# Status and Trend of Marbled Murrelet Population

Gus van Vliet

Rich MacIntosh

WASHINGTON STATE DEPARTMENT OF Natural Resources

CALIFORNIA DEPARTMENT OF FISH AND GAME

U.S. FISH & WILDLIFE SERVICE

USGS science for a changing world

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NATIONAL PARK SERVICE

U.S. DEPARTMENT OF THE INTERIOR 1824 BUREAU OF INDIAN AFFAIRS

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

# At-sea Monitoring of Marbled Murrelet Population Status and Trend in the Northwest Forest Plan Area

**Sherri L. Miller, C. John Ralph, and Jim Baldwin**,
Pacific Southwest Research Station

**Martin G. Raphael**, Pacific Northwest Research Station

**Craig Strong**, Crescent Coastal Research

**Christopher W. Thompson**, University of Washington,
School of Aquatic & Fishery Sciences,

**Mark H. Huff and Gary A. Falxa**,
U.S. Fish and Wildlife Service

## Marbled Murrelet Effectiveness Monitoring

# At Sea Population Monitoring OBJECTIVE

**Monitor changes in**

**Marbled Murrelet abundance**

**offshore of the Northwest Forest Plan Area**

**using a unified and scientifically valid**

**sampling design**

# Overview

- Population estimates offshore Northwest Forest Plan area

**18,000 – 23,700**

**Marbled Murrelets**

- We did not detect a decline over these sampling years

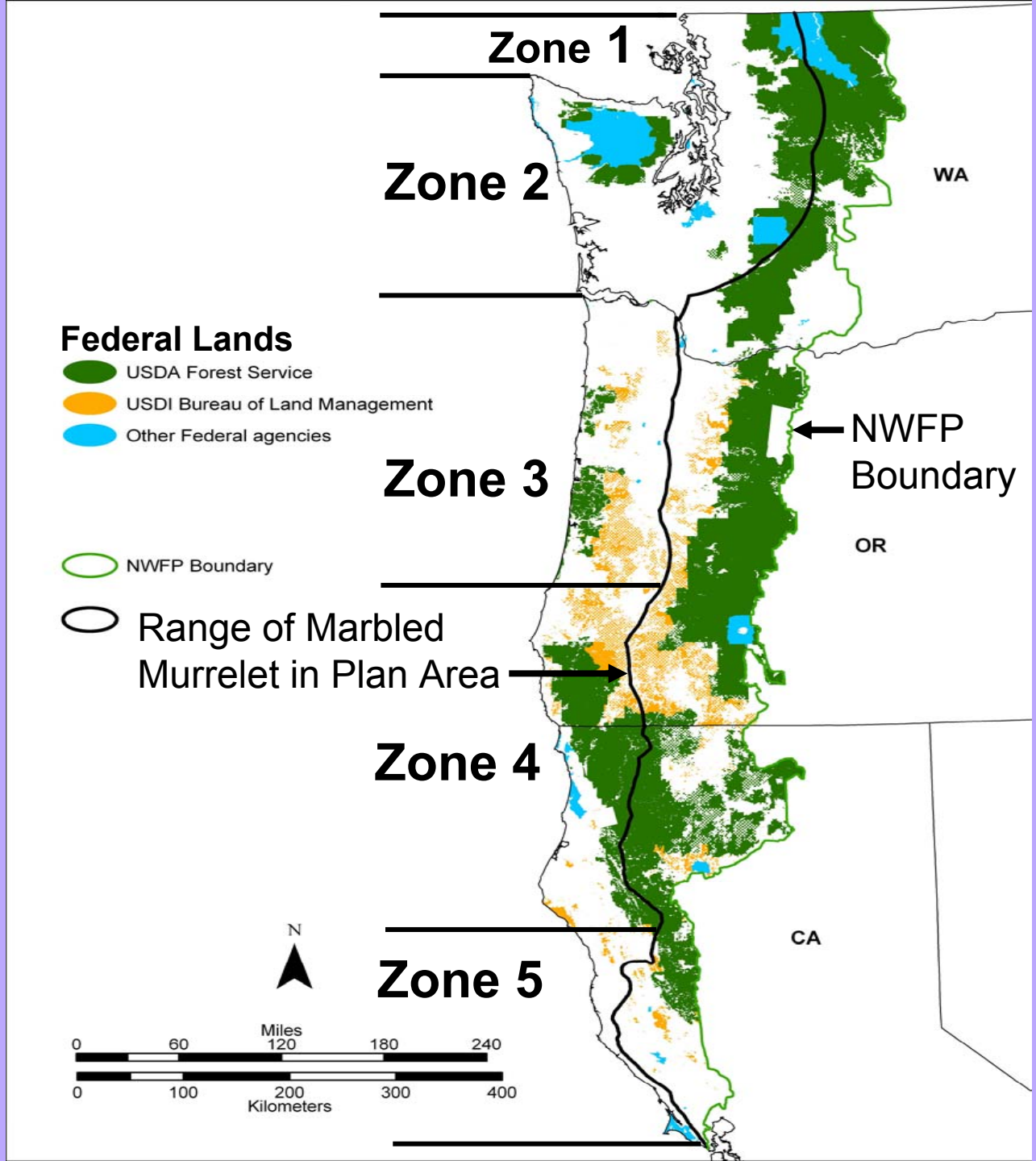
# Sampling Design Development

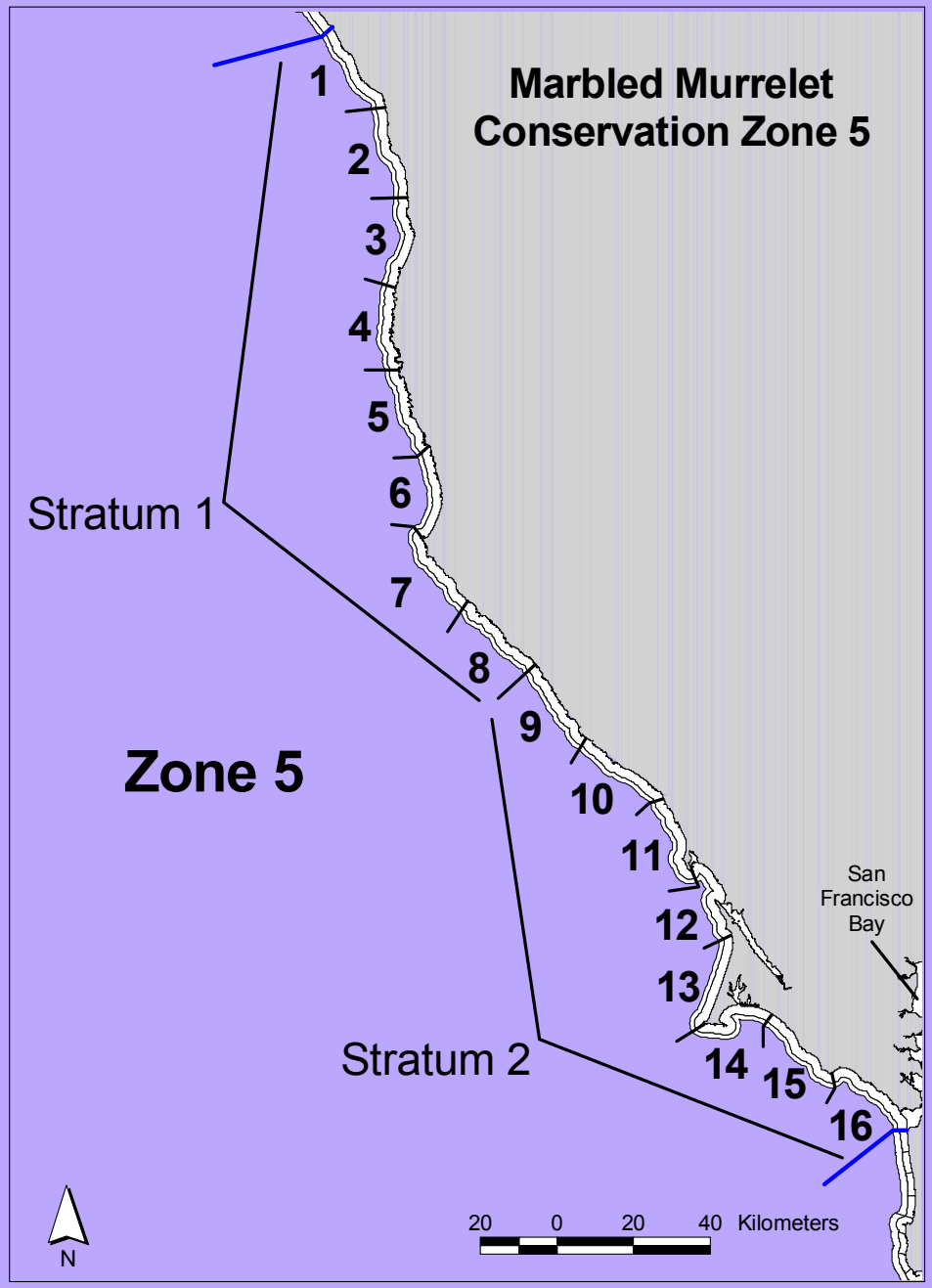
- Assembled a team with sampling, monitoring & murrelet biology expertise
- Gathered and examined existing data
- Defined our target population
- Used computer simulations to evaluate various design options
- Implemented surveys and tested results

# Target Population

- **Washington, Oregon, and No. California**

  **-- Offshore of Northwest Forest Plan Area**
- **Season: Breeding  May 15 – July 31**
- **Nearshore:  Within 8 km of shore**


Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
WA
OR
CA
Federal Lands
USDA Forest Service
USDI Bureau of Land Management
Other Federal agencies
NWFP Boundary
Range of Marbled Murrelet in Plan Area
NWFP Boundary
N
Miles
0 60 120 180 240
0 100 200 300 400
Kilometers

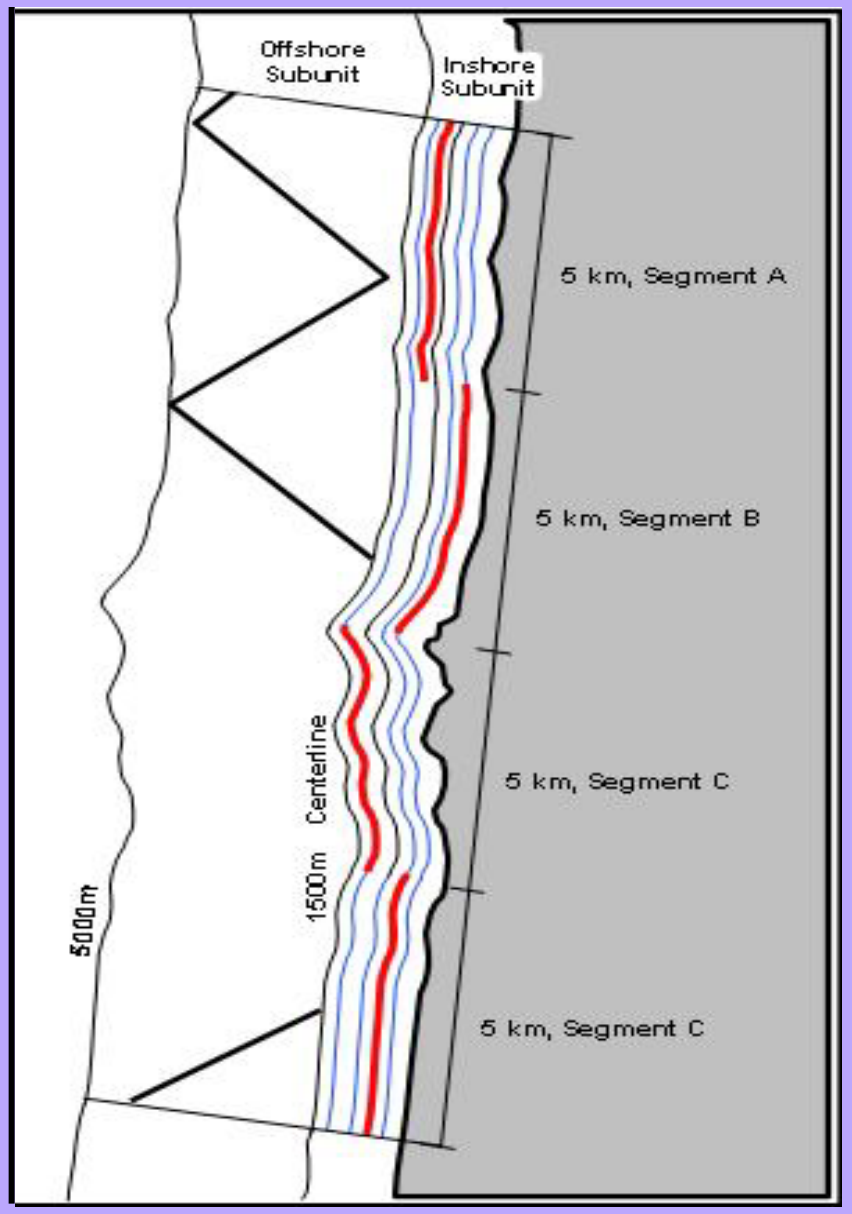



# Primary Sampling Units (PSUs)

- Random selection of PSUs
- Effort varied by stratum

# Primary Sampling Unit (PSU)

- ~12.5 mi (20 km) of coast
- 0.062 mi (100m) to 5 mi (8km) from shore
  - Differs by zone and stratum
- 2 Subunits –
  - Inshore and Offshore
  - Centerline varies by zone
  - Centerline and effort determined by murrelet density and subunit area



# Survey Effort for All Zones

| Year | Number of PSU Surveys | Survey Effort (mi) | Number of Birds Observed |
|---|---|---|---|
| 2000 | 176 | 3,504 | 2,896 |
| 2001 | 186 | 3,907 | 3,880 |
| 2002 | 200 | 4,044 | 4,616 |
| 2003 | 195 | 4,127 | 5,791 |
| Totals | 757 | 15,582 | 17,183 |

# Density Estimate

- **Average daily number of birds per square mile for the target population:**

$$\hat{d} = 1000 \cdot \hat{f}(0) \cdot \hat{E}(s) \cdot ER / 2$$

- **Bootstrap resampling methods were used to estimate precision**

# Results

# Density Estimates

(Number per Square Mile)

| Zone | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| 1 | 4.2 | 6.6 | 7.2 | 6.3 |
| 2 | 1.2 | 2.7 | 4.0 | 5.2 |
| 3 | 11.0 | 12.4 | 10.3 | 9.6 |
| 4 | 10.9 | 8.6 | 10.8 | 10.0 |
| 5 | 0.2 | 0.3 | 0.7 | 0.2 |
| All | 5.3 | 6.5 | 7.0 | 6.6 |

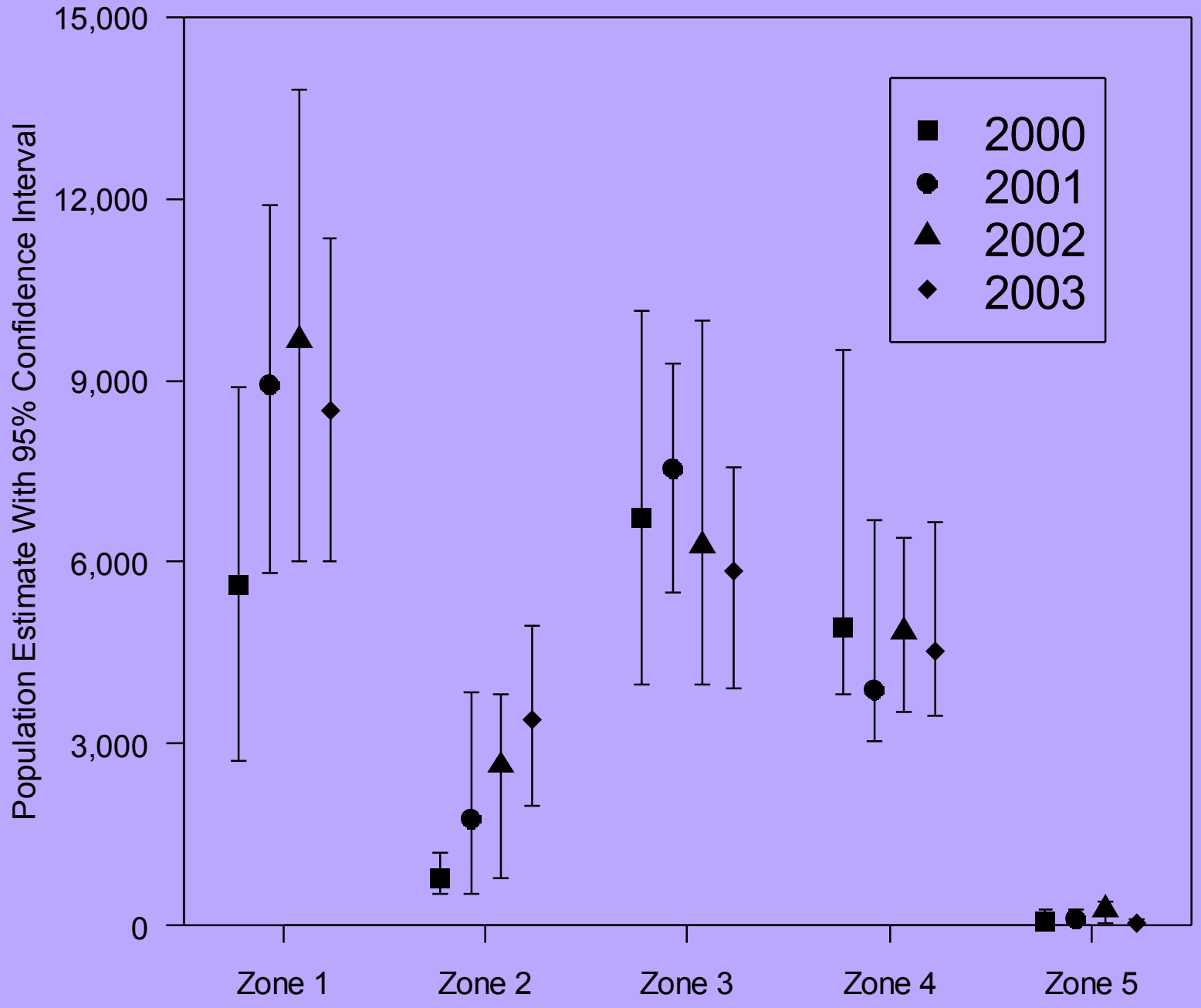
# Population Estimates

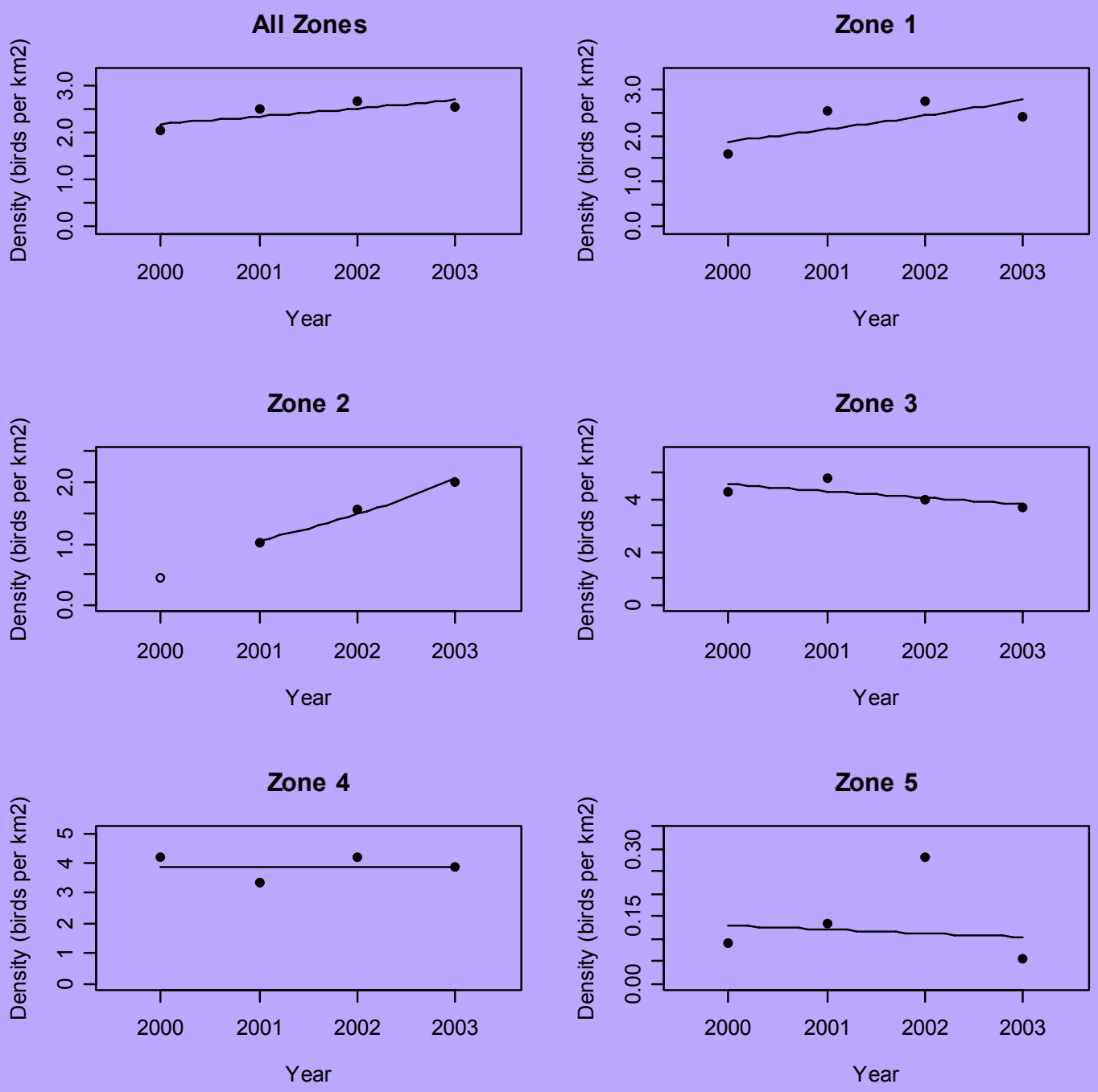
Michael G. Shepard

| Zone | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| 1 | 5,600 | 8,900 | 9,700 | 8,500 |
| 2 | 800 | 1,700 | 2,600 | 3,400 |
| 3 | 6,700 | 7,500 | 6,300 | 5,900 |
| 4 | 4,900 | 3,900 | 4,900 | 4,500 |
| 5 | 100 | 144 | 300 | 48 |

# Population Estimate – All Zones

| Year | Birds | 95% CL | |
|---|---|---|---|
| 2000 | 18,100 | 12,800 | 23,500 |
| 2001 | 22,200 | 17,700 | 26,700 |
| 2002 | 23,700 | 18,400 | 29,000 |
| 2003 | 22,300 | 18,300 | 26,300 |


15,000
12,000
9,000
6,000
3,000
0
Population Estimate With 95% Confidence Interval
2000
2001
2002
2003
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5


All Zones
Density (birds per km2)
0.0 1.0 2.0 3.0
2000 2001 2002 2003
Year
Zone 1
Density (birds per km2)
0.0 1.0 2.0 3.0
2000 2001 2002 2003
Year
Zone 2
Density (birds per km2)
0.0 1.0 2.0
2000 2001 2002 2003
Year
Zone 3
Density (birds per km2)
0 2 4
2000 2001 2002 2003
Year
Zone 4
Density (birds per km2)
0 1 2 3 4 5
2000 2001 2002 2003
Year
Zone 5
Density (birds per km2)
0.00 0.15 0.30
2000 2001 2002 2003
Year

# Detecting Trends with 80% Power

| Annual Decrease Rate (%) | Zone | | | | | |
|---|---|---|---|---|---|---|
| | All | 1 | 2 | 3 | 4 | 5 |
| | YEARS | | | | | |
| 3 | 10 | 16 | 8 | 10 | 12 | 39 |
| 5 | 7 | 12 | 6 | 7 | 9 | 28 |
| 10 | 5 | 8 | 5 | 5 | 6 | 18 |

# Summary

- We have developed and tested a scientifically valid sampling design

- We estimate the Marbled Murrelet population offshore of the Northwest Forest Plan Area to be

**18,000 – 23,700**

- We estimate we can detect a 5% annual decrease in the population of all Zones, in 7 years

# Summary (Cont)

- Over the next few years, we will be able to refine both our density estimates and our power to detect changes in the population

- As the Effectiveness Monitoring effort continues, the consequences of errors in estimating trends should be evaluated and goals established. In addition to setting population targets, management response to observed trends should be considered