Experimental Design and Analyses of Data for Estimation of Tag Shedding and Reporting Rates from Tagging Experiments in the WCPO

John Hampton
Chief Scientist
Oceanic Fisheries Programme, SPC

Outline

- Tag shedding
  - Double tagging during the RTTP
  - Double tagging during the PTTP
  - Tagger effects on tag shedding/mortality
- Tag reporting
  - Tag seeding RTTP
  - Tag seeding PTTP

Estimating Tag Shedding from Double Tagging

- Concept – double tag tuna, observe the numbers of recoveries with 2 and 1 tags intact
- Assumptions
  - Same shedding probabilities for double and single tagged fish
  - Shedding is a random and independent event w.r.t. The 2 tags
  - 1^{st} and 2^{nd} tags have the same probability of shedding
  - Tag pairs are reported (or not) as a pair, i.e. non-reporting does not result in 1-tag observations

Model

The probability, *Q*, of a tag being retained at time *t* after release

$$Q(t) = (1-\rho)\exp(-Lt)$$

ρ = probability of immediate shedding

L = rate of continuous shedding

$$P_2(t) = Q(t)^2$$

$$P_1(t) = 2Q(t)[1-Q(t)]$$

$$P_0(t) = [1-Q(t)]^2$$

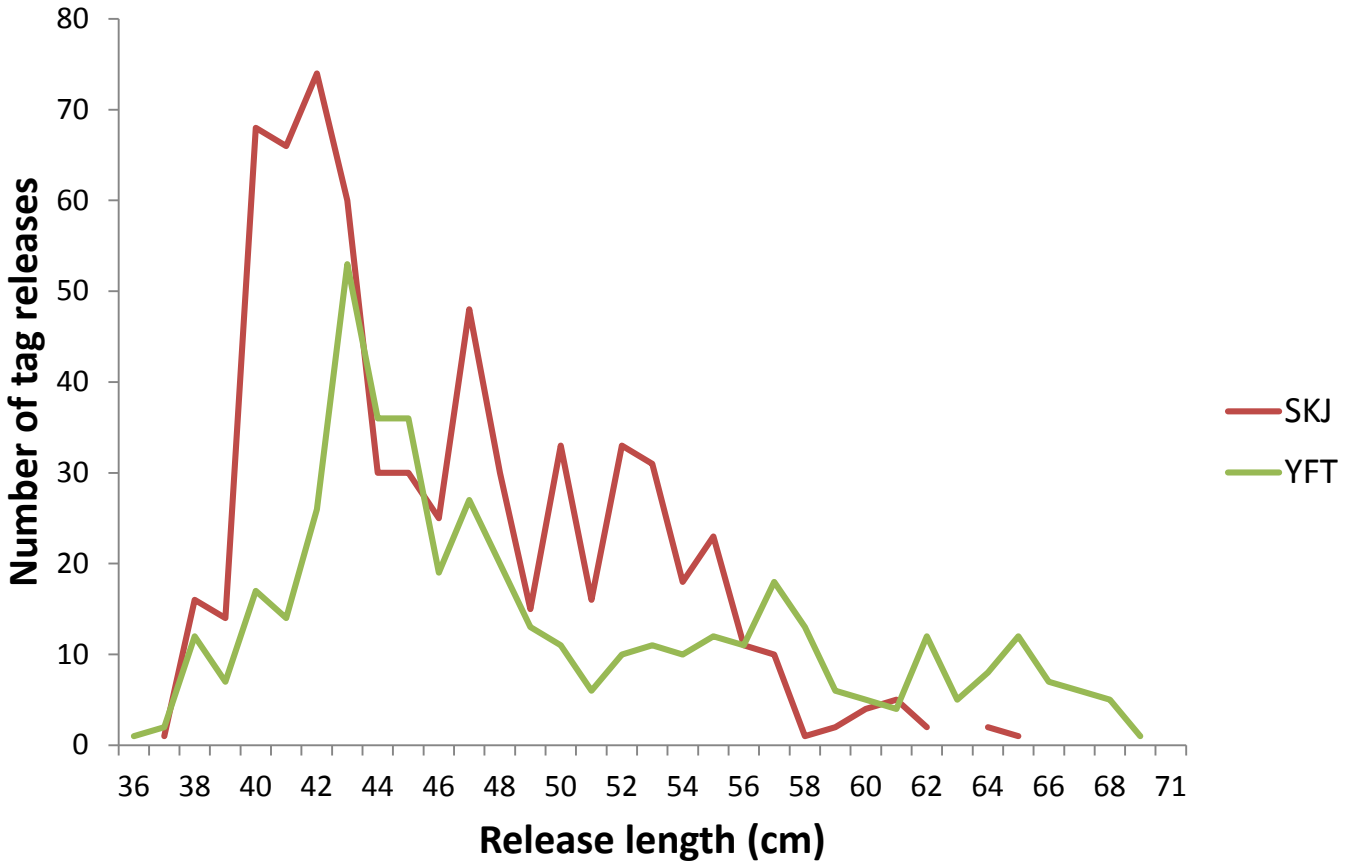
RTTP results (Hampton 1997)

- 525 double-tag returns, 457 with 2 tags, 68 with 1 tag
- Pooled data - $\rho = 0.059$; $L = 0.0023$ mo^{-1}
  - 89% (82-94%) of tags retained after 2 years
  - Species differences (SKJ, YFT, BET) not significant
  - Tagger differences (8 taggers) not significant

PTTP Double Tagging

- Experiment to detect differences in retention of 2 tag types – the standard (Y13) tag and the smaller (Y11) tag
- Double tagging by one tagger (BML)
- One Y13 and one Y11 placed in the same fish
- Y13 and Y11 tags rotated w.r.t. primary and secondary
- Fish double-tagged over the normal size range for Y13 tags (>38 cm LCF)

Size Distribution of Double Tags



Results

P	S	Releases		SKJ					YFT				
		SKJ	YFT	P+S	P	S	TOT	%	P+S	P	S	TOT	%
Y11	Y13	295	252	50	5	2	57	19.3	19	1	3	23	9.1
Y13	Y11	375	204	62	4	5	71	18.9	20	1	0	21	10.3

- Does not appear to be a placement order effect

- Pooled data:

	Releases	Recaptured			
		Both	Y13	Y11	One
SKJ	670	112	6	10	16
YFT	456	39	4	1	5

Results and Conclusions

- If no difference in shedding between Y13 and Y11 is assumed, and all shedding is immediate (type 1 loss), then the shedding probabilities are 0.067 for SKJ and 0.06 for YFT. No significant difference between the species and consistent with previous shedding estimates (equivalent RTTP result is 0.061).
- Allowing different shedding rates for Y13 and Y11, we then get shedding probabilities of 0.082 for Y13 and 0.051 for Y11 (SKJ) and 0.025 for Y13 and 0.093 for Y11 (YFT). So a suggestion that there could be a difference in the way the 2 tag types are retained in the different species, but the numbers are small.
- The other simple test is to just look at the recaptures with only 1 tag. If the shedding rates are the same, we would expect equal numbers of Y13 and Y11 only returns. If this hypothesis is true, the binomial probability for SKJ of obtaining 6 or fewer Y13s from 16 single tag recoveries is 0.227. Likewise for YFT, the binomial probability of obtaining 1 or fewer Y11 returns from a total of 5 single tag recoveries is 0.188. So in neither case is there strong evidence of a difference related to tag type. But not a lot of power to detect a difference if there is one because of the low numbers.

Using Reporting Rates by Tagging Event to Assess Tagger Performance

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Covariates of release mortality and tag loss in large-scale tuna tagging experiments

Simon D. Hoyle [1], Bruno M. Leroy, Simon J. Nicol, W. John Hampton

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Corrigendum to "Covariates of release mortality and tag loss in large-scale tuna tagging...

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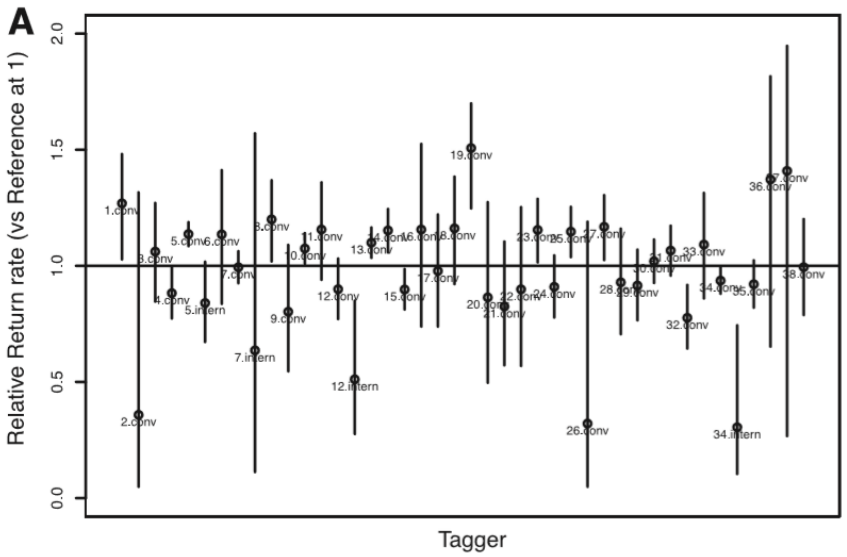
Abstract

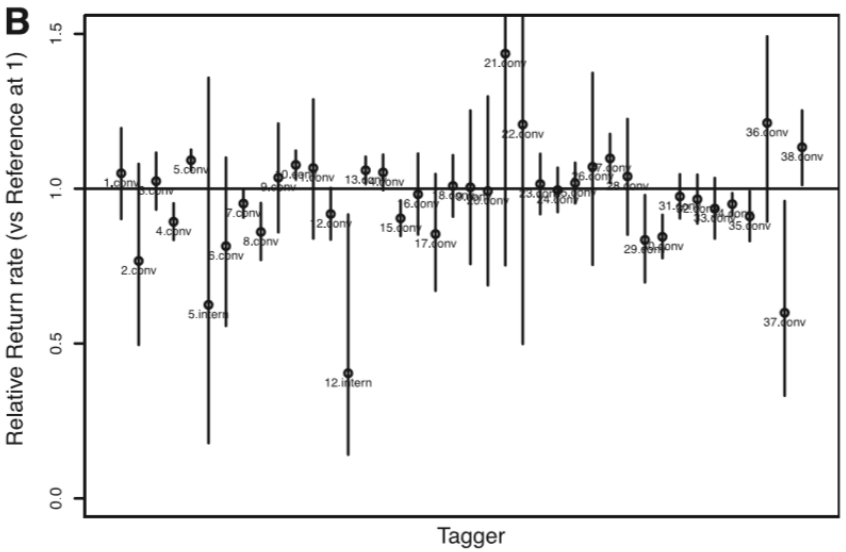
The data from tag-recapture experiments, which are used to help understand animal behaviour and dynamics, and to provide input data for population models such as stock assessments, are affected by mortality associated with tagging and by tag shedding. These processes introduce bias and uncertainty into parameters estimated in population models such as tuna stock assessments. The causes and magnitudes of tag shedding and post-release mortality in tuna tagging experiments are not well understood. We analysed data from tuna tagging experiments in the Western Pacific (330,000 releases) and Indian Oceans (168,000 releases) to investigate factors affecting post-release mortality and tag shedding.

Tagger Performance

Yellowfin/Bigeye

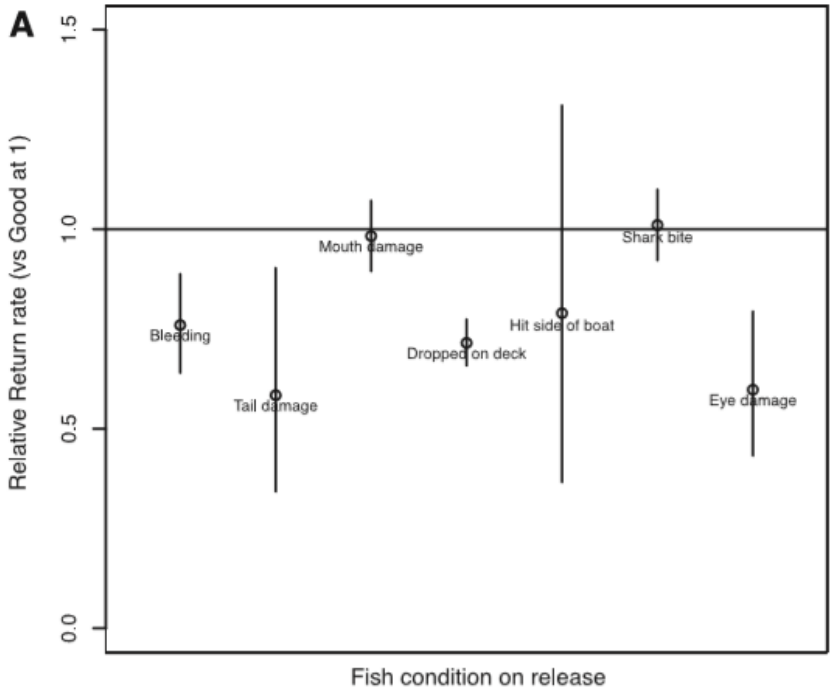


Skipjack



Fish Condition

Yellowfin/Bigeye



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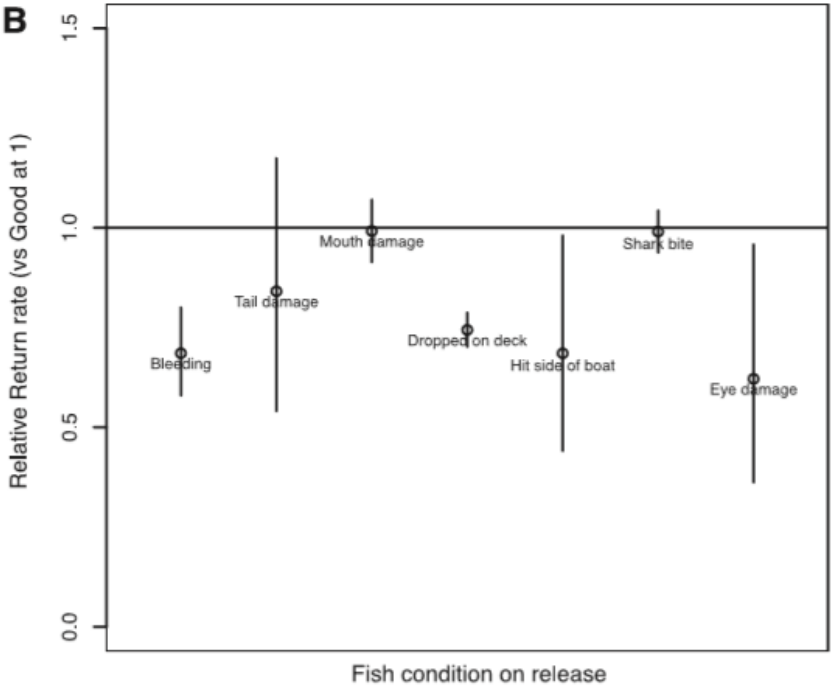


Overall Conclusions

- Effective SKJ, YFT and BET releases are reduced by tagger, fish condition, etc effects, which are applied to the data for inclusion in stock assessment

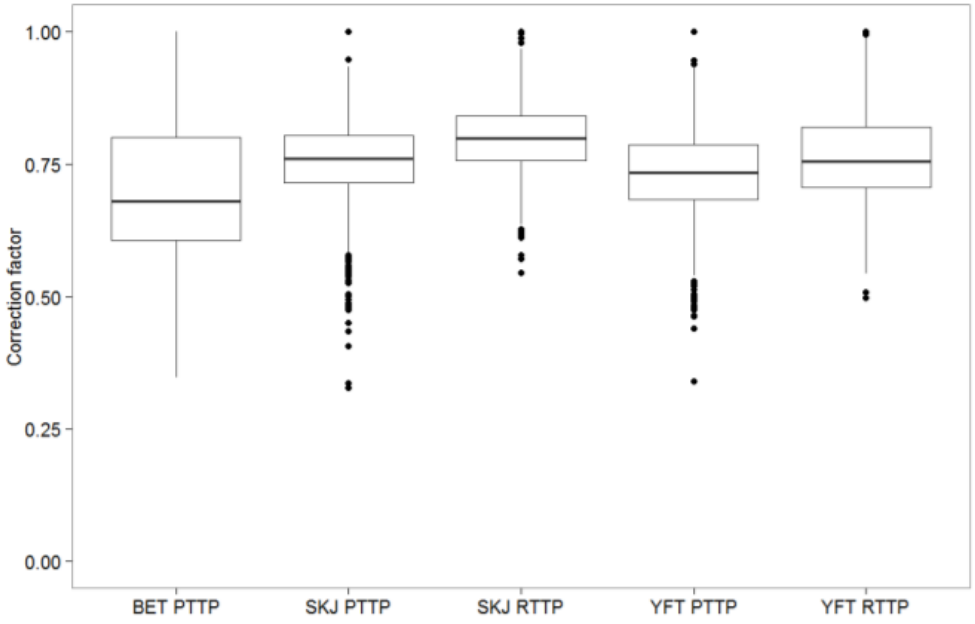


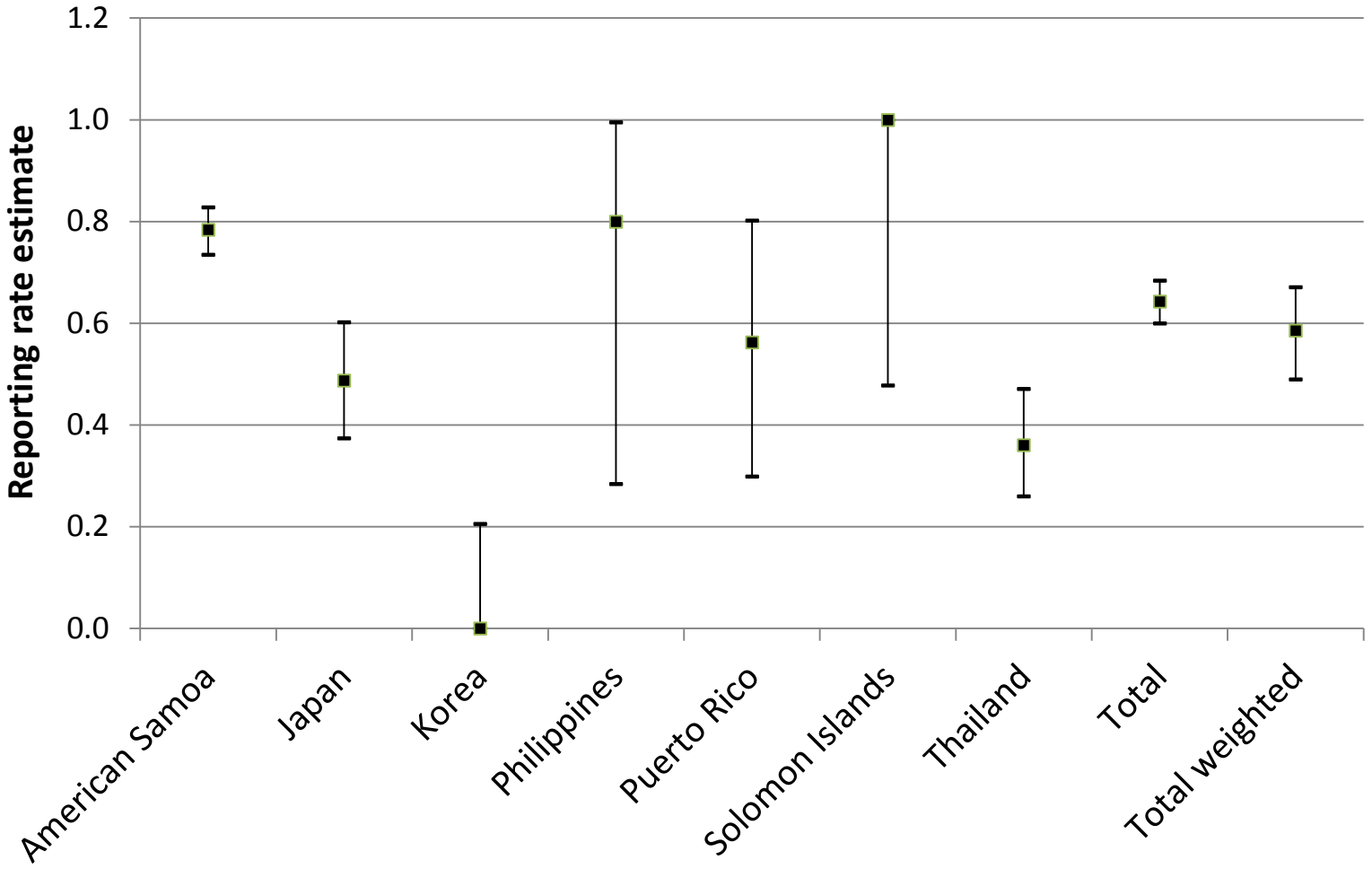
Figure 1. Boxplots showing the range of estimated correction factors that were applied to tag release events to adjust the number of tag releases for the influence of tagger effects on shedding and tag-related mortality. The central bar represents the overall median.

Reporting Rate Estimates from Tag Seeding

RTTP Tag Seeding

- Approximately 5 tags discretely implanted in dead tuna by observers on purse seine vessels
- 111 tag-seeding observer trips
- 532 tags seeded in total
- 342 (64%) recovered
- Tag-seeding events classified by port of unloading

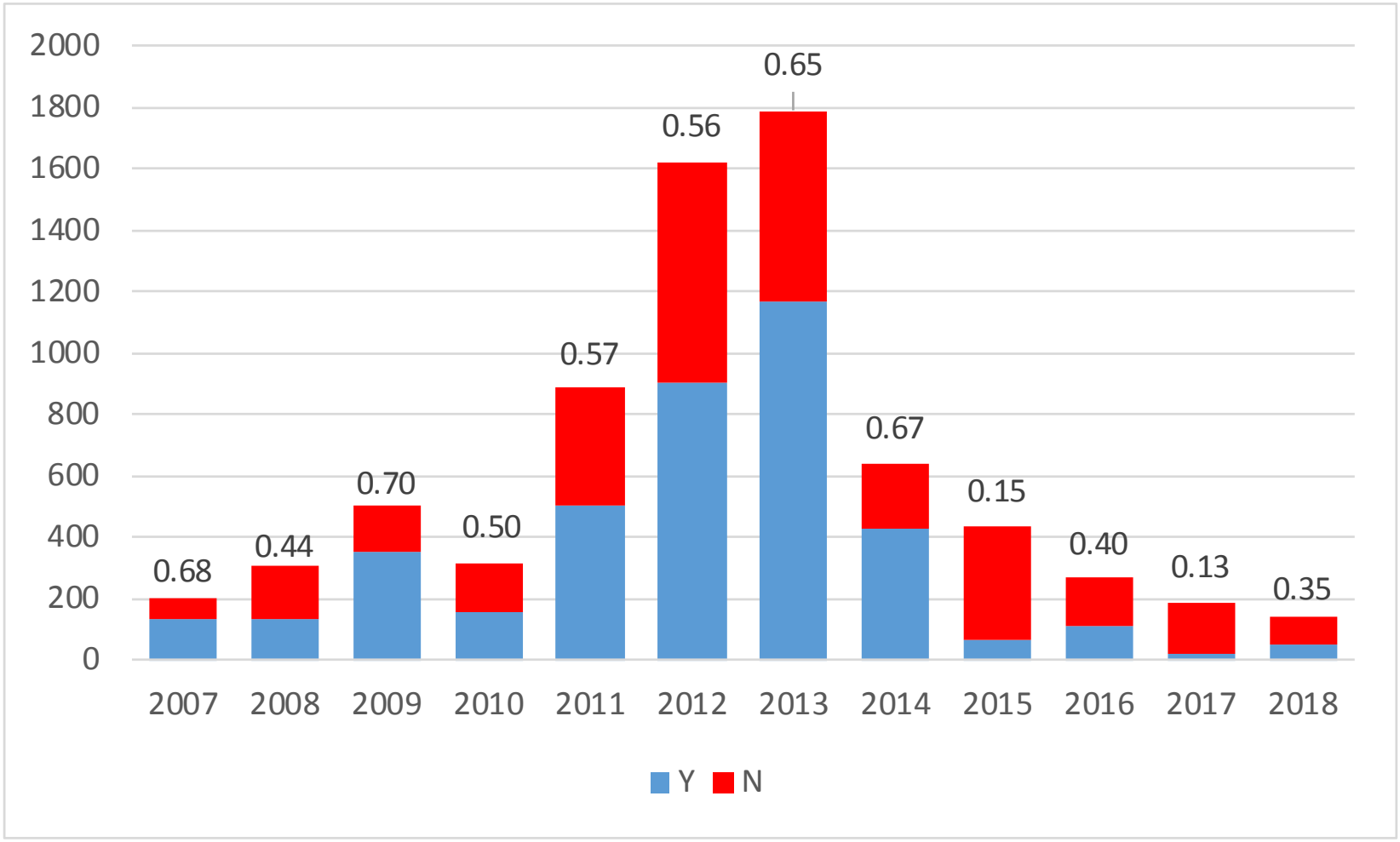
Results by Unloading Location



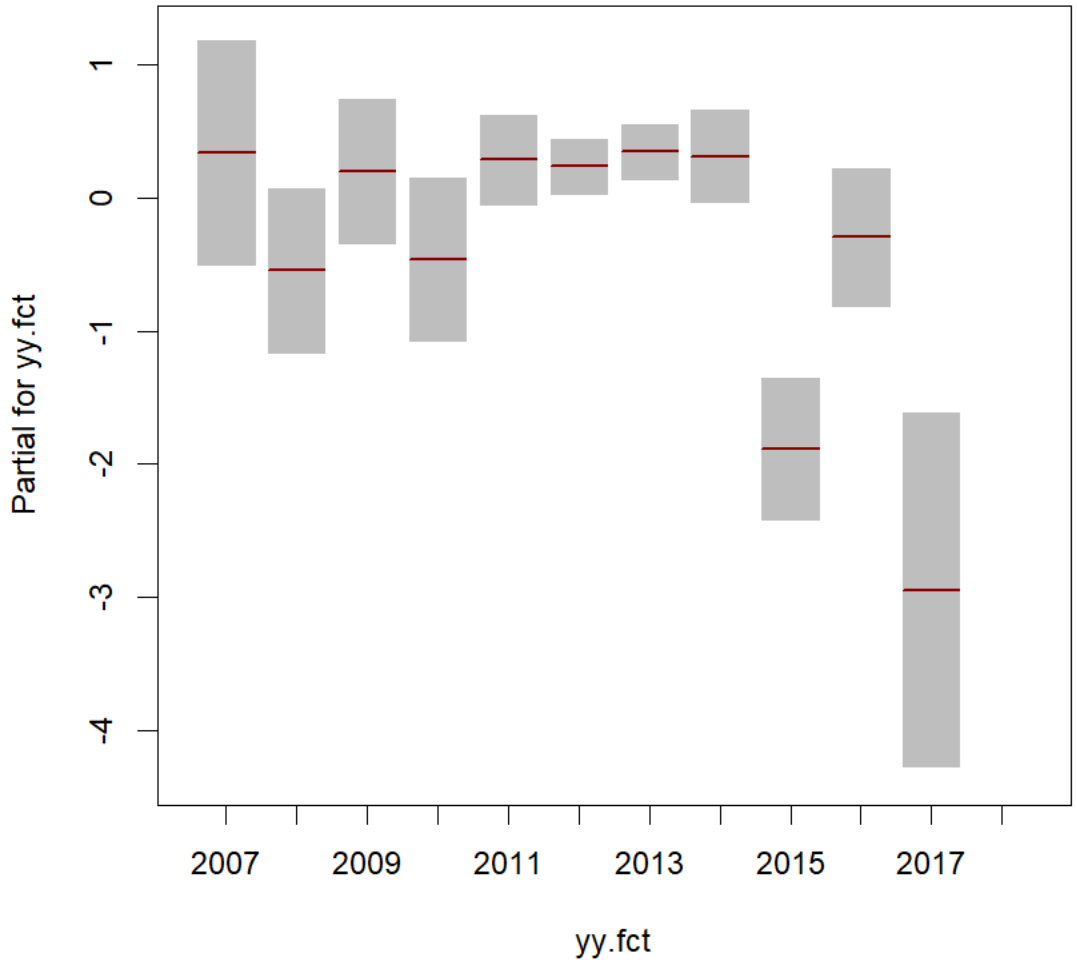
PTTP Tag Seeding

- Observers asked to tag 20 fish per trip
- 5 fish to be double tagged
- 407 tag seeding reports returned by observers
- Total of 7,299 tags seeded, 4,033 returned to date (55%)
- Standard tags vs steel head tags

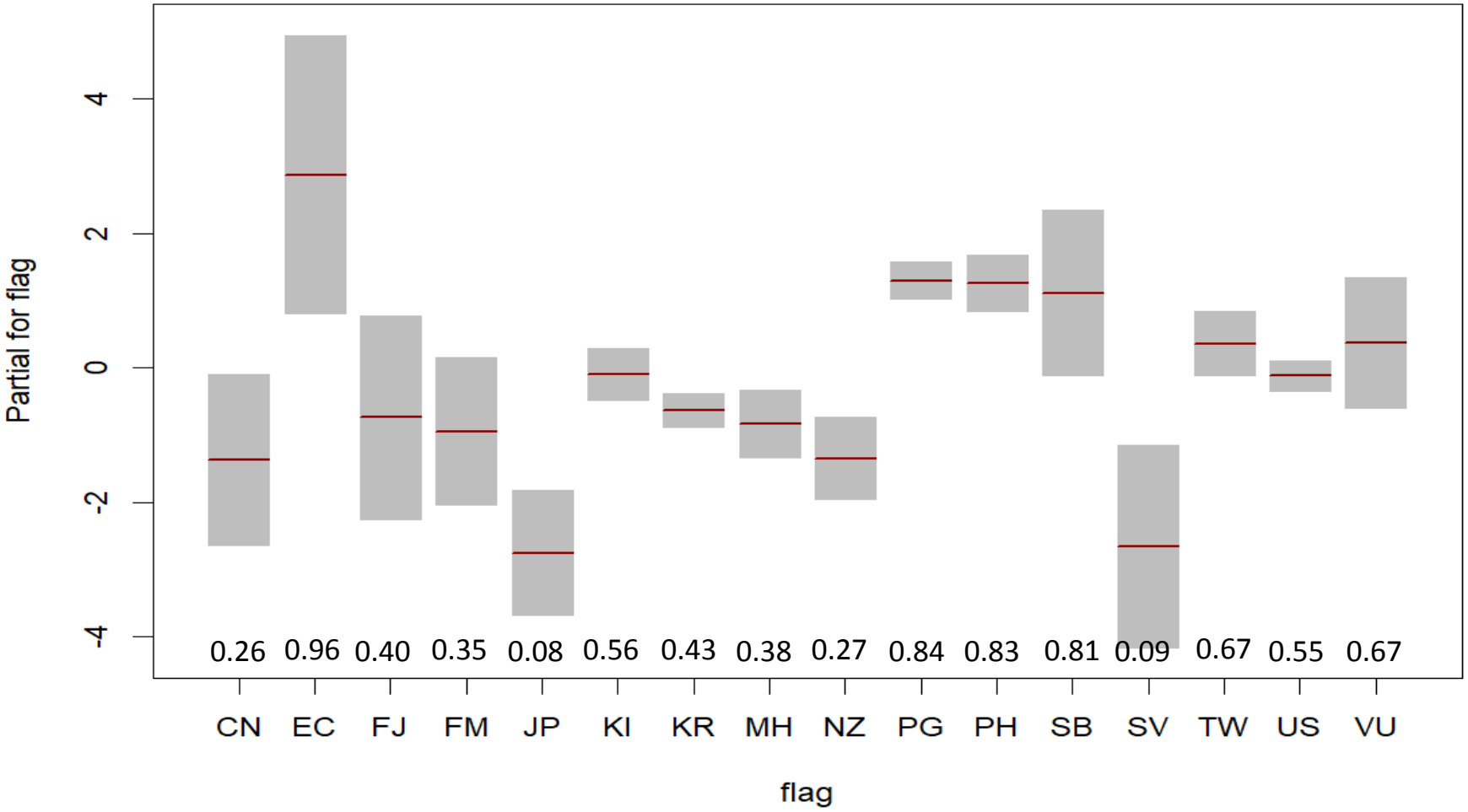
Raw Results


2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.68
0.44
0.70
0.50
0.57
0.56
0.65
0.67
0.15
0.40
0.13
0.35
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Y
N

Model estimates with year effect



Model estimates with flag effect



Double tagging of seeded tags

- Why?
  - To evaluate the hypothesis that conventional PDTs applied to dead fish might be more prone to "shedding in the well" than PDTs applied to live fish in the tagging program
  - To evaluate the assumption that non-reporting alone does not generate single tag returns of fish actually recovered with 2 tags
- Three types of double tagging of seeded fish:
  - Double tagging with 2 conventional PDTs
  - Double tagging with 2 steel-head PDTs
  - Double tagging with one of each PDT type

Properly applied, these can never come out!

Results

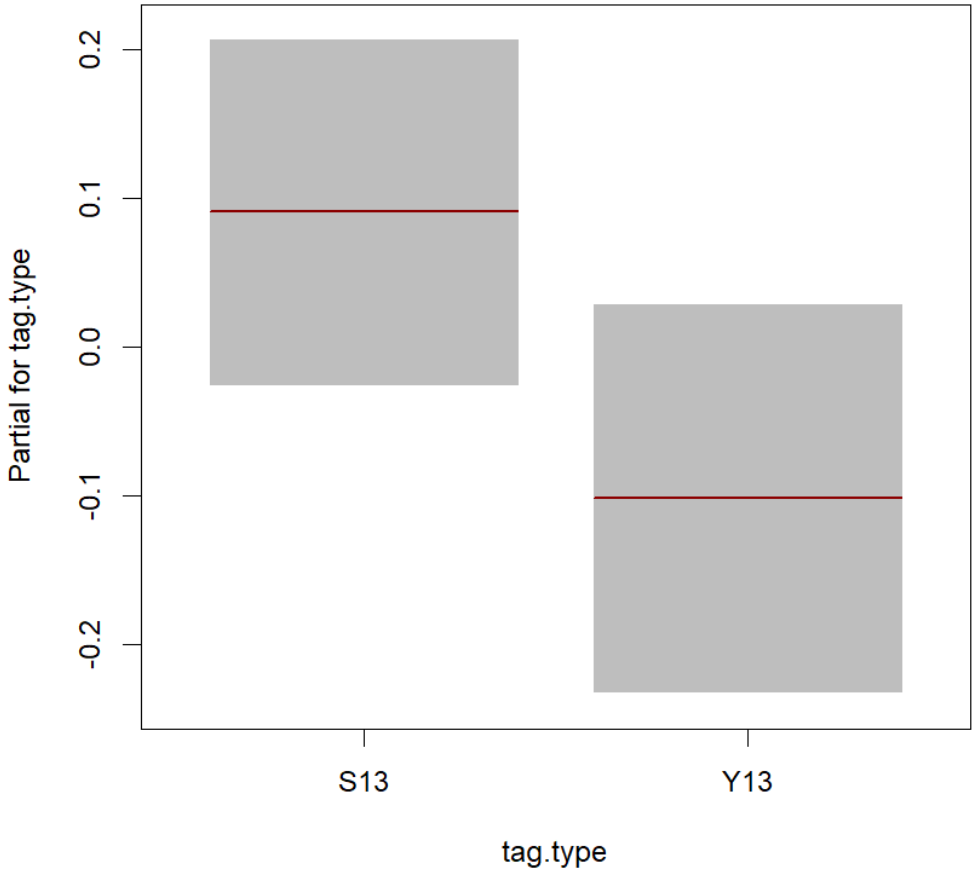
Double tagging with same tag type

Tag type	Number tagged	Total number reported	Prop. reported	Number with 2 tags	Number with 1 tag	Prop. with 2 tags
Steel-head	240	155	0.65	137	18	0.89
Conventional PDT	123	59	0.48	51	8	0.86

Double tagging with different tag types

Number tagged	Total number reported	Number with 2 tags	Steel-head only	PDT only	Prop. Steel-head reported	Prop. PDT reported
1,038	618	515	56	47	0.55	0.54

Results and Conclusions



Conclusions:

1. No significant difference in shedding of seeded steel-head and plastic dart tags
2. Non-reporting IS likely to generate some single-tag recoveries of fish recaptured with 2 tags, i.e. results of double tagging experiments are likely to be biased towards higher tag shedding