Well I made it through Johns Great Duck Island GPS data of gull nests yesterday. It was extremely informative. Johns GPS data was accurate enough so that they matched up with gull nests perfectly, for the most part. It would have been nice to have some ground photos of the nests that I didn't see on the aerial photo so that I can be sure of its exact location. Without that, we are left with some questions in interpretation, but here are the details so that you can see what I mean:

**GBBG:**

Ground Count = 26 nests

Photo Count = 40 nests

**HEGU**

Ground count = 481 nests

Photo Count = 404 nests

**Total Gulls**

Ground count = 507 nests

Photo count = 444 nests

Overall, that makes the photo count and the ground count fairly comparable. The ground count picked up only 37 more birds than we did in the photo. Success - well, almost; read on...

But, first, need to mention that the photo quality was extremely poor throughout this colony. It was uniformly poor quality throughout. I would categorize it as some of the lowest quality images that we got on the entire coast. The average photo quality was 7.3 (on a scale of 1-10) and this imagery was likely between 5 and 6. That being the case, we missed some birds because the image quality was poor and these would have been visible in images of better quality.

**Difference in species ID:** John identified species of gull for each nest by direct observation. However, he had 15 nests marked as HEGU that were actually GBBG. In addition, 2 nests were marked as GBBG but they were actually HEGU nests. I was only able to correct this for the nests that were visible on the photo, thus there were likely a few more differences.

Here are the corrected count totals, based on this new information, plus I will add in some additional details on the number of nests marked by both ground and photo crews:

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**GBBG:** 36 nests marked by both the ground crew and photo count (ignoring species ID issues)

Corrected Ground Count: = 39 nests (3 were nests not marked in the photos)

Photo Count = 40 nests (4 were nests not marked during the ground survey)

**HEGU:**  349 nests marked by both the ground crew and photo count (ignoring species ID issues)

Corrected Ground count = 468 nests

Photo Count = 404 nests

**Total Gulls**

Ground count = 507 nests

Photo count = 444 nests

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That puts the GBBG nests just about bang on, with a slight underestimation of the HEGU nests. No surprises here. But, it gets more interesting....

Let’s focus on the GBBGs first, the easy one. We counted 1 more nest than the ground count. However, we marked 4 nesting GBBGs that were not marked during the ground count, and based on the aerial photo interpretation, these look like good nests and not roosting birds. That means 36 nests were marked by both the ground crew and on the photos. Possibly the ground crew missed them, possibly the birds attempted nesting but abandoned before laying eggs, etc. Overall, this is not that bad.

Now, let’s try to interpret the HEGU complexity. Overall, the ground crew counted 64 more nests than we marked on the aerial photo. No surprises here, but it gets more interesting. We marked 74 HEGU nests in the aerial photos that were not picked up in the ground survey. 42 of these 74 really do look like nesting HEGUs in the photo, with a settled bird with some bare ground directly adjacent to the sitting bird. 32 of these 74 could be roosting birds - the birds are settled in an area where nesting is happening, but there is no telltale patch of bare ground directly adjacent to the sitting bird. For the bird nests that were GPSed during the ground survey but not picked up in the aerial photos, 21 of them looked like they were obscured by trees or veg or overhanging ledges and an additional 34 were missed on the photo count, but by looking at the ground count data, I could see that there was a nesting bird there (missed because of poor photo quality). Also one bird recorded as nesting during the ground count was visible on the aerial photo, although it looked like it was roosting and not nesting. Also for 8 nests marked during the ground count, the nest bowl is visible in the photo, but no bird is present. Thus 64 nests were missed in the aerial photos that we should have gotten in with perfect imagery and visibility and birds being present and being able determine roosting versus nesting. That is not all. We had 48 birds marked as nests during the ground count and nothing is visible in the photo at all and not sure of the reason why. These could be because the GPS coordinates of the nest were far off, although the GPS data is overall really quite good, thus this does not seem likely. My guess is that at least some of these (and likely a majority of these) were nests set up after the date of the aerial photograph. If this is really the case, then we would not have picked these nests up during a ground count on the same day as the aerial photo. Thus, let me correct the total counts with this last bit of new information:

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**HEGU:** 349 nests marked by both the ground crew and photo count (ignoring species ID issues)

Corrected Ground count = 420 nests on date aerial photo was taken

Photo Count = 404 nests

**Total Gulls**

Ground count = 459 nests

Photo count = 444 nests

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Thus, in summary, lots of issues going in with HEGUs in the photo count. If we make the assumption that there were 420 nests on the ground on the date that the plane took the imagery, and we tallied 404 nests, things are looking really quite good. However, there were still only 349 nests marked by both the ground crew and in the aerial image.

**HEGU**

**SUMMARY OF NESTS MISSED IN AERIAL IMAGERY**

8.1 % OF NESTS MISSED BECAUSE OF POOR PHOTO IMAGERY

5.0% OF NESTS MISSED BECAUSE LIKELY OBSCURED BY TREES, VEG, BUILDINGS, ETC.

0.2% OF NESTS MISSED BECAUSE NESTING BIRD LOOKED LIKE IT WAS ROOSTING

1.9% OF NESTS MISSED BECAUSE BIRD WAS NOT ON NEST BOWL

15.2% OF NESTS MISSED OVERALL FOR VARIOUS REASONS

**SUMMARY OF NESTS DOCUMENTED IN AERIAL PHOTO THAT WERE NOT NESTING**

7.6% OF NESTS DOCUMENTED MAY HAVE BEEN ROOSTING BIRDS

10.0% OF NESTS DOCUMENTED REALLY DO LOOK LIKE NESTING BIRDS

17.6% OF NESTS DOCUMENTED IN AERIAL PHOTO NOT DOCUMENTED ON GROUND SURVEY

Overall, these errors tend to counteract each other, that is why our total counts are not that bad. With better imagery, more typical of the image quality that we got this past year, I would see the percent of nests missed in the aerial imagery to be much lower, on the order of less than 10%. I think with better image quality, we also would have seen a drop in the number of birds that we marked as nesting that were not recorded on the ground count. With better image quality, it is easier differentiating between roosting and nesting birds, thus I could see this error falling slightly, maybe on the of slightly greater than 10%.

Thus, what did we learn by this. I think that our errors with counting from aerial images tend to cancel themselves out, thus our colony estimates are likely within 10% of the colony size at the time of the photo for HEGUs and our error is likely much less for GBBGs, likely within 5% of the colony size at the time of the photo.