

Further investigations of low PIT tag recovery rates

William G. Clark

Abstract

The unexpectedly low recovery rates of PIT tags in western Alaska do not appear to have resulted either from uneven scanning rates within regulatory areas or from small-scale mismatches between the distribution of released tags and the distribution of commercial fishing.

Introduction

In 2003 the Commission staff marked with PIT tags and released all fish caught on three skates of gear at all setline survey stations coastwide, totaling almost 44,000 fish (Kaimmer and Geernaert 2004). The release was repeated in 2004 in Areas 2B and 3A, totaling another 23,000 fish (Williams et al. 2005). In 2003, 2004, and 2005 samplers in the ports scanned a substantial part of the landings to recover tags (Forsberg 2004).

Recovery rates in the commercial fishery have been far lower than expected in Areas 3 and 4 (Clark 2006a). Earlier analysis (Clark 2006b) showed that at least in Areas 3A, 3B, and 4A, this did not result from a greater degree of mismatch between the distribution of tag releases and the distribution of commercial catches in the western areas than in the eastern areas. There was some worry about possibly low detection rates in some ports, but extensive seeding experiments in 2005 showed detection rates near 100% in all ports (Forsberg 2006).

This paper investigates two other possible explanations: uneven scanning of the catch from different statistical areas, and small-scale mismatches between the distributions of tag releases and commercial catches. Neither holds up.

Uneven scanning

The thought here is that while the relative distributions of tag releases and commercial catches were similar in eastern and western areas, there may have been some difference in the relative distributions of tag releases and commercial catches that were actually scanned by samplers. This feature cannot be examined at the level of individual survey stations but it can be examined at the level of statistical areas.

Figure 1 shows the proportion of landings scanned by statistical area in 2004. Clearly scanning proportions were relatively low for some statistical areas (southern 2C, eastern 3A, western 3B) because the nearby ports were not staffed. This could lead to low overall recovery rates in a regulatory area if the tag releases were concentrated in the statistical areas where the scanning proportions were low. To explain the east-west difference in recovery rates, there would have to be an east-west difference in the degree of overlap of tag releases and scanned catch by statistical area. But a quantitative measure of overlap (calculated as in Clark 2006b) turns out to be 0.5-0.6 in all regulatory areas except 3A, where it is about 0.8 (out of a possible maximum of 1.0).

Small-scale mismatches

The thought here is that tagged fish may move so little that recoveries are only made when a commercial vessel fishes at or very near a survey station. This does not seem very likely in view

of the number of tags recovered in a statistical area other than the area of release (Fig. 2). On the other hand, there is a great deal of variation in the proportion of tags recovered among stations in each statistical area in 2004 (Fig. 3), suggesting an element of hit-or-miss.

If recoveries depended on fishing on just the right spot, the distribution of tag recoveries among scanned landings would be highly contagious, meaning that there would be an unexpectedly high number of landings with no recoveries and an unexpectedly high number of landings with multiple recoveries. In the absence of contagion, the expected number of recoveries from each scanned landing would be a Poisson random variable with mean equal to the overall proportion of tagged fish to scanned fish, multiplied by the number of fish scanned from that landing. The null distribution of tag recoveries from each landing can be computed on this basis and the distributions summed over landings to calculate the expected numbers of landings with 0, 1, 2, 3, 4, or 5+ tag recoveries in each regulatory area. The results (Table 1) do indeed show an excess of zeros and of multiple recoveries in all areas, but the observed frequencies are quite similar to the expected ones, and there is certainly no east-west difference in the apparent degree of contagion.

References

- Clark, W.G. 2006a. Analysis of PIT tag recoveries through 2005. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2005:123-134.
- Clark, W.G. 2006b. Possible causes of low PIT tag recovery rates in 2004. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2005:285-292.
- Clark, W.G., and Chen, D.G. 2005. Preliminary estimates based on 2004 PIT tag recoveries. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2004:199-209.
- Clark, W.G., and Hare, S.R. 2006 Assessment of the Pacific halibut stock at the end of 2005. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2005 (this volume).
- Forsberg, J.E. 2004. Portside sampling for recovered PIT tags in Pacific halibut. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2003:361-376.
- Forsberg, J.E. 2006. Portside sampling for recovered PIT tags in Pacific halibut. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2005:253-276.
- Kaimmer, S.M., and Geernaert, T.O. 2004. 2003 PIT tagging: tagging equipment and protocol, and tag shedding studies. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2003:351-360.
- Williams, G.H., Geernaert, T.O., and Chen, D. 2005. PIT tagging in 2004. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2004:345-350.

Table 1. Expected and observed numbers of landings in 2004 with 0, 1, 2, 3, 4, or 5+ tag recoveries. The expected values are calculated by treating the number of tag recoveries from each landing as a Poisson random variable.

	Number of tags recovered					
	0	1	2	3	4	5+
Area 2B						
Expected	541	143	33	8	2	0
Observed	568	108	31	13	2	5
Area 2C						
Expected	1351	146	18	2	0	0
Observed	1364	122	26	6	0	0
Area 3A						
Expected	1782	359	78	17	4	1
Observed	1842	279	81	25	8	6
Area 3B						
Expected	525	134	29	6	1	0
Observed	545	104	34	9	1	2
Area 4A						
Expected	238	11	0	0	0	0
Observed	240	8	0	0	1	0

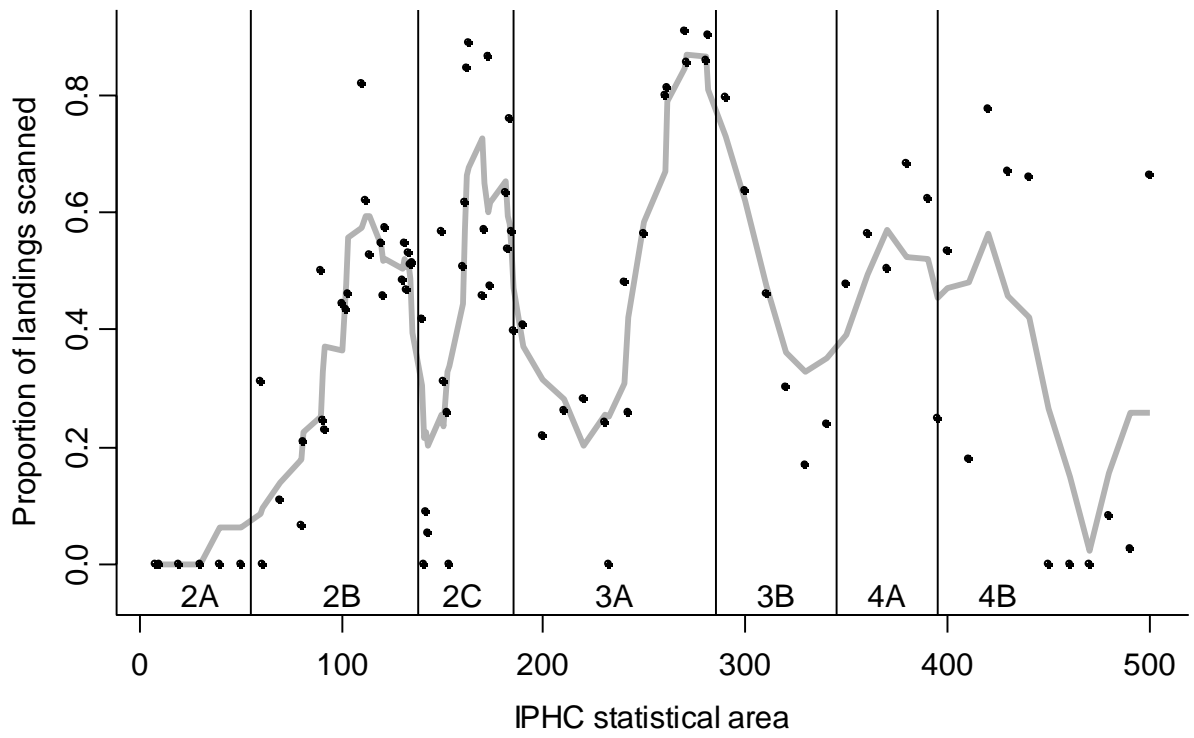


Figure 1. Proportion of landings scanned by IPHC statistical area in 2004. The gray line is a data smoother.

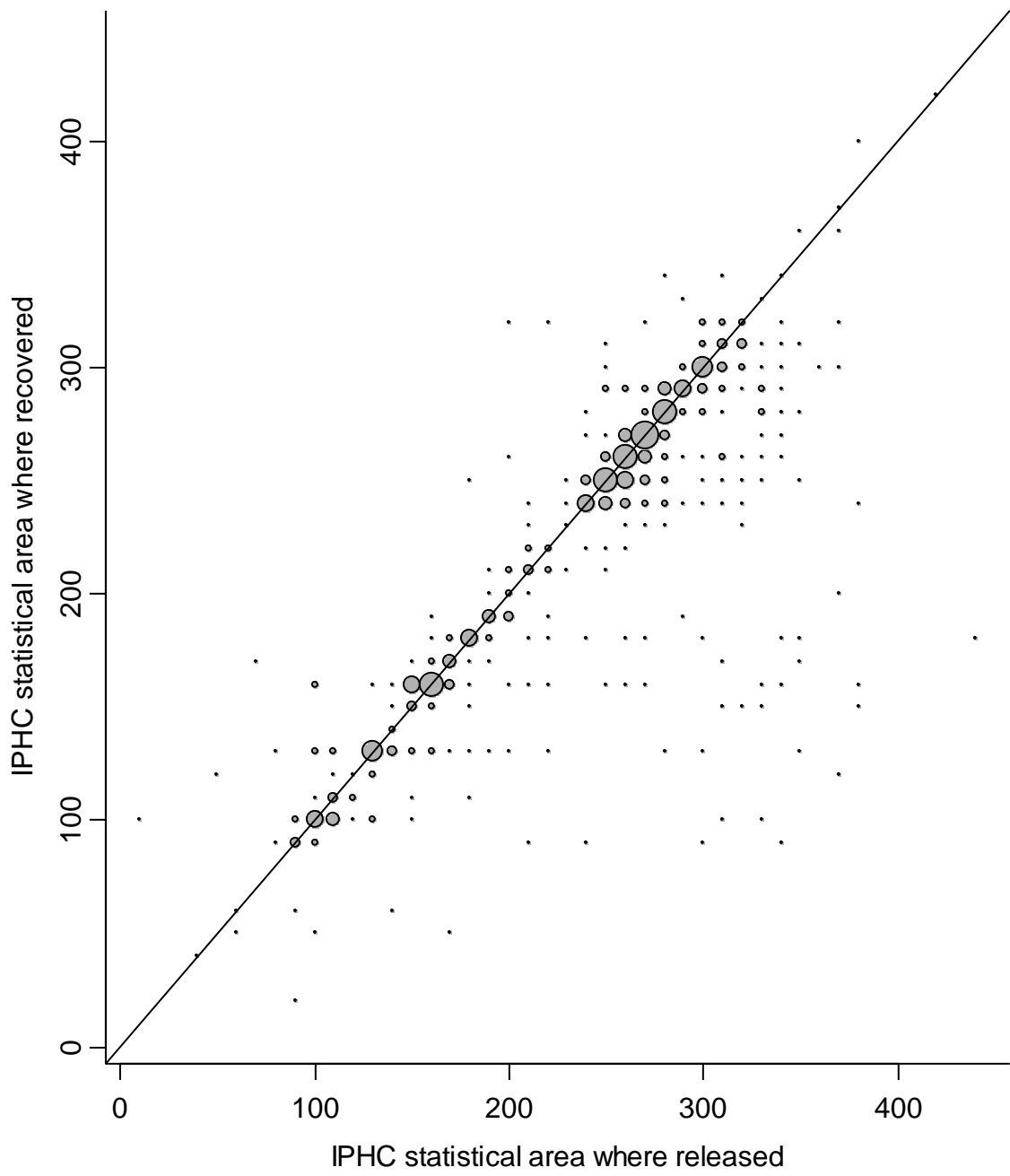


Figure 2. All Gulf of Alaska recoveries (2003-2005) plotted by statistical area of release and recovery. The area of each point is proportional to the number of recoveries. The diagonal line runs through recoveries in the area of release, comprising 85% of total recoveries.

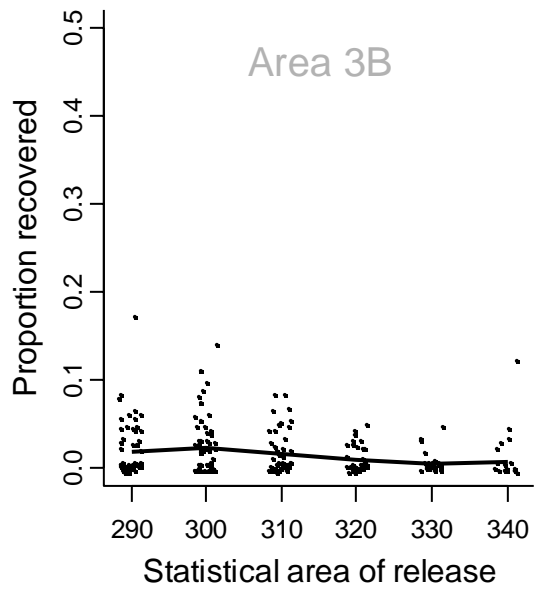
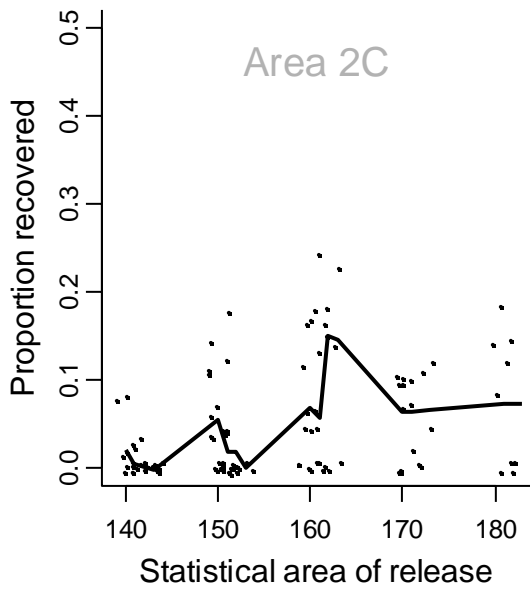
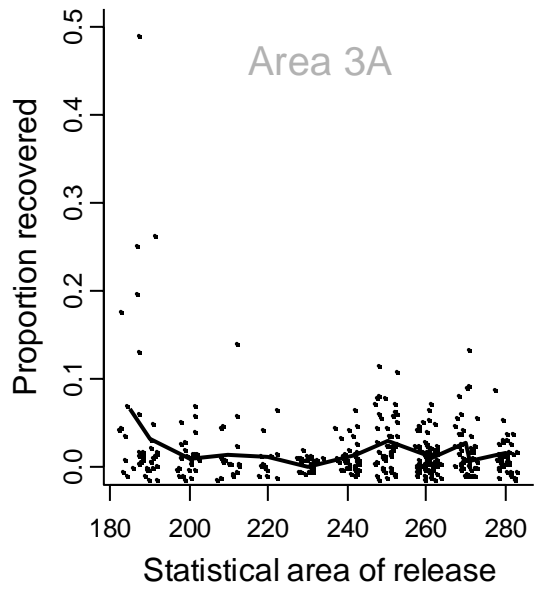
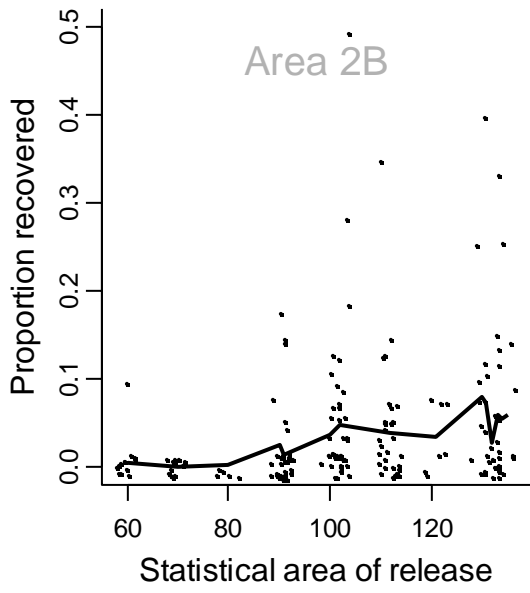


Figure 3. Proportion of tags released in 2003 that were recovered in 2004, plotted station by station. The lines are data smoothers.