INTRODUCING PROJECTFLOCKTOGETHER:

A CROWDSOURCING APPROACH TO AERIAL PHOTO SURVEY ANALYSIS OF NORTH AMERICA'S WATERBIRDS

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By Emily Silverman & Shanie Gal-Edd
U.S. Fish & Wildlife Service Division of Migratory Bird Management

IN COLLABORATION WITH:
John Pickering, Discover Life & the University of Georgia
Joe Evenson, Washington Department of Fish & Wildlife
Tim Jones, Atlantic Coast Joint Venture
Tim Bowman, Sea Duck Joint Venture
Sam Droege, US Geological Survey

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The U.S. Fish & Wildlife Service's Division of Migratory Bird Management, in partnership with the Atlantic Marine Assessment Program for Protected Species (AMAPPS), Washington Department of Fish & Wildlife, and the Sea Duck Joint Venture, is pioneering the use of high resolution digital imagery in conjunction with standard observer data for aerial waterbird surveys. The goals of this effort are to:

1. Collect high quality imagery along with data from aerial observers,
2. Create a working crowdsourcing infrastructure for photo survey analysis,
3. Deploy crowdsourcing for photo review and assess the value of the approach, and
4. Employ the results to adjust and correct aerial observer data,

with the ultimate goal of providing unbiased information about species distribution and abundance to aid in the conservation and management of migratory waterbirds.

To this end, the 2011-2014 Sea Duck Aerial Survey Detectability Project collected data using two observer biologists who identified and counted birds in real time, simultaneous with cameras that took continuous photos from two positions: front-facing (FF) and point-of-view (POV). POV images, which should have the same field of view as the observer biologists, will be used to evaluate the detection and misidentification rates of the observer biologists; while FF images, which record the presence of birds within the transect strip ahead of the plane, will be compared to the corresponding POV images to determine whether plane disturbance is biasing observer data (availability bias).

With the digital imaging technology in place, the next challenge has been to create a platform with the capability to process the resulting photos quickly, inexpensively, and accurately. As these aerial surveys have two cameras that each take multiple photos per second, hundreds of thousands of photos are generated and thousands of man-hours are required to process them (e.g., over 14 months at 40 hr/week for one survey effort).

Crowdsourcing is an ideal format to analyze massive amounts of photo data that require the ability to make subtle visual distinctions beyond the current capability of computer algorithms. Via crowdsourcing, we can solicit small contributions from each of a large group of people in order to achieve a large goal, within a short timeframe, and inexpensively. Crowdsourcing has the additional benefit of doubling as outreach and community education, which is fundamental to the U.S. Fish and Wildlife Service's mission.

Our design for the crowdsourcing platform recognizes three phases. In Phase I, participants identify photos as bird “positive” or “negative.” The goal of Phase I is to sort out the bird negative photos. False negatives must be carefully avoided, as those marked bird negative will not be reviewed in later phases. In Phase II, participants count the birds. This entails clicking on each bird, whereupon a cropped photo at maximum resolution is saved for Phase III. Phase II

may need to happen in two steps: first, groups of birds will be cropped out, and later each bird within a cropped image will be counted and further cropped. In Phase III, the birds are identified to species. This requires the development of an identification guide and extensive volunteer training. In this project, species identification will be the greatest challenge and require the most user-training materials, including, ideally, an aerial photo guide for all species that might appear in our surveys.

We are collaborating with John Pickering, Professor at University of Georgia and creator of Discover Life, to host our project through the Discover Life crowdsourcing platform. We have developed working prototypes of Phases I & II, and are in the early stages of designing a species guide for Phase III. In Phase I, users classify the photos as bird positive or bird negative. In Phase II, bird positive photos are randomly presented and volunteers are asked to place a yellow square outline around one or more birds (see Image), which will automatically save a cropped image to be reviewed in Phase III.

In our beta test of Phases I and II, ProjectFlockTogether elicited an enthusiastic reaction from our volunteers and delivered on its promise to process a huge number of photos quickly. It took approximately 100 users 18 days to complete both Phase I and II of 16,847 photos. Given this, we can estimate that to process 160,000 photos through Phases I & II would require approximately one month of work by 650 volunteers. Furthermore, the 100 site visitors generated from a single email sent to approximately 1500 people represents ~6% response rate.

With its enormous potential well-demonstrated, the next steps for ProjectFlockTogether will be to improve upon the Phase I and Phase II interface, develop the platform and associated materials for Phase III, evaluate data quality generated by volunteers, integrate data quality measures and training into the platform, resolve the unique challenges that remain in each phase, create a web-presence for the project on USFWS and other citizen science websites, design a volunteer appreciation program, and, when the platform is ready to launch, recruit a large volunteer base. Finally, the crowdsourcing image data must be used to enhance and correct the corresponding observer data, thereby improving the data quality of our aerial bird surveys.

Our ultimate goal is for ProjectFlockTogether to be a working platform in place for all future aerial bird surveys. After the initial investment in development, ProjectFlockTogether is designed to require few resources to maintain itself going forward, and will revolutionize aerial wildlife monitoring.