

Humpback whales, conservations concern in the light of maternal fidelity to feeding grounds



Content:

- Facts about humpback whales and their migration
- conservation and quotas: commercial extinction a huge experiment and the experience from that is humpback whales as subpopulations
- research to clarify their migration subunits with maternal mtDNA and nuclear DNA variations



Megaptera novaeangliae, means the giant wing of New England





Megaptera novaeangliae.

P.J. Clapman, J.G. Mead (1999)

- huge pectoral fins, 1/3 of bodylength with large tubercles,
- rounded tubercles present in both jaws
- 270-400 baleen plates on each side of mouth
- length 14-16 m, females 1m longer
- dorsal side black, ventral surface various pattern and serration of fluke is characteristic



Distribution

- highly migratory, but distribution change with season
- found in all oceans
- spends spring, summer and autumn on feeding grounds, in temperate or high latitude
- in winter, migrate to mating and calving grounds in tropical and subtropical waters

Ontogeny, reproduction

♀ come in estrus during winter

♀ southern hemisphere*:
ovulation June-Nov

♀ boreal six months late ☒

♀ gestation is 11-12 month

♀ peak birth is august*
and early february ☒

♂ exhibit a marked increase in spermatogenesis in winter

😊 nurse up to one year

😊 sexual maturity: 5 years

😊 physical: 5+ 8-12 years



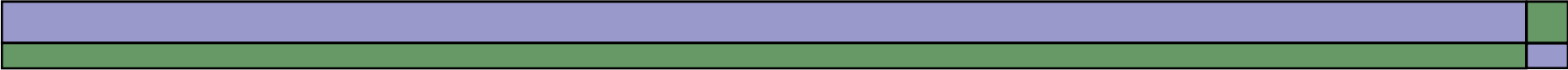
Ecology and behavior

- have a varied diet: euphasiids and various species of schooling fish
- fidelity to relatively discrete summer feeding grounds
- migrations can reach 8 000 km
- migr. to and from the tropics is staggered by sex and maturational class:
lactating females, immature animals, mature males
etc



Social organisation

- is extremely fluid at both ends of the migratory cycle
- individuals frequently change associates
- have "lobtail" feeding in groups
- maternal fidelity to feeding grounds over generations gives genetic differences



Determining spatial and temporal scales for management: lessons from whaling. *P.J. Clapman et al (2007)*

- The greatest wildlife exploitation: extirpated subpopulations by commercial whaling
- no recovery or repopulation in extinct areas: because of "culture memory" and/or segregation
- select appropriate units, define from population structure and timescale



IWC

- International Whaling Commission
- shall oversee management-related research on whale stocks and set quotas:
were excessive and populations of several speies were reduced to very low levels
- IWC have no good definition of stocks



Methods

- the history of five species of baleen whales
- catch data: from published papers and from records of the Bureau of International Whaling Statistics
- uncertainty in figures with historical hunts
- define "terminal decline" and "recovery" of stocks



Whaling operations effects

Fixing points is subjective and arbitrary but:

- "terminal decline"=commercial hunting abundance of a subpopulation as a target
- and "recovery"= subpopulation has rebounded



Results humpback whales

South Georgia was major feeding grounds for several species

- 1904-1915 commercial extinct: 21 016 taken and illegal takes by USSR 48 000 1948-1971
- after that very few recordings of humpback whales

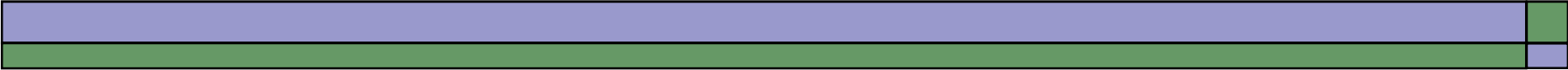
New Zealand major migratory pathway for humpback whales from eastern part of Australia

- 1912-1963 commercial extinction: 5 224
- In two seasons 59/60 and 60/61, 25 000 was taken by USSR. It was the crash of NZ stock, after that a few sightings



Southeastern Caribbean

- was primarily breeding ground for North Atlantic humpback whales
- in 19th century large catches of American whaler ships: commercial extinct 1926. 2400 whales taken before 1912.
- now: low visual and acoustic survey of humpback whales
- today they are found throughout and in the northern West Indies



A review of Humpback whales' migration patterns worldwide and their consequences to gene flow.

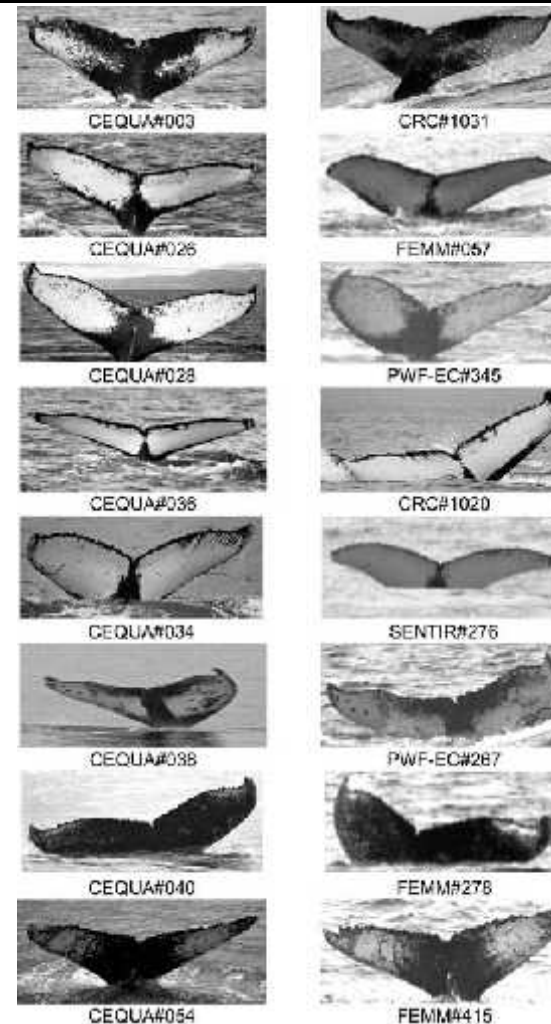
L.Y.Rizzo, D.Schulte (2009)

Content of review:

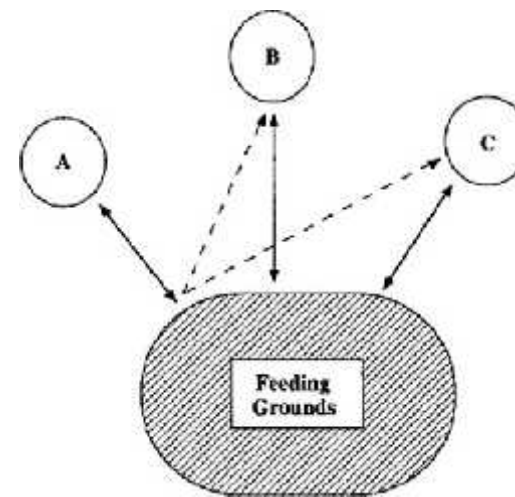
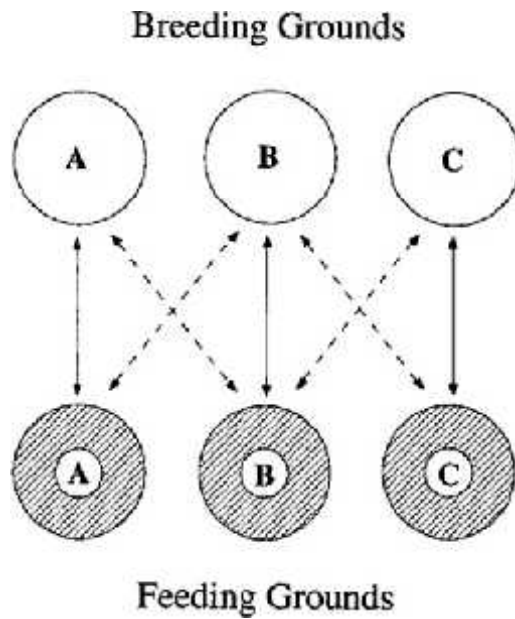
- Migration studies
- Genetic studies
- Evidence of long movements
- Conclusion

Migration studies

- Some tools:
- comparison of photographs (photo-ID) from flukes and dorsal fin shape
- catalogus for identify re-sightings (College of Atlantic)

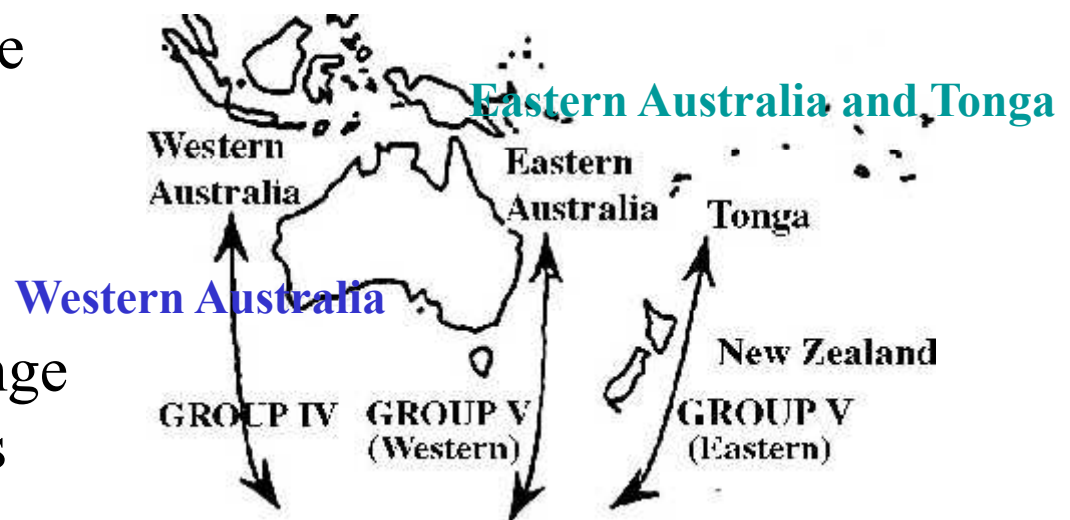


Alternative



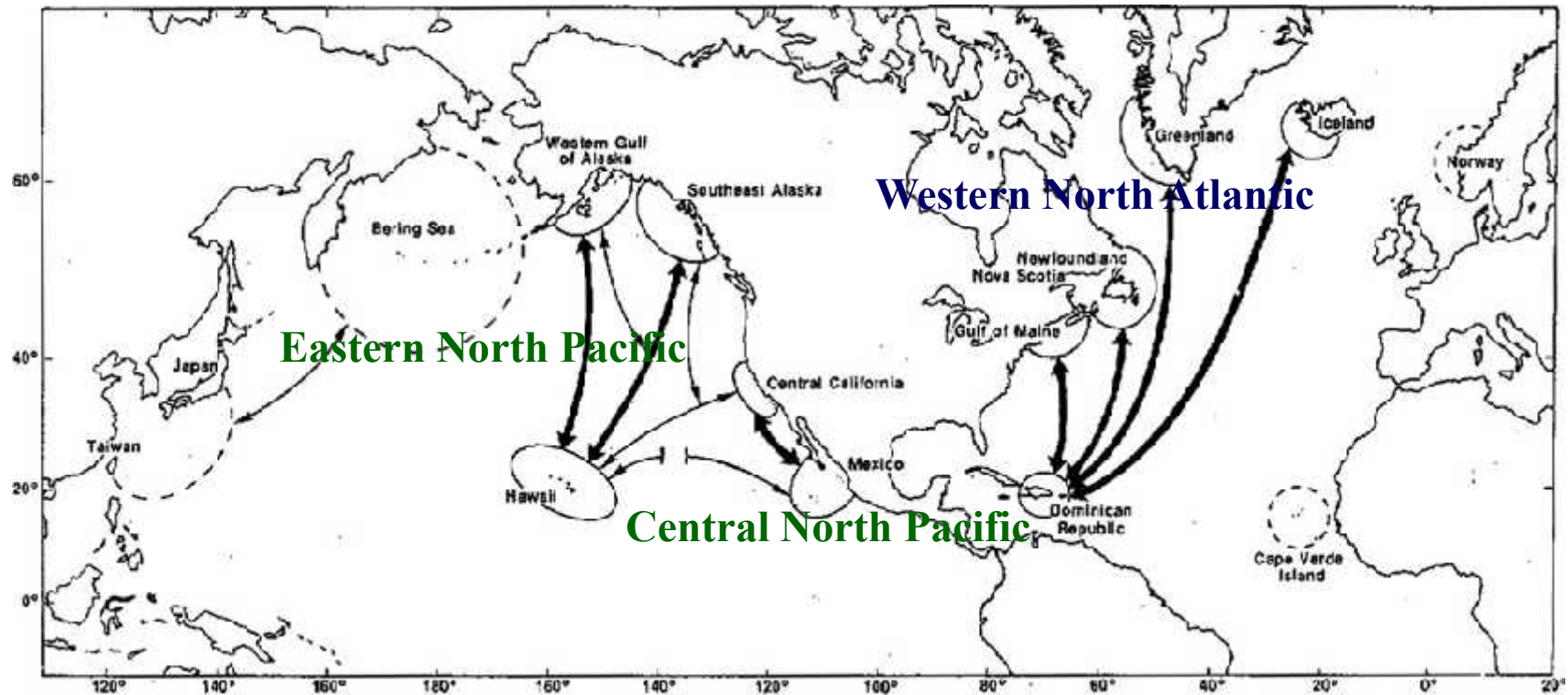
Antitropical migration patterns:

- northern and southern hemisphere whales have seasonal opposition of migration cycle
- and effective inter-change between hemispheres is prevented or limited



Picture from: Culture change in the song of ...

Genetic studies




Antarctic Peninsula



Mitochondrial DNA

- genetic studies based on mtDNA analysis have shown that whale populations are distributed in three:
 - the North Atlantic, the North Pacific, the Southern Oceans:
six subpopulations
- mixing between populations is not seen very often
(Baker et al., 1990, 1993, 1994)
- high degree of geographical differentiation
 - within and between ocean populations
(Baker et al., 1994)



Hierarchical structures of mtDNA gene flow among humpback whales *Megaptera novaeangliae*, world-wide. *Baker et al (1994)*

Samples of 230 whales collected by biopsy darting in 11 seasonal habitats representing six subpopulations or stocks.

- !-----Western North Atlantic
- ! !-----Eastern Australia and Tonga
- ! !-----Antarctic Peninsula
- ! !-----Western Australia

- !-----Eastern North Pacific
- !-----Central North Pacific

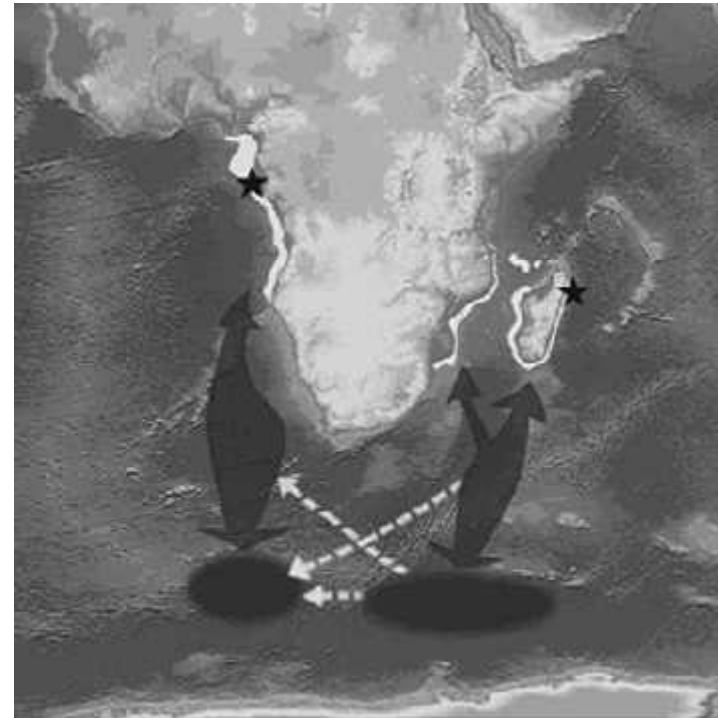


mtDNA a maternal inheritance (known)

- whales have a tremendous mobility
- absence of barriers in ocean basins and still formation of significant genetic divisions between stocks
- -----
- that indicates strong fidelity to migratory destinations
- likely mechanism for a "cultural" transmission
- calves born on or near wintering grounds, complete a roundtrip before separating from their mothers

Nuclear DNA-gender biased migration

- similar estimates of gene flow as mtDNA
- discrepancy on smaller scale:
males disperse more,
move between breeding grounds,
- alleles mix more





Well recovery?

From: ”*Determining spatial and temporal scales*”

- some subpopulations
- some never recover: continuing low levels of take and/or
 - i. ”cultural memory”
 - ii. population near by also extincted
 - iii. socially mediated shift in distribution

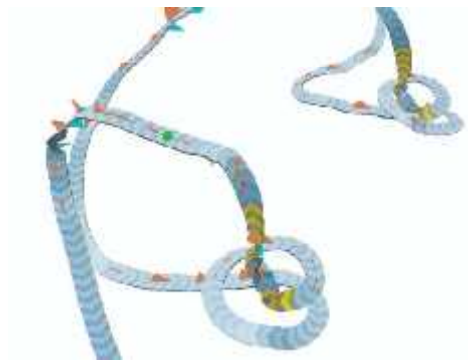
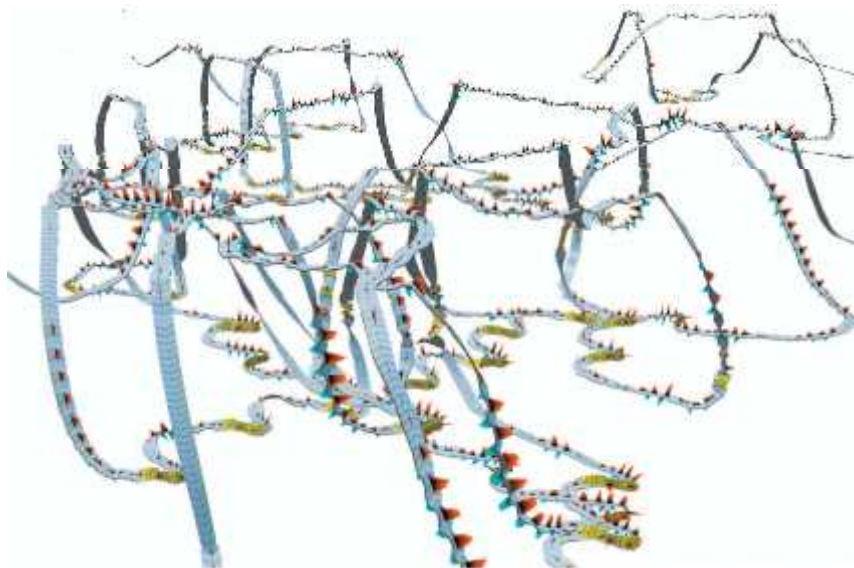


Regulate feeding areas to!

Define subpopulations:

- as "*functioning elements*" in their ecosystem
- *demographically independent* with birth and deaths
- *integrate* information from multiple lines of evidence, all data collected
- *use both* evolutionary and ecological paradigm

Visualizing the Underwater Behavior of Humpback whales. *Colin Ware (2006)*





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- Four articles:
- Megaptera novaeangliae. *P.J. Clapman, J.G. Mead (1999)*
- Determining spatial and temporal scales for management: lessons from whaling. *P.J. Clapman et al (2007)*
- A review of Humpback whales' migration patterns worldwide and their consequences to gene flow. *L.Y.Rizzo, D.Schulte (2009)*
- Hierarchical structures of mtDNA gene flow among humpback whales *Megaptera novaeangliae*, world-wide. *Baker et al (1994)* {Article just as reference}