

Tagging and stock assessment

Tim Sippel, Dale Kolody, Simon Hoyle, Mark
Maunder, Pierre Kleiber, Simon Nicol



Integrated Assessment Models

- Combine data from multiple sources through the use of a joint likelihood
 - e.g. Multifan-CL, Stock Synthesis, SEAPODYM
- Tagging data adds information to assist estimation of mortalities, growth and movement.
- Applications with conventional tagging data common for tuna and billfishes
- Few examples of the integration of electronic tagging data

Integrating Tagging Data

- Concentrated on models that apply block transfer to represent movement.
- ADR example – see Senina et al
- Examined both the application of conventional and electronic tagging data in these models.
- Concentrated on estimation of movement.
 - Transfer rate
 - Mixing

Electronic and conventional tagging data

- Expert workshop held at IATTC in La Jolla in October 2011
 - Current assessment models
 - Movement models
 - Experimental design
- Prepared a review paper examining the current status of spatially-explicit assessment models, the kinds of electronic data available, and the steps needed to make better use of this data source
 - Submitted to Fisheries Research as part of the IOTC Tagging Symposium Proceedings
 - Tim Sippel is leading this manuscript

Key conclusions from review

- Objective Function – how do we modify without the need to penalise some data sources
- Dealing with psuedo-replication
 - ET's provide thousands of data points that are all highly correlated and represent extreme psuedo-replication.
 - Effective sample size of ET data would be much less than the actual number of data points and would be related to the number of tags recaptured and the time at liberty of each tag.
 - The simplest methods would involve sub-sampling or averaging the position data.
 - More sophisticated methods might involve modeling the probability of being in an area.

Key conclusions from review

- Experimental design
 - Conventional tagging experiments implemented with stock assessment the primary purpose
 - Electronic tagging experiments implemented with understanding ecology the focus
- Key Assumption for use in assessment
 - Tagged Fish are representative of the broader untagged population (or some useful subset of it)

Key conclusions from review

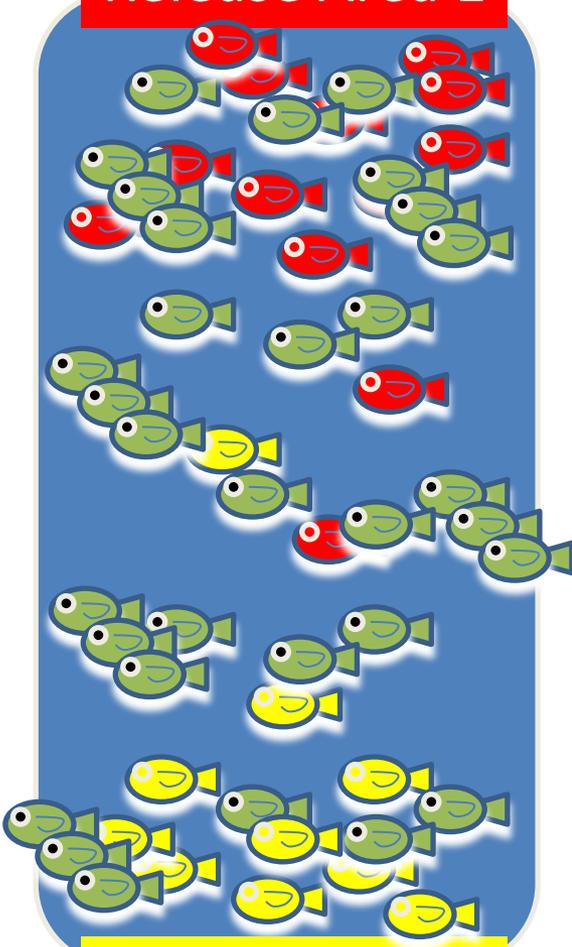
- Future Experiments with ETs
 - Remove the existing imbalance of electronic tag releases near coastal and near-shore fisheries.
 - Balanced across size classes.
 - Recovery across fleets.
- Additional source of information on mixing
 - Conventional tags only provide information at position of release and recapture
 - Electronic tags can help fill in the detail

Mixing

- Utilised three decades of conventional tagging data to examine mixing assumptions for the skipjack assessment in the WCPO.
- Work lead by Dale Kolody.
- Developed an objective method to assess mixing assumptions.

Catch Distribution

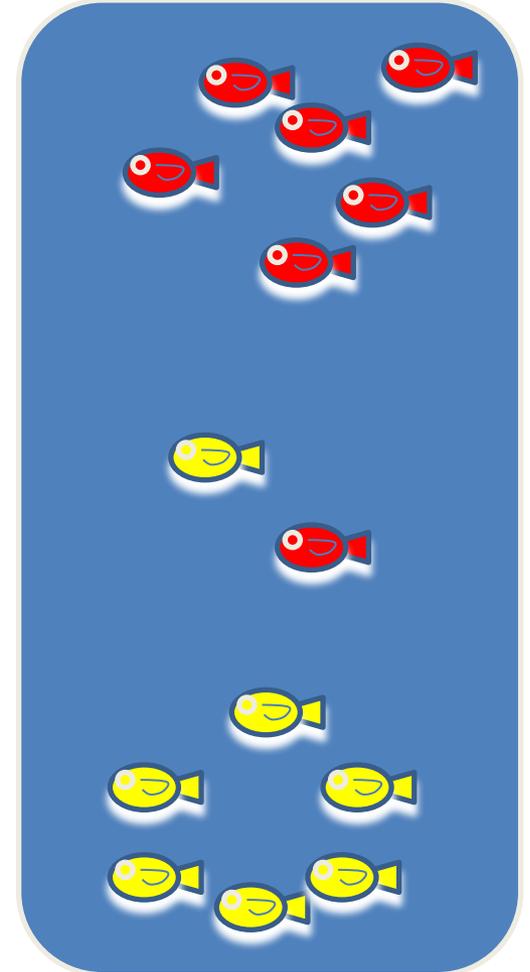
Release Area 1



Release Area 2

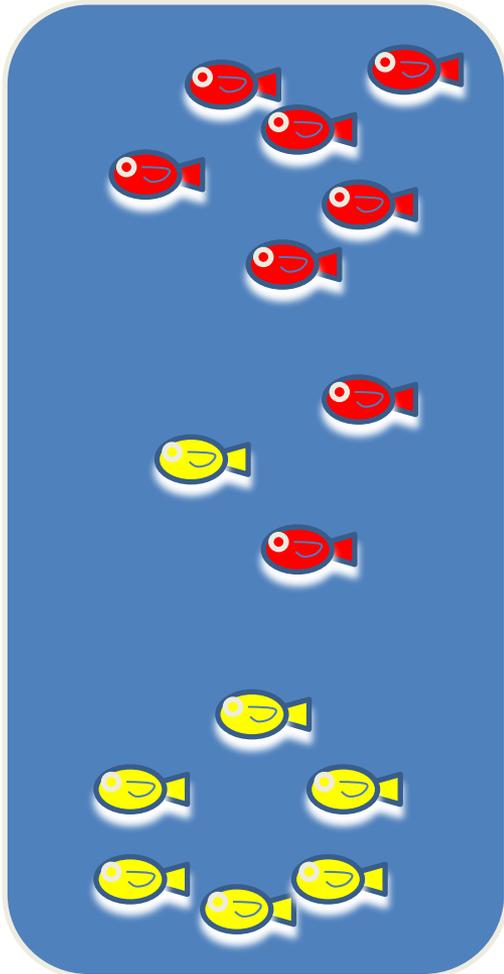
-  Release Event 1 tags
-  Release Event 2 tags
-  Untagged fish

Recovered Tags (time 0)

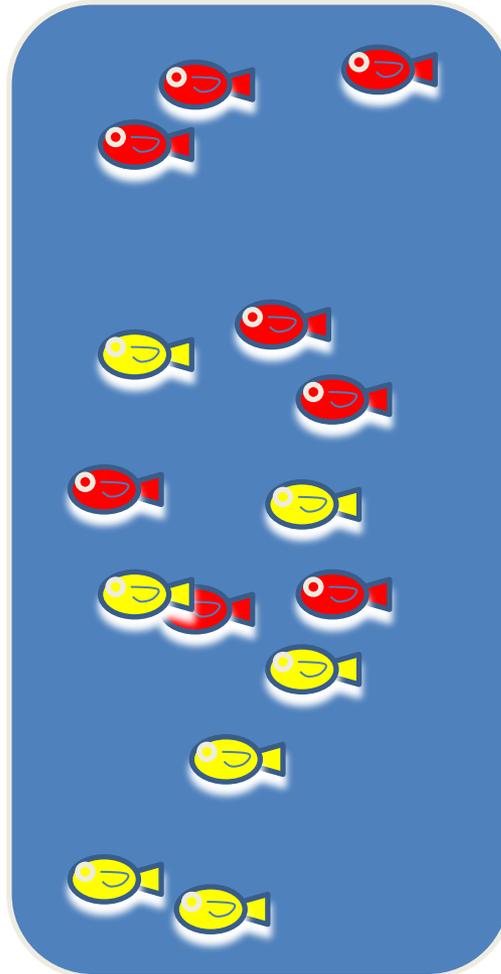


We generally assume a gradual mixing process

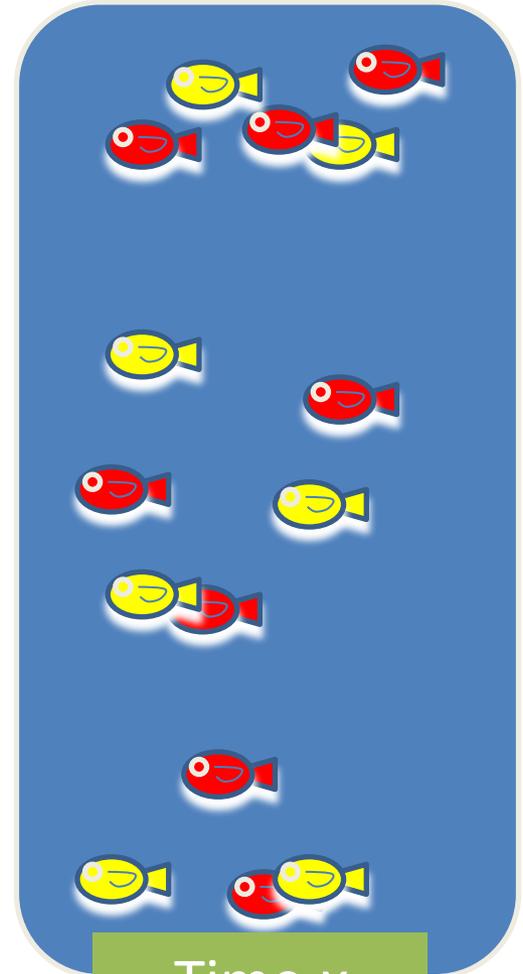
- Release Event 1 
- Release Event 2 



Time 0



Time 1

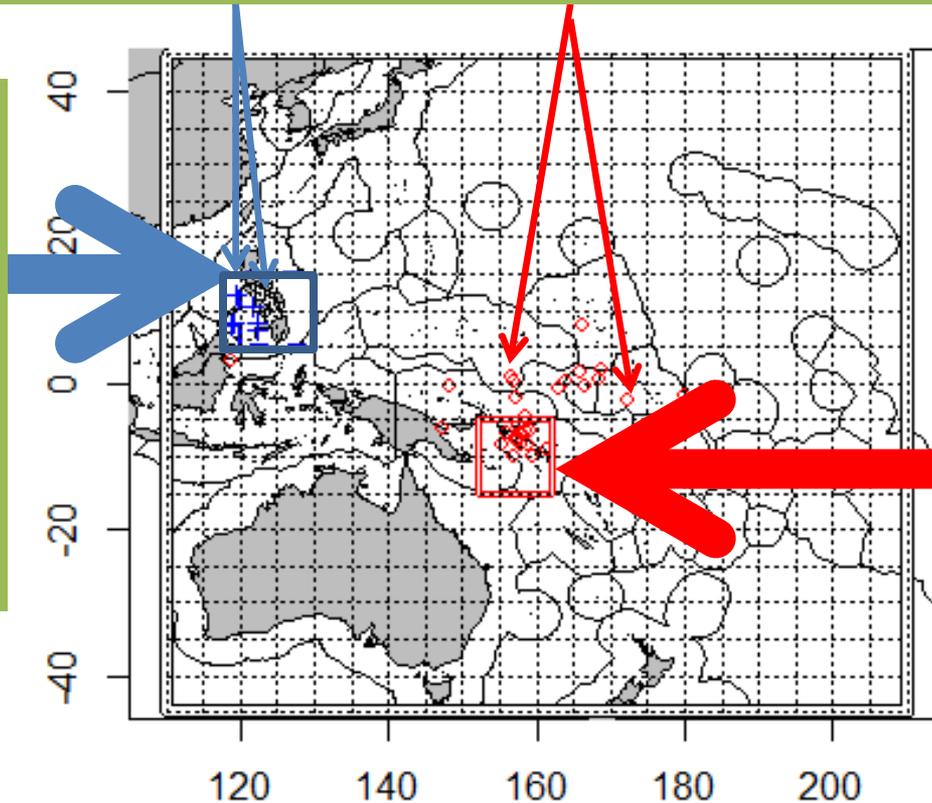


Time x
fully mixed

Example 1

Recoveries in the same quarter

Release
Event 2:
Philippines
6 Qtrs
previously

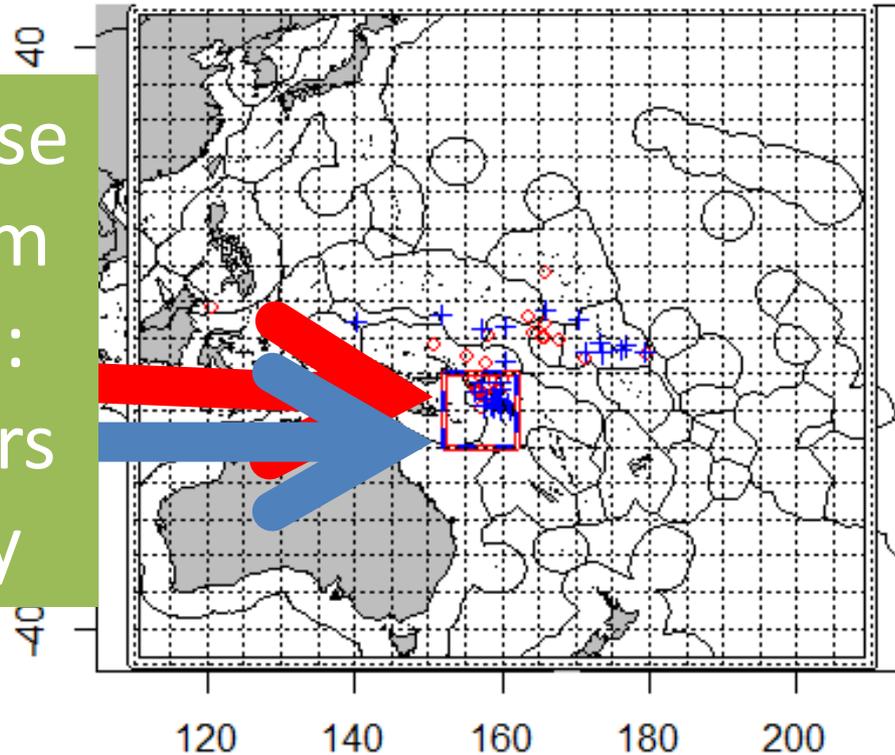


Release
Event 1:
Solomons
5 Qtrs
previously

Recovery distributions are clearly
not well-mixed

Example 2

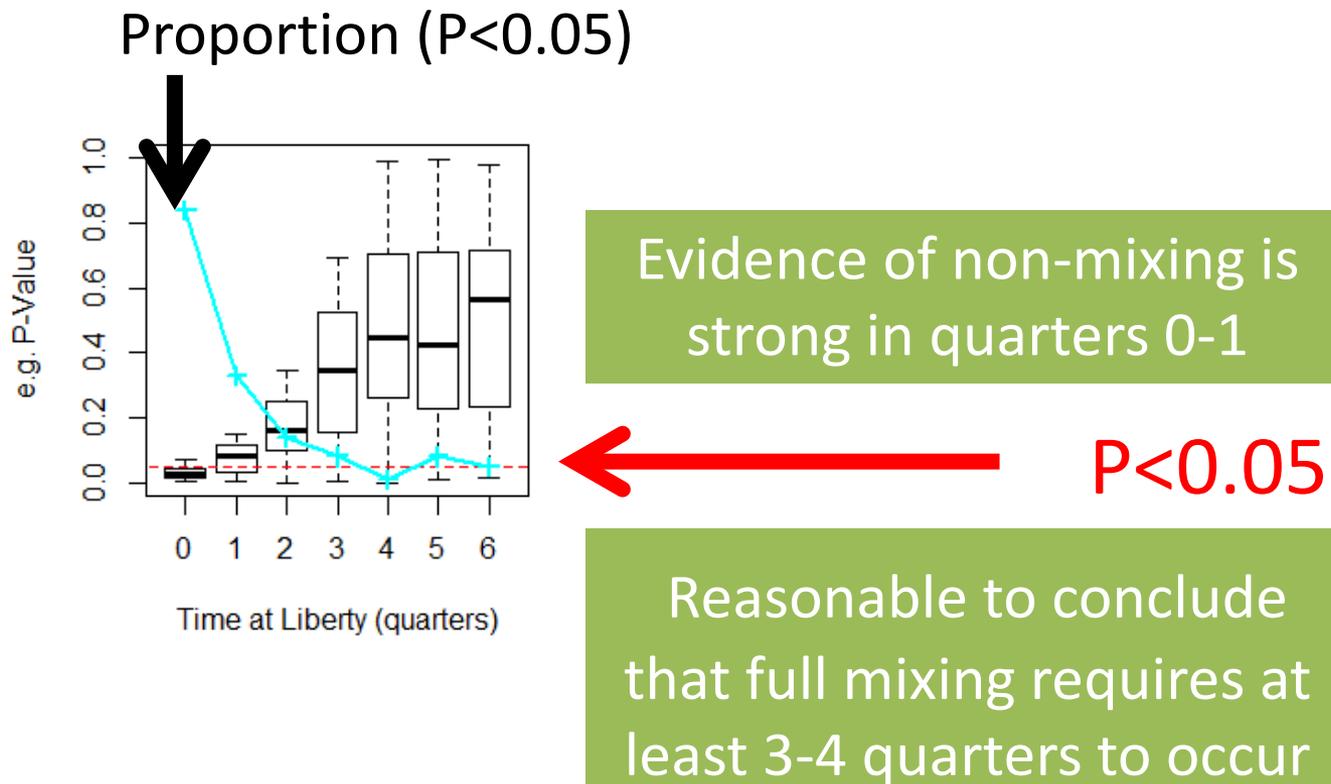
Both Release
Events from
Solomons:
4 and 6 Qtrs
previously



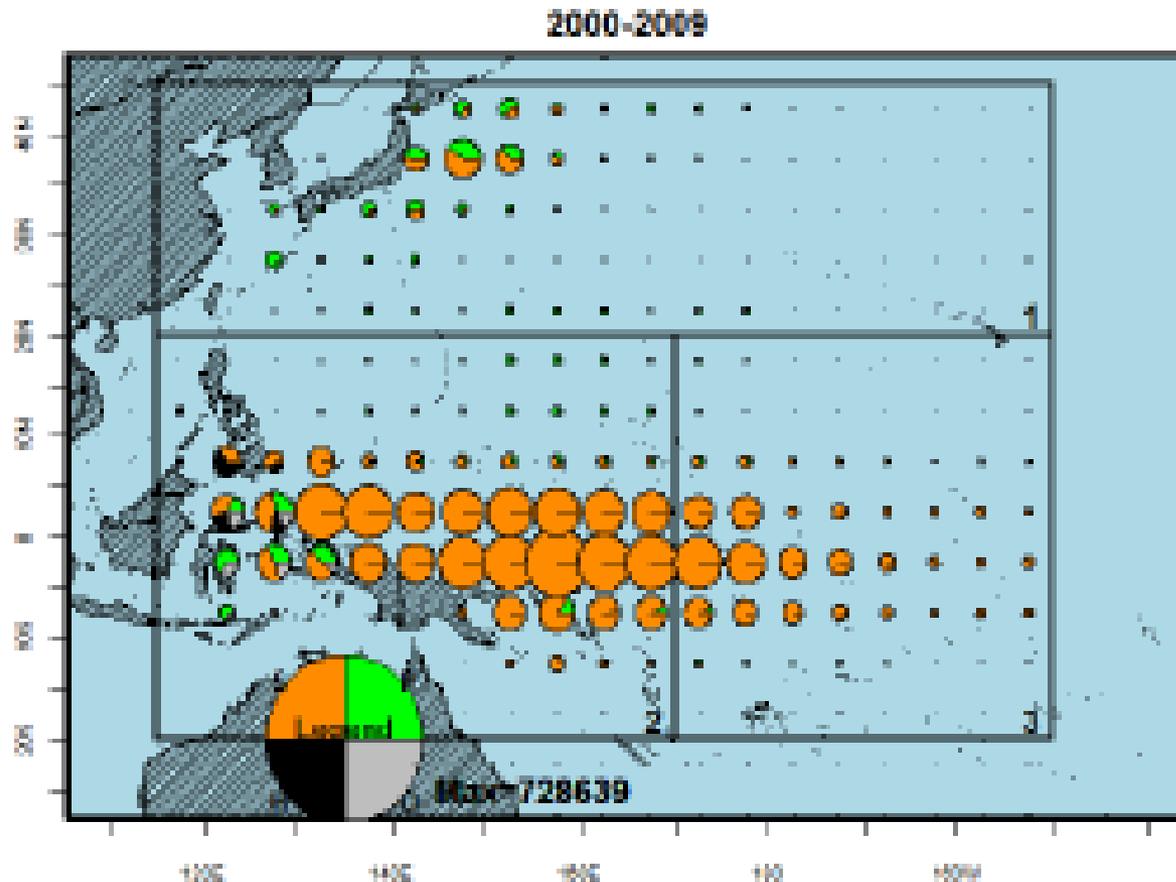
Recovery distributions appear similar (probably well-mixed)

Formalising Results

- Applying some statistical tricks we can use p-value as an Index of Similarity and summarise over 100's of experiments.



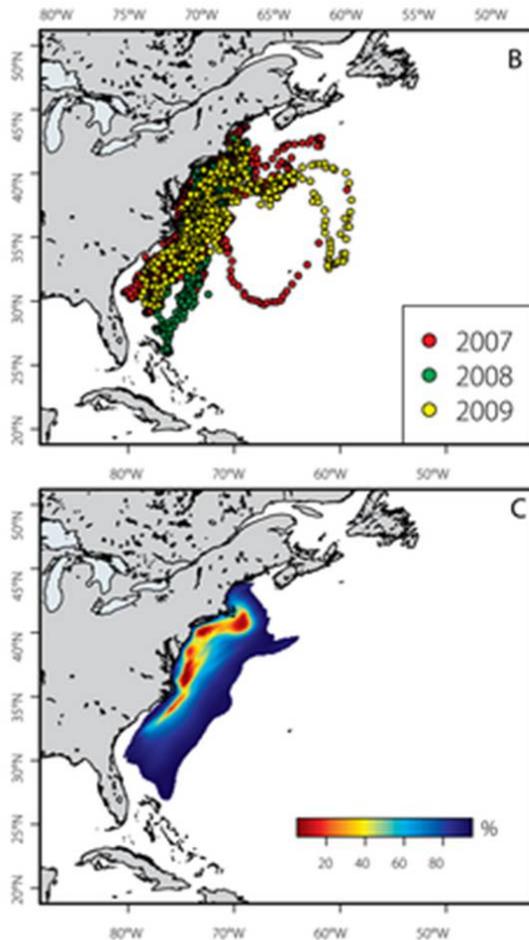
So, are tags adequately mixed in the current SKJ WCPO Stock Assessment?



Conclusions: WCPO SKJ Assessment

- Mixing assumptions are not currently being met, particularly region 3.
- Supports prevailing biological notions:
 - Residency in archipelagic waters
 - Rapid displacements in open water
- Suggests a direction for re-structuring the assessment to reduce the impact of mixing assumption.
- Method and results to be submitted to Fisheries Research as part of the IOTC Tagging Symposium Proceedings.

Using electronic tags



- Combining multiple tracks to produce habitat utilisation distributions.
- Further opportunity to test the assumptions of mixing.
- Applying these methods to the 2013 WCPO tuna assessments.