Inferring animal abundance from associative behavior

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Abstract: Estimating the abundance of animal populations is a central issue in applied ecology and conservation issues. Despite the development of satellite, archival and acoustic tagging techniques that allow the tracking of animals in their natural environments, these technologies have so far been underutilized in developing abundance estimation of animal populations, both for marine and terrestrial species. We propose a new sampling theory for estimating species abundance that employs these technologies and that can be applied to species that aggregate at well-defined sites. Based on a behavioral model describing the associative behavior of animals, we relate the time that individuals spend associated at a particular aggregative site and out of it to their abundance. Taking the case study of tropical tuna associated with floating objects (which constitute aggregation points for several pelagic fish species), we implemented our approach using a data set obtained through acoustic tagging. Our method opens a new perspective, which is fisheries independent, for direct estimation of populations of tropical tuna. The same approach can be applied to obtain population assessments for any marine and terrestrial species that display associative behavior and from which behavioral data have been acquired using acoustic, archival, or satellite tags or even visual observations where individual animals can be recognized.