group size
L = length of transect
w = effective strip width

Buckland et al. 1993

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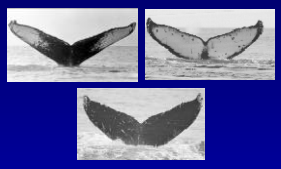
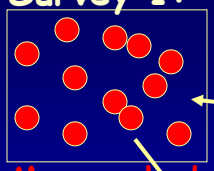
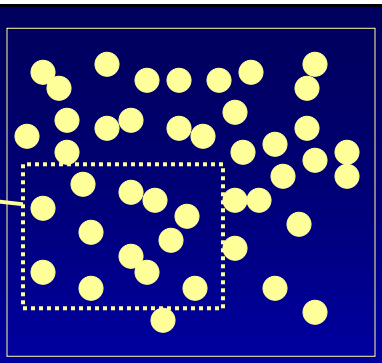
Mark Recapture



Survey 1:

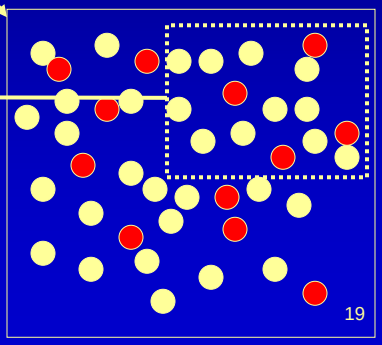


M = marked



$$N = \frac{M*C}{R}$$

Survey 2:



$$45 = \frac{12*15}{4}$$

C = captured
R = recaptured

✓Sampling considerations

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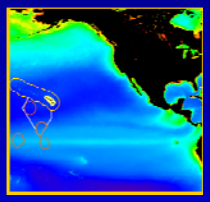
Comparison of Methods

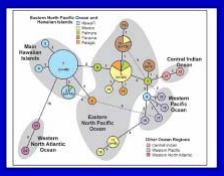
- Ship surveys
  - Pros:
    - Large scale
    - Two detection modes
    - In situ environmental data
  - Cons:
    - Expensive
    - Poor seasonal coverage
- Aerial survey
  - Pros:
    - Broad seasonal coverage
    - Historic data
    - Variety of scales
    - Cost-effective?
  - Cons
    - Weather-dependant
    - No environmental data
- Small boat surveys
  - Pros:
    - Broad seasonal coverage
    - Fine scale
    - Opportunity for other studies
  - Cons:
    - Small study area
    - Limited detection capability

Stock Identification tools

- Distribution
- Movements
- Population trends
- Genetic differences
- Morphological differences
- Life history
- Contaminant loads
- Natural isotope ratios
- Parasite differences
- Habitat differences





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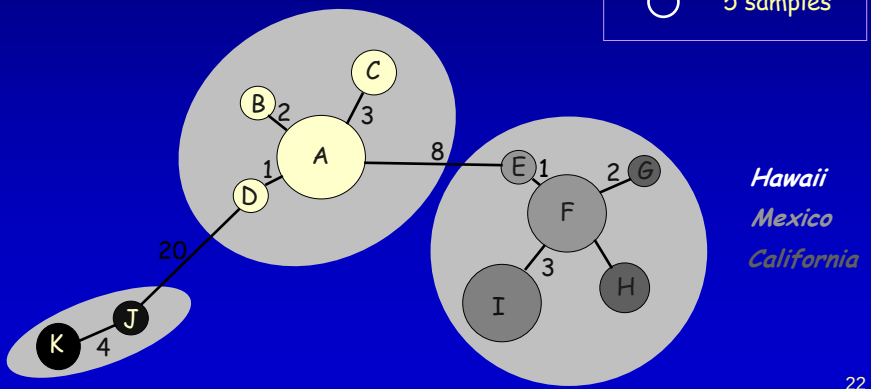
Evaluating genetic structure

*Haplotype **A** = ATGCGCTTTTAAGC*
Haplotype B = ATGCGCTTAAAAGC



Hawaii
Mexico
California

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Stock Identification

- Must be aware of localized impacts
- Even though distribution may appear continuous, localized reductions may eliminate undetected or result in reduction in range

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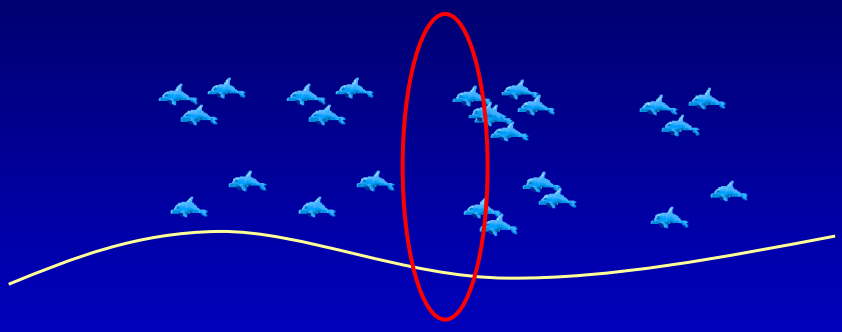
Stock Identification



"In particular, where mortality is greater than a PBR calculated from the abundance just within the oceanographic region where the human-caused mortality occurs, serious consideration should be given to identifying an appropriate management unit in this region."

- NMFS 2005

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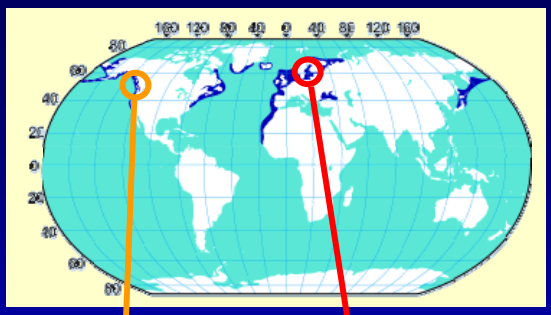
Case Study: Harbor Porpoise *Phocoena phocoena*

Continuous distribution in coastal temperate waters of northern hemisphere



- *Puget Sound:*
  Harbor porpoise were abundant prior to ~1940s
  Extensive gillnet fishing activity (unmonitored)
  In recent decades harbor porpoise are rare
  No recolonization from waterways to north

- *Baltic Sea*
  Harbor porpoise have been virtually eliminated by fishery bycatch (documented).
  No recolonization from adjacent North Sea

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Stocks that Span International Boundaries

- Ideally manage entire range of population through international agreements
- If have bycatch estimates and abundance estimates throughout range, manage based on PBR for whole stock
- For false killer whales, we do not have abundance estimates outside of US waters
  - Estimate PBR based on portion of stock in US waters
  - Estimate bycatch within US waters

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Questions?

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Assessing human-caused mortalities and serious injuries

MMPA, Sec. 117. (a) (3):

Each draft stock assessment, based on the best scientific information available, shall estimate the annual human-caused mortality and serious injury of the stock by source…

Human-caused mortality & injury sources:

Incidental fishery takes
Ship strikes
Power plants
Illegal shooting
Research mortalities
Naval exercises
Other…

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Sources of information

- Self-reports by fishermen (required by MMPA)
- Strandings (rarely observed, biased)
- At-sea reports (ship strikes, sightings)
- On-board observer programs:
  - ✓ Document marine mammal takes on sampled trips
  - ✓ Trained in species identification
  - ✓ Can collect biological samples
  - ✓ Record mortalities / injuries
  - ✓ Forms designed to collect data to distinguish serious vs. not serious injuries.
  - ✓ Collect additional data on the nature of marine mammal interactions with gear

Photo: NOAA-PIRO Observer Program

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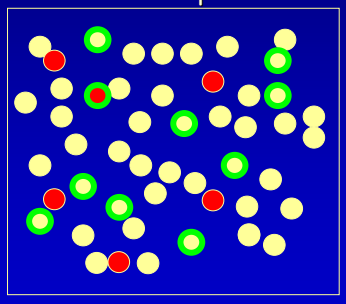
Estimating annual takes of marine mammals in fisheries

- Based on a sample of all fishing trips, extrapolated to rest of fleet
- Simplified conceptual overview:

"50 Trips"



10 Observed (20%):
1 with a take
9 with no take

→ 1 take per 10 trips
(rate = 0.1)

For all 50 trips:

50 * 0.1 = 5 estimated takes
(observed and unobserved)

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Assumptions and additional estimation steps

- Simple method assumes sampled trips are representative of unsampled trips
- Actual calculations are more complex to adjust for potential uneven sampling, season, area, and numbers of marine mammals killed or seriously injured vs. not seriously injured…
- Need to…
  - …Differentiate species and stocks
  - …Differentiate serious from non-serious injuries

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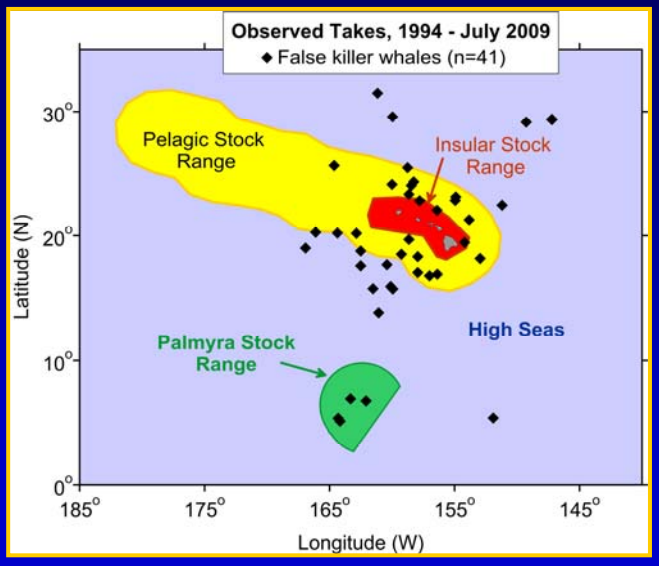
Attributing takes by stock

Attribution methods

- *Geographic*
- *Genetics*
- *Seasonal (e.g. Atlantic bottlenose dolphin)*
- *Prorating*
- *Individual identification*



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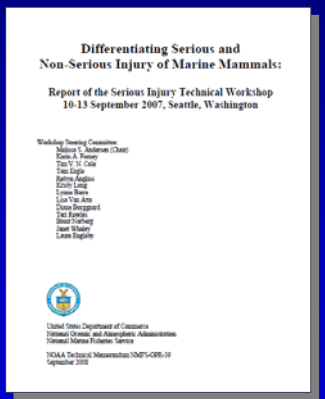
Serious Injury Determination Takes = Mortalities and Serious Injuries

Serious Injury = "Any injury that will likely result in mortality" (*NMFS, 50 CFR 229.2*)

- April 1997: Serious Injury Workshop *(Angliss and DeMaster 1998, NOAA Tech Memo NMFS-OPR-13)*
- September 2007: Serious Injury Technical Workshop *(Andersen et al. 2008, NOAA Tech Memo NMFS-OPR-39)*


Differentiating Serious and Non-Serious Injury of Marine Mammals:

Report of the Serious Injury Technical Workshop 10-13 September 2007, Seattle, Washington

Andersen et al. 2008

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Serious Injury Determination Guidelines

1997 Workshop (*Angliss and DeMaster 1998*)

- Marine mammal, fishery, and veterinary experts
- Serious injuries: impair feeding or locomotion
- Key recommendations relevant to longline fishery:

Serious:	Hooked internally (mouth, ingested)
	Released with substantial gear attached
	Swimming abnormally
Not serious:	Hooked externally (body, fluke)
	Released with no or minimal gear

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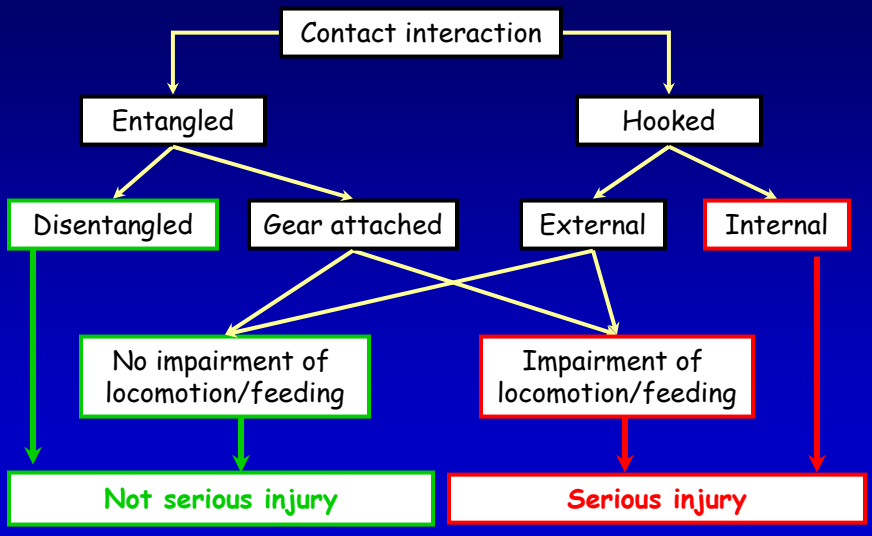
Serious injury determination



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Updated Serious Injury Determination Guidelines

2007 Serious Injury Technical Workshop Report
(Andersen et al. 2008)

- Broadly reaffirmed previous determinations
- Clarified 'Substantial gear' = gear wrapped or with potential to wrap around appendages, beak, or head
- Should consider length of 'confinement' (capture myopathy = severe muscle tissue damage)
- Developed table with injury types to guide process

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Serious Injury Determination - Examples

Photos: NOAA-PIRO Observer Program

False killer whale hooked in fluke, line cut with only 1 ft of line and hook attached.

Not in head area, cannot wrap around appendages or head, swimming actively

Therefore, animal is not seriously injured.

False killer whale hooked in mouth

→ Mouth/head hookings are considered serious for dolphins and small whales because this impairs feeding.

Therefore, animal is seriously injured.

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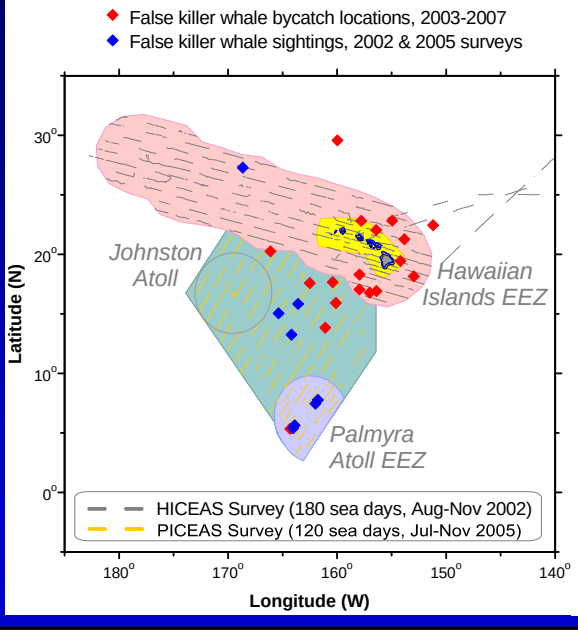
False Killer Whale Draft 2009 SAR overview



HI Insular Stock:
Abundance:
Nbest = 123
Nmin = 76
PBR = 0.8/yr
Bycatch = None documented
Status: Not strategic

HI Pelagic Stock:
Abundance:
Nbest = 484
Nmin = 249
PBR = 2.5/yr
Bycatch = 7.4/yr
Status: Strategic

Palmyra Stock:
Abundance:
Nbest = 1329
Nmin = 806
PBR = 6.4/yr
Bycatch = 0.3/yr
Status: Not strategic

High Seas & Johnston Atoll: (no SAR)
Abundance:
Nbest = 906
Nmin = 539
PBR = 5.2/yr
Bycatch = 5.4/yr
Status: (Strategic)

Questions?

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Back Pocket Slides

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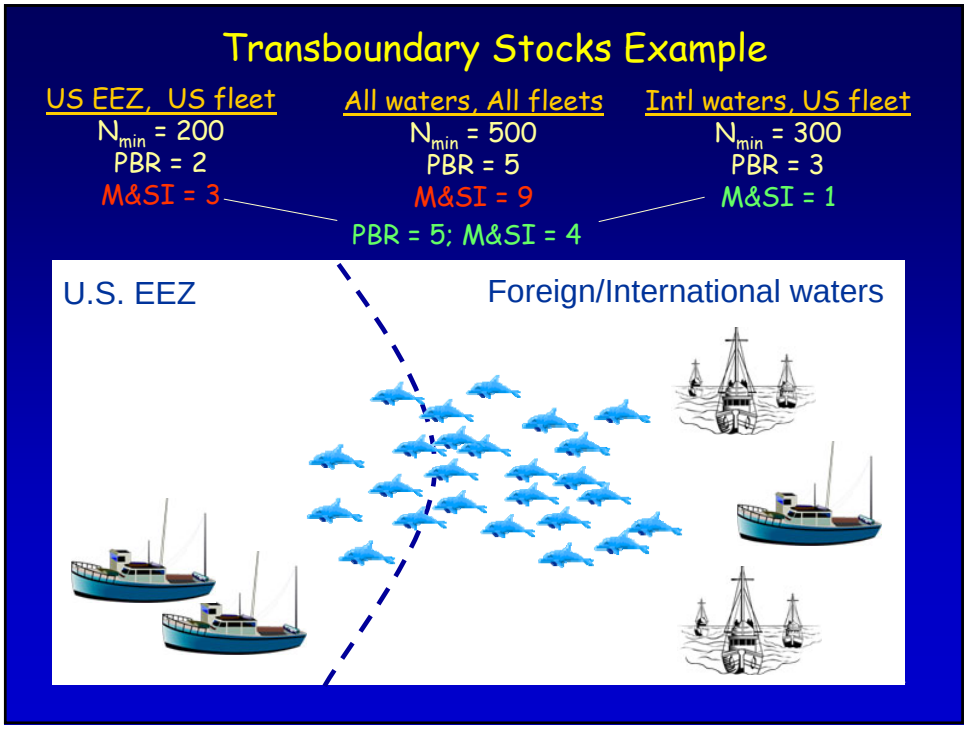
Transboundary Stocks Example
US EEZ, US fleet
N_{min} = 200
PBR = 2
M&SI = 3
All waters, All fleets
N_{min} = 500
PBR = 5
M&SI = 9
Intl waters, US fleet
N_{min} = 300
PBR = 3
M&SI = 1
PBR = 5; M&SI = 4
U.S. EEZ
Foreign/International waters