

#### 40. AT-SEA SURVEYS OF MARBLED MURRELETS IN STEPHEN'S PASSAGE, SOUTHEAST ALASKA--RECOMMENDATIONS FOR MONITORING

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We conducted at-sea surveys of marbled murrelets (*Brachyramphus marmoratus*) during June and July, 2004, in Stephens Passage, Southeast Alaska. Each survey sampled an approximately 400 km<sup>2</sup> study area with 23 transect lines (192 km) extending shore to shore on each minute of latitude from Midway Island (57° 50' N) to Point Bishop (58° 12' N). Mean transect length was 9.0 km (SD = 2.1). Murrelets were surveyed by standard distance sampling methods (Buckland et al. 2004), with an observer measuring angle to the birds and estimating sighting distance. Detection probabilities declined as distance from the centerline increased (to 100 m) in all conditions, and by > 50% under some survey conditions. Missing birds away from the centerline does not violate assumptions of distance sampling, but it can cause a strong negative bias when using strip transects. For the area overall, murrelet densities were highest in July, exceeding 47 birds/km<sup>2</sup>. Within the study area, murrelets increased by an order of magnitude between the shoreline and 2.0 km offshore. Appropriate survey design would orient transects across this distributional gradient (i.e., perpendicular to shore). We recommend sampling efficiency and precision could be increased by stratifying the sample into a high-density strata (< 2.5 km

offshore) and low-density strata ( $> 2.5$  km offshore), with greater sampling effort applied to the high-density strata. Negative biases can occur if birds on the centerline are missed due to waves, glare, birds diving or inattentive observers. Training and testing can reduce these biases. Knowing the spatial and temporal distributions of animals you are surveying, and measuring at an appropriate landscape scale, are key to the design of an effective monitoring program.



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