### Satellite telemetry as a tool to help defining the International Whaling Commission whale management areas

Prieto, R; Silva, MA; Cascão, I; Cruz, MJ; Oliveira, CIB; Waring, G; Vaz J & Gonçalves, J

> Presentation to the Biologging4 Conference 14-18 March 2011, Hobart, Tasmania, Australia



## Whaling management by the International Whaling Commission

- IWC was set up under the International Convention for the Regulation of Whaling in 1946;
- Early years: management tended to be based on ocean areas and location of whaling operations; at a great extent, regulations were not based on species and the Blue Whale Unit (BWU) was used instead: 1 BWU=2 fin = 2.5 humpback = 6 sei whales;
- Early 1970's: stocks were defined for several species and oceans

### BUT

- The definition of the term *stock* was never clear (biological or management stock?)
- Data used to establish stock identity (catch distribution, length distributions, mark-recapture, biological parameters) not appropriate to define biological stocks
- In 1989 a workshop highlighted the usefulness of molecular genetic techniques to aid in the management of cetacean populations (Hoelzel 1991);
- In 2003 the IWC began the Testing of Spatial Structure Models (TOSSM) in order to provide a systematic tool for deciding what degree of spatial management is necessary for harvested whale populations, based on genetic methods to infer population structure.

Five broad categories of population structure, referred to as Archetypes:

- Archetype I: A single, panmictic population that serves as a control
- Archetype II: Stepping-stone dispersal pattern between two or three populations, with dispersal only occurring between adjacent populations mixing
- Archetype III: Diffusion-type, where genetic isolation between individuals occurs continuously as a function of distance
- Archetype IV: Two discrete breeding grounds with feeding grounds that overlap partially or completely
- Archetype V: A single breeding population with two separate feeding grounds





(e) Archetype V









## Limitations

- Population structure may be difficult to detect when genetic divergence is low among putative populations (Palsbøll 2010) either by:
  - high ongoing migration
  - historic high migration but no current ongoing migration
- For many whale populations we do not have enough information about the Archetype to be followed



### The North Atlantic sei whale (Balaenoptera borealis) as a case study

Les Galagher - ImagDC

- Adult average size:15 m and 19 tons;
- Mainly offshore distribution;
- It's considered unpredictable regarding distribution, often disappearing from a known feeding ground for years;
- One of the most generalist baleen whale species, but in the NA feeds primarily on copepods of the Genus Calanus and on euphausiids;
- In the NA a minimum of 16933 sei whales were captured between 1864 and 1984, but that is
  probably an underestimation;
- There are no reliable recent population estimates for the NA;
- Difficult to photo-id;
- The stock structure in the NA is still virtually unknown;
- The breeding areas remain unidentified;
- Forgotten by science until very recently.



North Atlantic sei whale IWC stock boundaries (from 1978 onwards; still in effect) North Atlantic sei whale concentrations from whaling records: 1. Nova Scotia; 2. Iceland-Denmark Strait; 3. Eastern



Redrawn from Bongood 1997



RA

# Investigating sei whale large-scale movements using satellite telemetry

- Wildlife Computers SPOT5<sup>©;</sup>
- Deployed with ARTS<sup>©</sup> gun;
- Linked to the ARGOS system;
- 2008: transmissions every other day;
- 2009: transmissions every day.







In two seasons and with few sat tags, we were able to partially answer an long lasting question;

An integrated, multinational effort could efficiently and rapidly answer some of the pending questions on distribution, location of breeding areas and overlap of putative stocks;

Sat telemetry information could aid in modeling spatial structure and management areas within frameworks such as TOSSM.



## In conclusion

- An adequate understanding of population structure is essential for informed conservation and management decisions;
- Although being powerful to address populational questions, genetics is not efficient for all scenarios and can profit from information from other techniques;
- Satellite tagging can be a fast and relatively inexpensive aid to identify population structure, as it has been shown for other organisms (eg: North Atlantic bluefin tuna);
- To obtain conclusive results from sat telemetry we need broad international cooperation, large-scale programs (such as for some fisheries) and some technical improvements



## Acknowledgements

• This research was funded by the Portuguese Science and Technology Foundation (FCT) under the Project TRACE (PTDC/MAR/74071/2006) and by an EU INTERREG project (05/MAC/A4/2007);

• RP is supported by a FCT doctoral grant (FCT BD/32520/2006); MAS is supported by a FCT postdoctoral grant (SFRH/BPD/29841/2006);

• IMAR-DOP/UAç is the R&D Unit #531 and part of the Associated Laboratory #9 (ISR) that is funded through the pluri-annual and programmatic funding schemes of FCT-MCTES and DRCT-Azores;

### We are deeply grateful to MICHAEL SUMNER for developing and proving invaluable help with TRIP package for R

#### Licenses

This research was conducted under two licenses from the Environment Directorate of the Regional Government of the Azores in 2008 and 2009.







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