**Supplementary Material**

At-sea distribution and habitat of breeding Japanese Murrelets *Synthliboramphus wumizusume:* implications for conservation management

MARK G. R. MILLER, YUTAKA YAMAMOTO, MAYUMI SATO, BEN LASCELLES, YUTAKA NAKAMURA, HITOSHI SATO, YASUHIRO ANDO, ITSURO EZAKI, PHIL TAYLOR, SHIGEAKI MORI, SEIJI HAYAMA, YUTAKA KOBAYASHI

**Contents**

Table S1. Details of oceanographic variables used in modelling.

Table S2. Names and locations of all known Japanese Murrelet colonies within Japan, coordinates not disclosed for Seinan colonies for conservation purposes.

Figure S3. Bimodal distribution of Japanese Murrelet density (birds/km2) in relation to distance from colony (D\_COL, km) around Northern Izu colonies.

Table S1. Details of oceanographic variables used in modelling.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable code | Variable | Type | Source | Layers created |
| SST | Sea Surface Temperature | Dynamic oceanographic | MODIS Aqua Terra; http://oceancolor.gsfc.nasa.gov/ | 5 (one per year: 2008-2012) |
| CHLA | Chlorophyll-a Concentration | Dynamic oceanographic | MODIS Aqua Terra; http://oceancolor.gsfc.nasa.gov/ | 14 (one per survey) |
| G\_SST | SST gradient | Dynamic oceanographic - derived | MODIS Aqua Terra; http://oceancolor.gsfc.nasa.gov/ | 5 (one per year: 2008-2012) |
| G\_CHLA | Chlorophyll-a gradient | Dynamic oceanographic – derived | MODIS Aqua Terra; http://oceancolor.gsfc.nasa.gov/ | 14 (one per survey) |
| Bathy | Bathymetry | Static | GEBCO; http://www.gebco.net/ | 1 |
| Slope | Seabed slope angle | Static - derived | GEBCO; http://www.gebco.net/ | 1 |
| D\_Land | Distance to land | Static - derived | GEBCO; http://www.gebco.net/ | 1 |
| D\_Col | Distance to colony | Static - derived | Survey data | 1 |

Table S2. Names and locations of all known Japanese Murrelet colonies within Japan, coordinates not disclosed for Seinan colonies for conservation purposes.

|  |  |  |  |
| --- | --- | --- | --- |
| Location (Island/Islet) | Latitude | Longitude | Region |
| Nanatsujima Oshima | 37.61028791 | 136.9002056 | Chubu |
| Nanatsujima Aramikojima | 37.58873089 | 136.876688 | Chubu |
| Kutsujima | 35.70024392 | 135.4452896 | Chubu |
| Udonejima | 34.47189184 | 139.294281 | Northern Izu |
| Niijima | 34.43069985 | 139.2795181 | Northern Izu |
| Hanshima | 34.32571722 | 139.2772865 | Northern Izu |
| Tadanaejima | 34.20768528 | 139.1914558 | Northern Izu |
| Onbasejima  | 34.18695586 | 139.0754986 | Northern Izu |
| Onoharajima (Sanbondake) | 34.048056 | 139.383889 | Northern Izu |
| Motone | 33.851028 | 139.62001 | Northern Izu |
| Kojine | 33.12993056 | 139.6986361 | Central Izu |
| Torishima | 30.48344429 | 140.2885437 | Southern Izu |
| Mimianajima | 34.18393831 | 136.3799429 | Kansai |
| Okinoshima koyajima | 34.23146103 | 130.1111698 | Kyushu |
| Eboshijima | 33.68963859 | 129.9828529 | Kyushu |
| Biroujima | 32.46472948 | 131.7308807 | Kyushu |
| Danjogunto hanaguri | 32.01127832 | 128.3615112 | Kyushu |
| Tsukuejima  | 33.68333333 | 130.2166667 | Kyushu |
| Oki  | 36.154 | 133.073 | Oki |
| Seinan 1 | - | - | Shikoku |
| Seinan 2 | - | - | Chuugoku |
| Takeshima /Dok  | 37.239167 | 131.868611 | Japan/South Korea (disputed) |

Figure S3. Bimodal distribution of Japanese Murrelet density (birds/km2) in relation to distance from colony (D\_COL, km) around Northern Izu colonies. A clear break in murrelet observations is observed at 20km distance from colonies in both March (pink) and May (blue).

