Are roadside surveys of secretive marsh birds biased?

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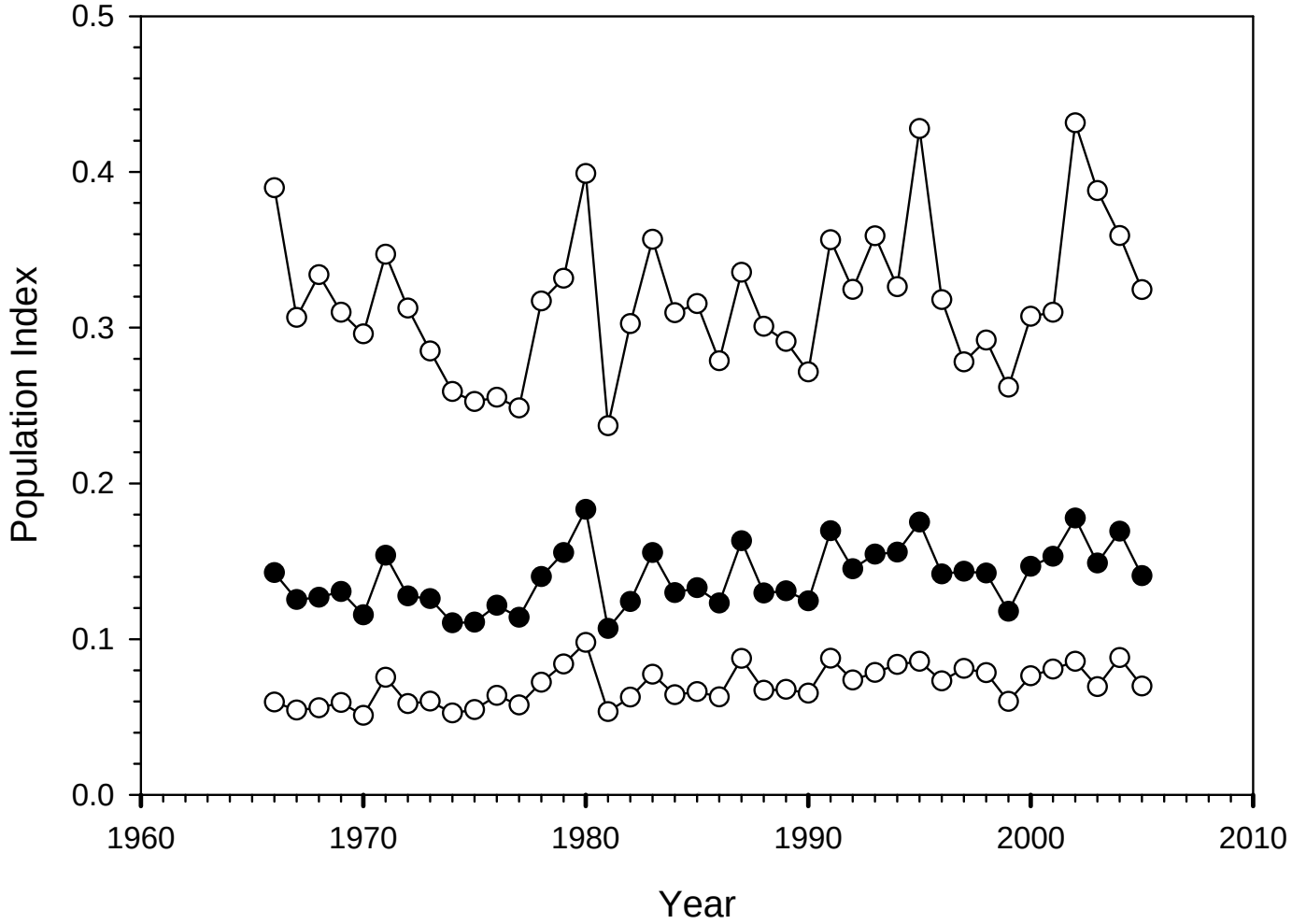
Neal Niemuth, USFWS Region 6 HAPET

Photo by R. Bohn

Photo by M. Wilson

Least Bittern (Breeding Bird Survey)



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Breeding Bird Survey (BBS)

- Annual, nation-wide survey
- 25-mi survey routes follow roads
- Observers stop every ½ mile to record birds they see or hear from the road.
- All bird species , terrestrial and wetland, are recorded.

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BBS Limitations

- Effectiveness (accuracy) varies widely among species.
- Secretive marsh bird species (SORA, AMBI) are under-represented.
- Roadside bias likely for some species, but is poorly understood.

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Roadside Bias

- Components:
  1. Birds may be more (or less) abundant near roads than far from roads.
     - Habitat may be different near roads.
     - Edge-sensitive species may avoid roads.
  2. Birds may be more (or less) detectable from the *roadside* than from *off-road* locations.

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Moving Ahead on a Continental-Scale Marsh Bird Monitoring Framework

- Workshops held in 1998 and 2006

- *Program Goal:*
  - Estimate temporal and spatial changes in abundance of selected breeding marsh bird species at continental, national, regional, and possibly local scales

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Focal Species

- Pied-billed grebe
- Least bittern
- American bittern
- Sora
- Clapper rail
- King rail
- Black rail
- American coot
- Common moorhen
- Purple gallinule
- Limpkin
- Seaside sparrow
- Salt-marsh sharp-tailed sparrow

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Monitoring Framework

Components

1. Standardized survey protocol
   - How to survey
2. Sampling design
   - Where to survey
   - Feasible for diverse regions of the continent and provide continental-scale information
3. Analysis system
   - "Rolling up" results
4. Data management system

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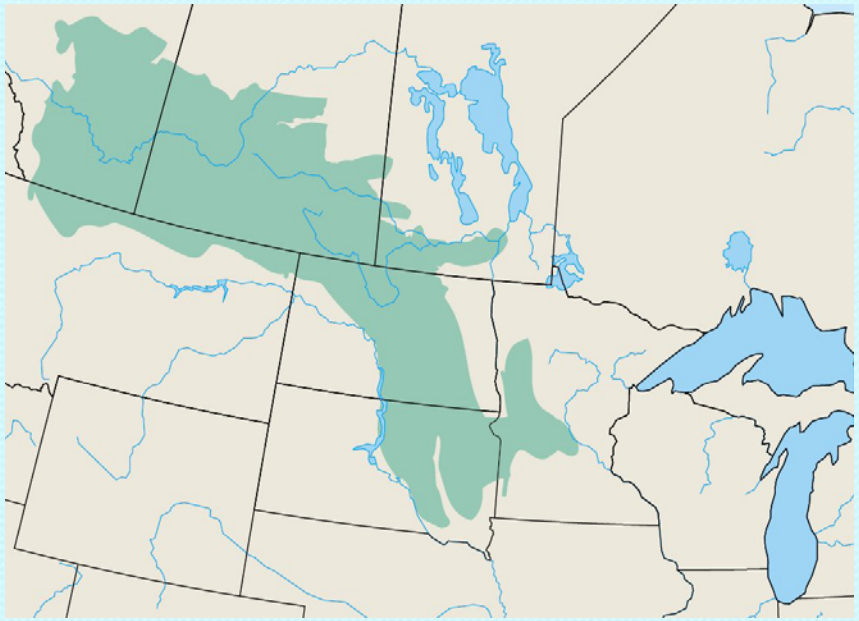
Prairie Pothole Region

- Significant breeding area for marsh birds
- Mostly private ownership
  - Access issues (trespass)
- But public lands significant as well
  - Different type of access issue



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Prevailing beliefs:

- To be feasible at a large scale in the Prairie Pothole Region, surveys of privately owned wetlands must be conducted from roadsides.
- Surveys on public lands will likely include a mix of roadside and off-road sampling locations.

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Study Objective

- Evaluate whether roadside surveys of marsh birds reflect marsh bird numbers overall
  - Is “roadside bias” an issue?
    1. Are marsh birds more (or less) abundant near roads than far from roads?
    2. Are marsh birds more (or less) detectable from roadsides than from off-road sampling locations?

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Study Design

- Paired surveys of “roadside” and “non-roadside” habitats

- What is a road?
  - Maintained by county or township (paved or unpaved)
  - No U.S. or state highways
  - No 2-tracks

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Definitions

- *Roadside habitat*:
  - Seasonal or semi-permanent wetland habitat (suitable for marsh birds) that occurred ≤100 m of a road
    - Assumption is that birds within 100 m of the road have non-zero probability of being detected from the road

- *Non-roadside habitat*:
  - Seasonal or semi-permanent wetland habitat that occurred >100 m of a road

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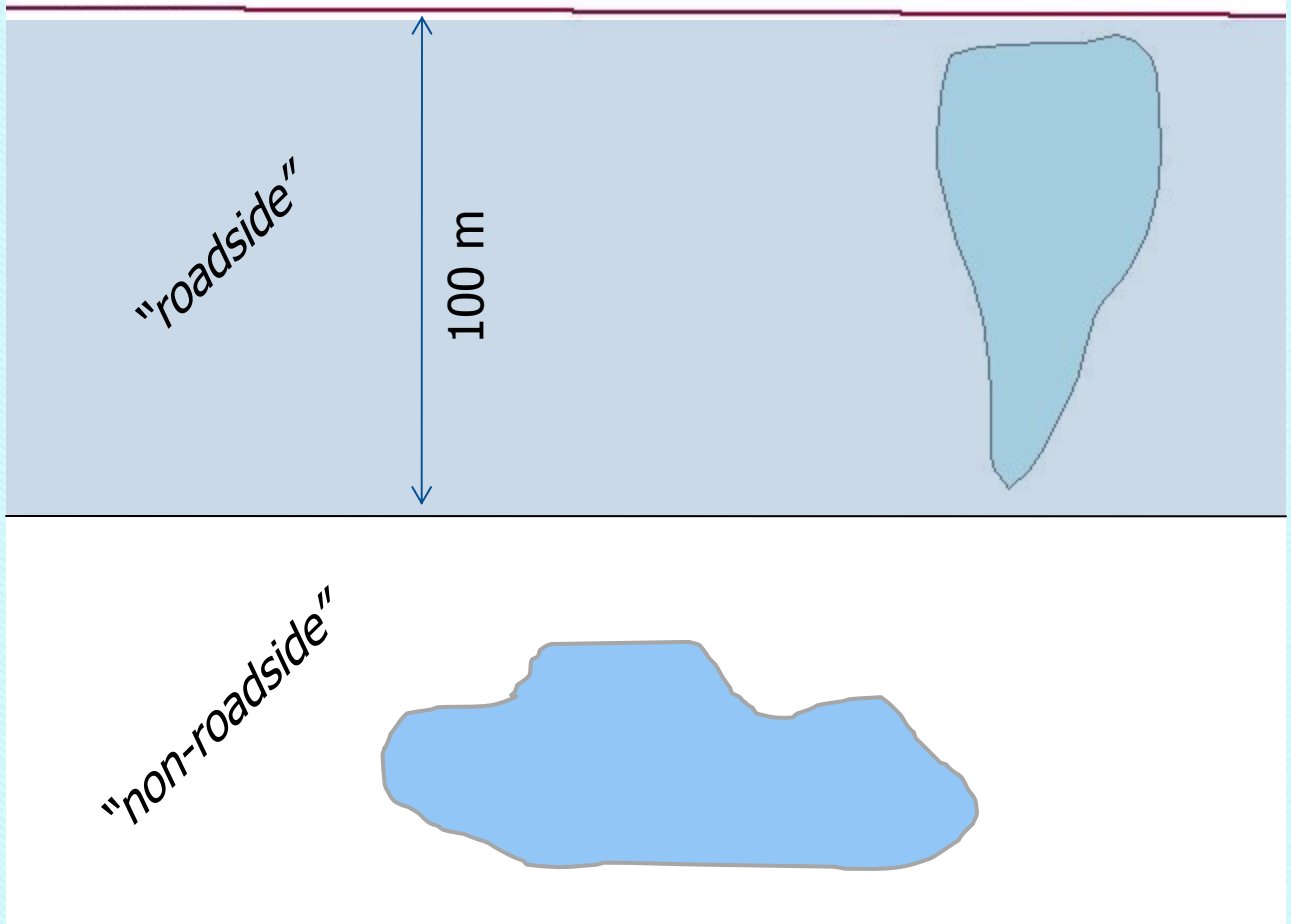
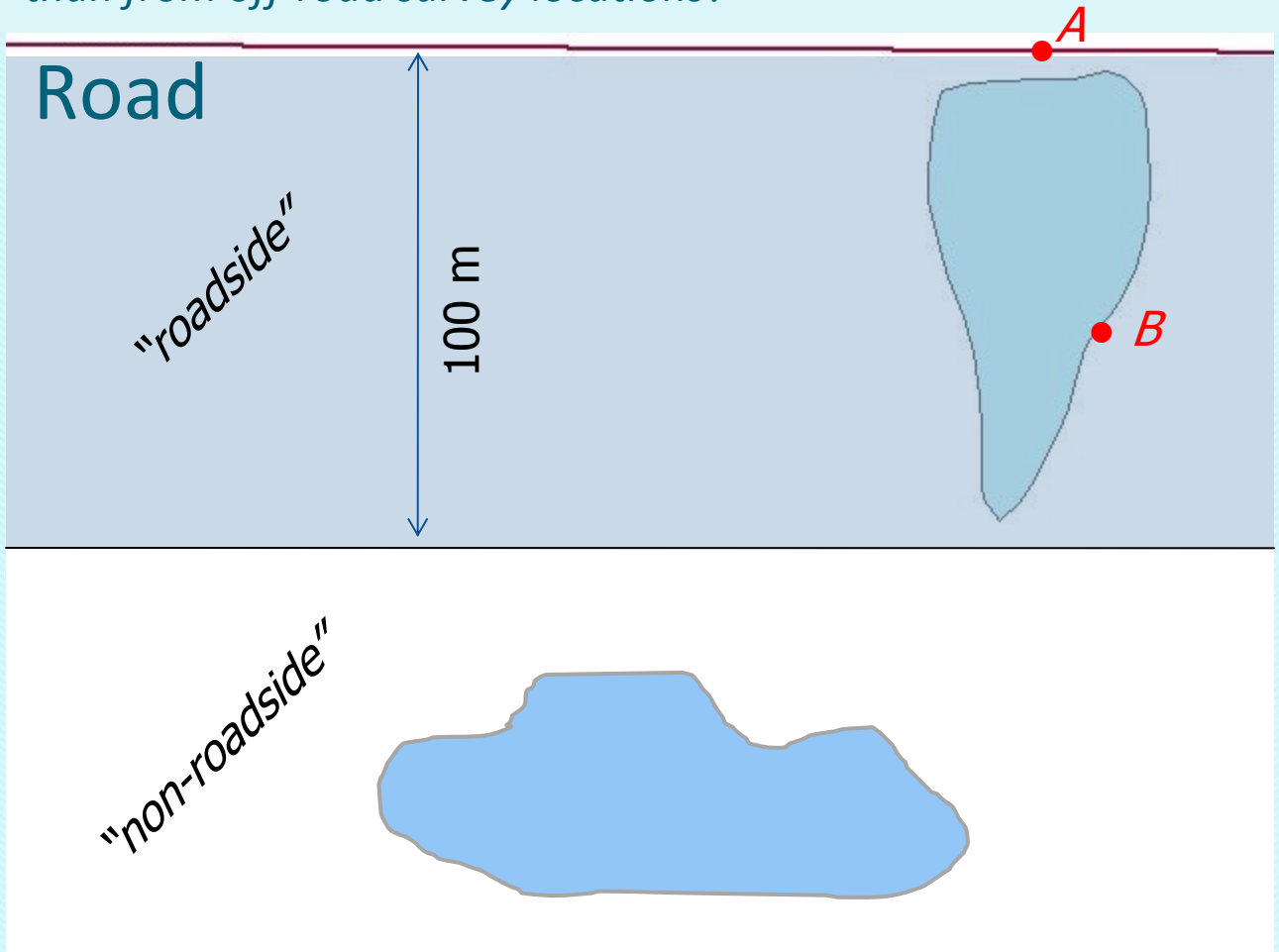
Road



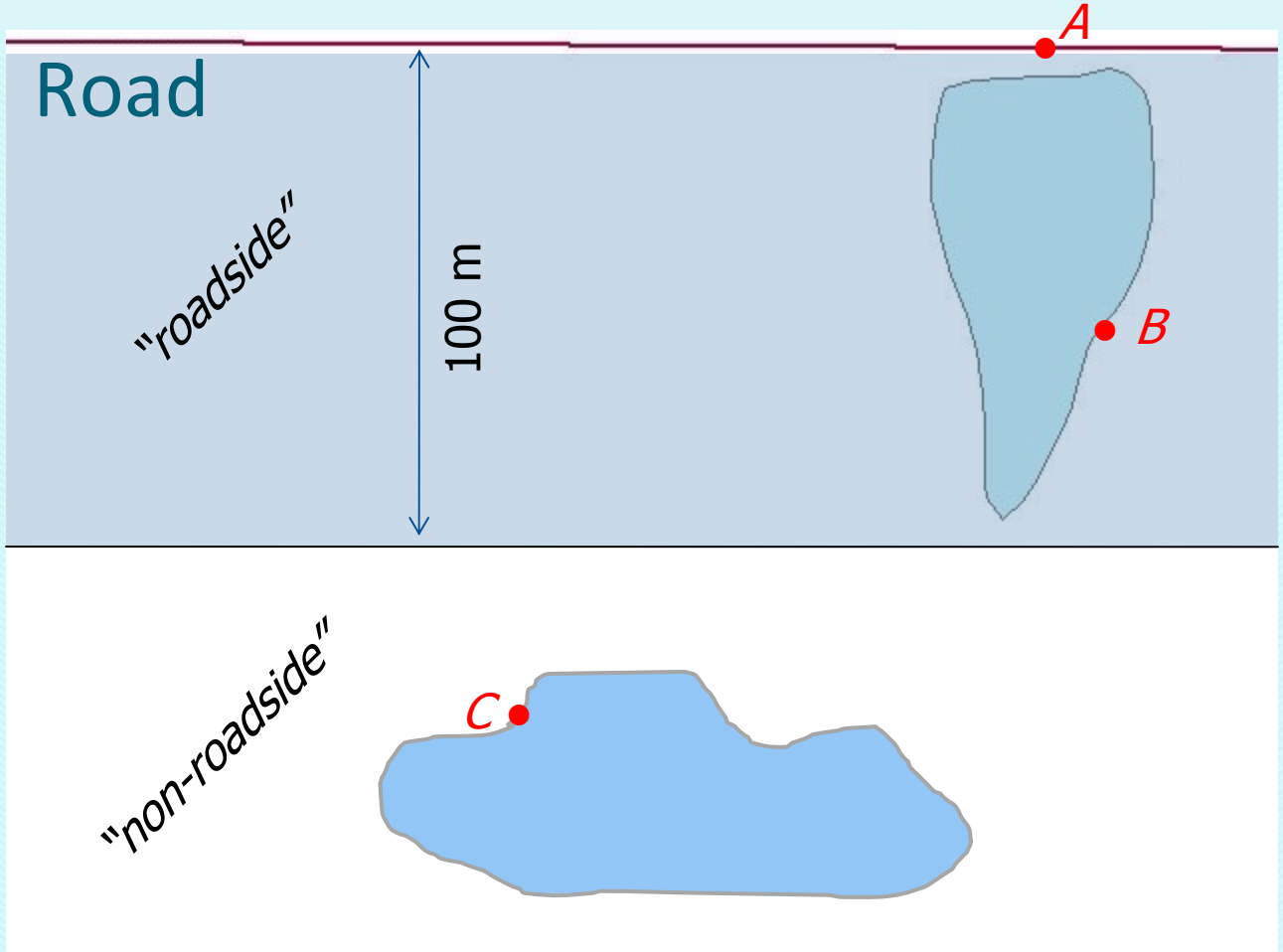
USGS

Are marsh birds more (or less) detectable from roadsides than from off-road survey locations?

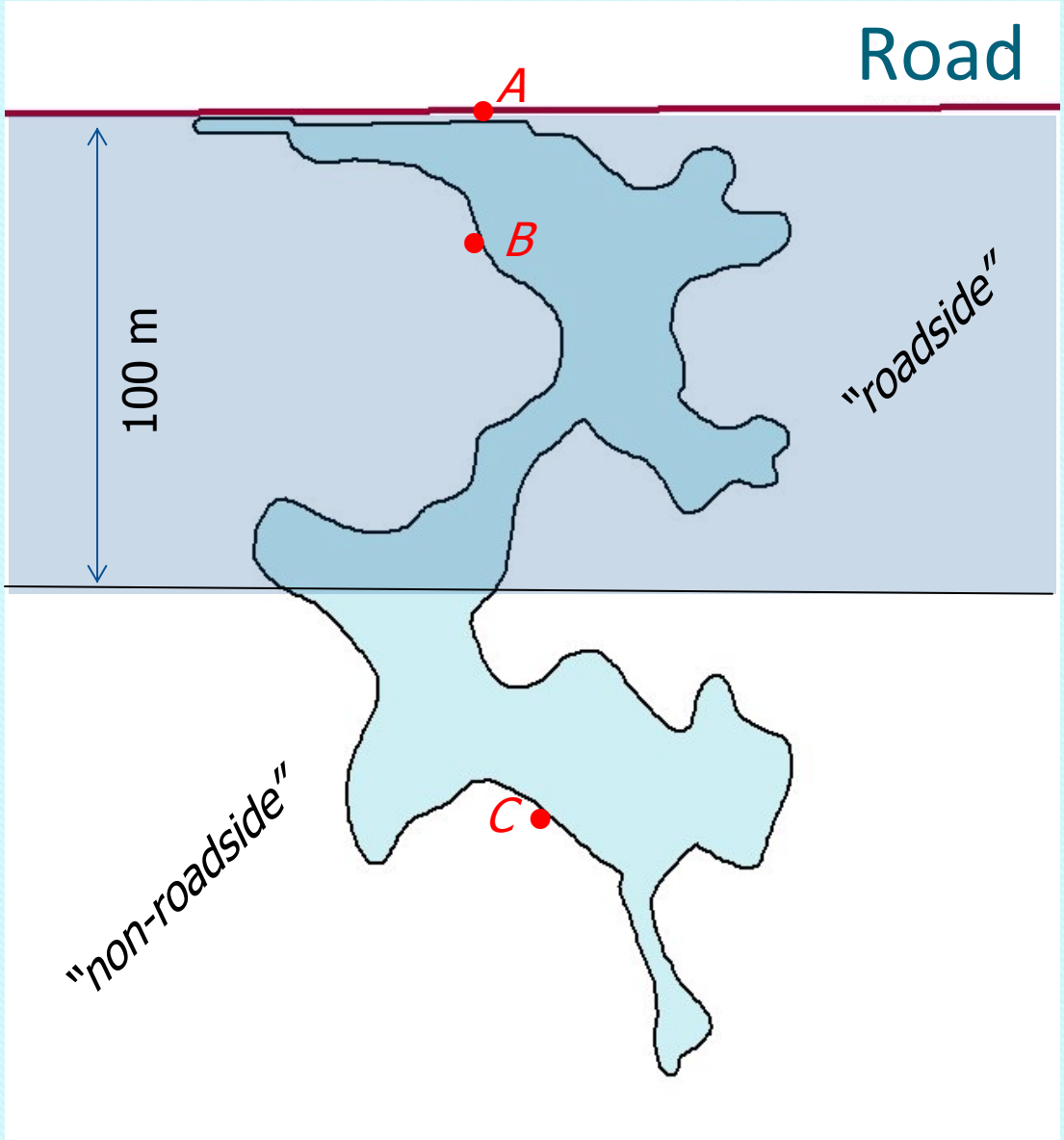


USGS

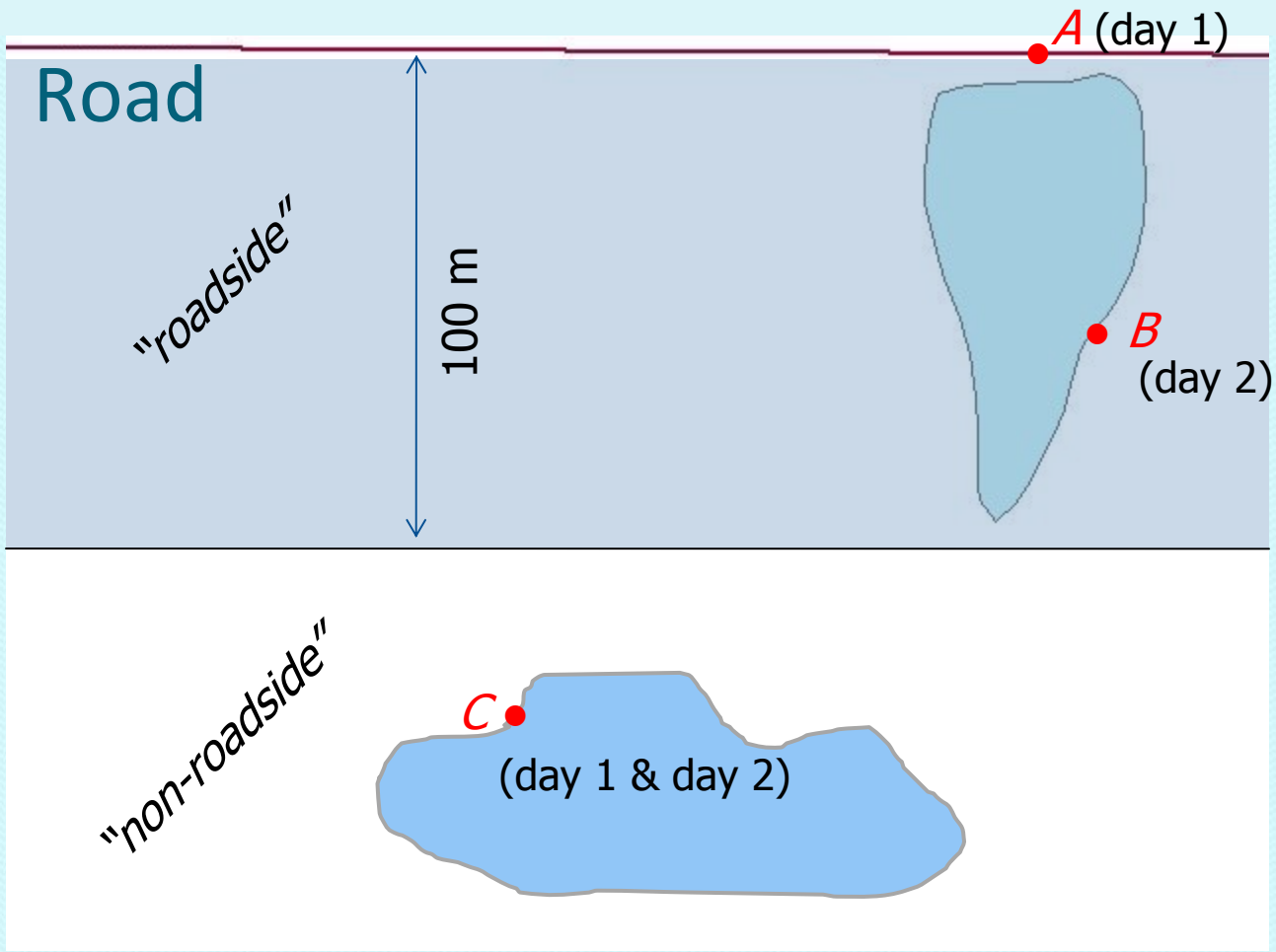
Are marsh birds more (or less) abundant near roads than far from roads?



USGS


Road
A
B
C
100 m
"roadside"
"non-roadside"

Surveys conducted on 2 consecutive days



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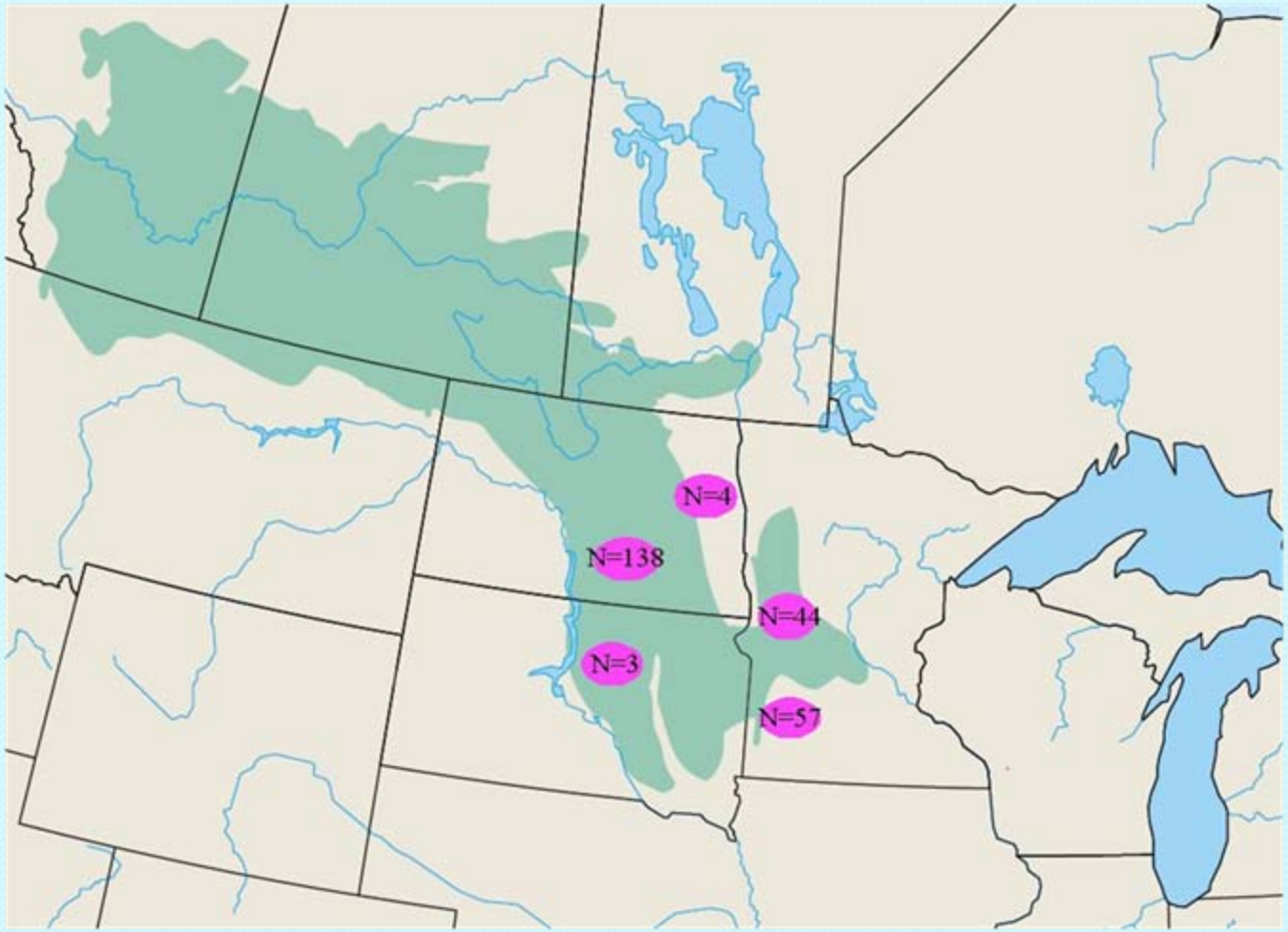
2008 and 2009 Study Areas



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Study Area Pairs

Study Areas	2008	2009	ALL
MN North	44	0	44
MN South	0	57	57
ND North	4	0	4
ND South	74	64	138
South Dakota	3	0	3
ALL	125	121	246

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Basin Regimes

	2008	2009
Lake/Lake	8	7
Semipermanent/Semipermanent	75	77
Seasonal/Seasonal	39	36
Temporary/Temporary	3	1
ALL	125	121
Lake/Semi	4	1
Lake/Seas	1	
Semi/Seas	13	5
Semi/Temp	1	
Seas/Temp	2	1
All Mismatched Pairs	21	7

Mismatched Pairs

	2008	2009
Lake/Semi	4	1
Lake/Seas	1	
Semi/Seas	13	5
Semi/Temp	1	
Seas/Temp	2	1
ALL	21	7

Survey Protocol (Conway et al.)

- 10-min point counts at each survey location
  - 5-minute passive period
  - 5 1-minute active call-broadcast periods
    - 30 sec broadcast + 30 sec listening period

      Least bittern, Virginia rail, American bittern, Pied-billed grebe, Sora
    - Recorded all individuals seen or heard and distance from observer
- Surveys conducted pre-dawn to 9:00 AM
- 3 survey periods during early May to early July

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"Use of trade names does not imply endorsement by the U.S. Government"

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Detections: 2008

Species	No. Individuals	No. Study Pairs
American bittern	193	74
American coot	2942	96
Black tern	263	47
Least bittern	14	12
Pied-billed grebe	617	101
Sora	1277	122
Virginia rail	424	106

USGS

Detections: 2009

Species	No. Individuals	No. Study Pairs
American bittern	144	47
American coot	1049	72
Black tern	161	46
Least bittern	20	8
Pied-billed grebe	648	96
Sora	958	107
Virginia rail	317	81

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Detections: ALL

	2008		2009		ALL	
Species	No. Individuals	No. Study Pairs	No. Individuals	No. Study Pairs	No. Individuals	No. Study Pairs
American bittern	193	74	144	47	337	121
American coot	2942	96	1049	72	3991	168
Black tern	263	47	161	46	424	93
Least bittern	14	12	20	8	34	20
Pied-billed grebe	617	101	648	96	1265	197
Sora	1277	122	958	107	2235	229
Virginia rail	424	106	317	81	741	187

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Detections: Within detection radius

	Survey periods in 2008		
Species Detection Radius	**1 (6 May – 4 June)**	**2 (28 May – 26 June)**	**3 (16 June – 21 July)**
AMBI 250 (m)	71 (39%)	58 (32%)	54 (30%)
AMCO 300 (m)	1874 (67%	486 (17%)	455 (16%)
BLTE 150 (m)	39 (16%)	93 (38%)	116 (47%)
LEBI 150 (m)	4 (33%)	4 (33%)	4 (33%)
PBGR 300 (m)	189 (31%)	192 (33%)	212 (36%)
SORA 150 (m)	588 (48%)	299 (25%)	326 (27%)
VIRA 100 (m)	149 (36%)	112 (27%	151 (37%)

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Detections: Within detection radius

	Survey periods in 2009		
Species Detection Radius	**1 (5 May—2 June)**	**2 (26 May—23 June)**	**3 (17 June—10 July)**
AMBI 300 (m)	51 (39%)	36 (27%)	44 (34%)
AMCO 300 (m)	404 (39%)	284 (28%)	341 (33%)
BLTE 200 (m)	14 (9%)	52 (35%)	82 (55%)
LEBI 300 (m)	7 (44%)	6 (37%)	3 (19%)
PBGR 300 (m)	190 (33%)	200 (34%)	195 (33%)
SORA 150 (m)	280 (33%)	272 (32%)	288 (34%)
VIRA 100 (m)	78 (27%)	87 (30%)	121 (42%)

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Results (preliminary)

- Are marsh birds in roadside habitat more (or less) detectable from the road than from off-road survey locations?

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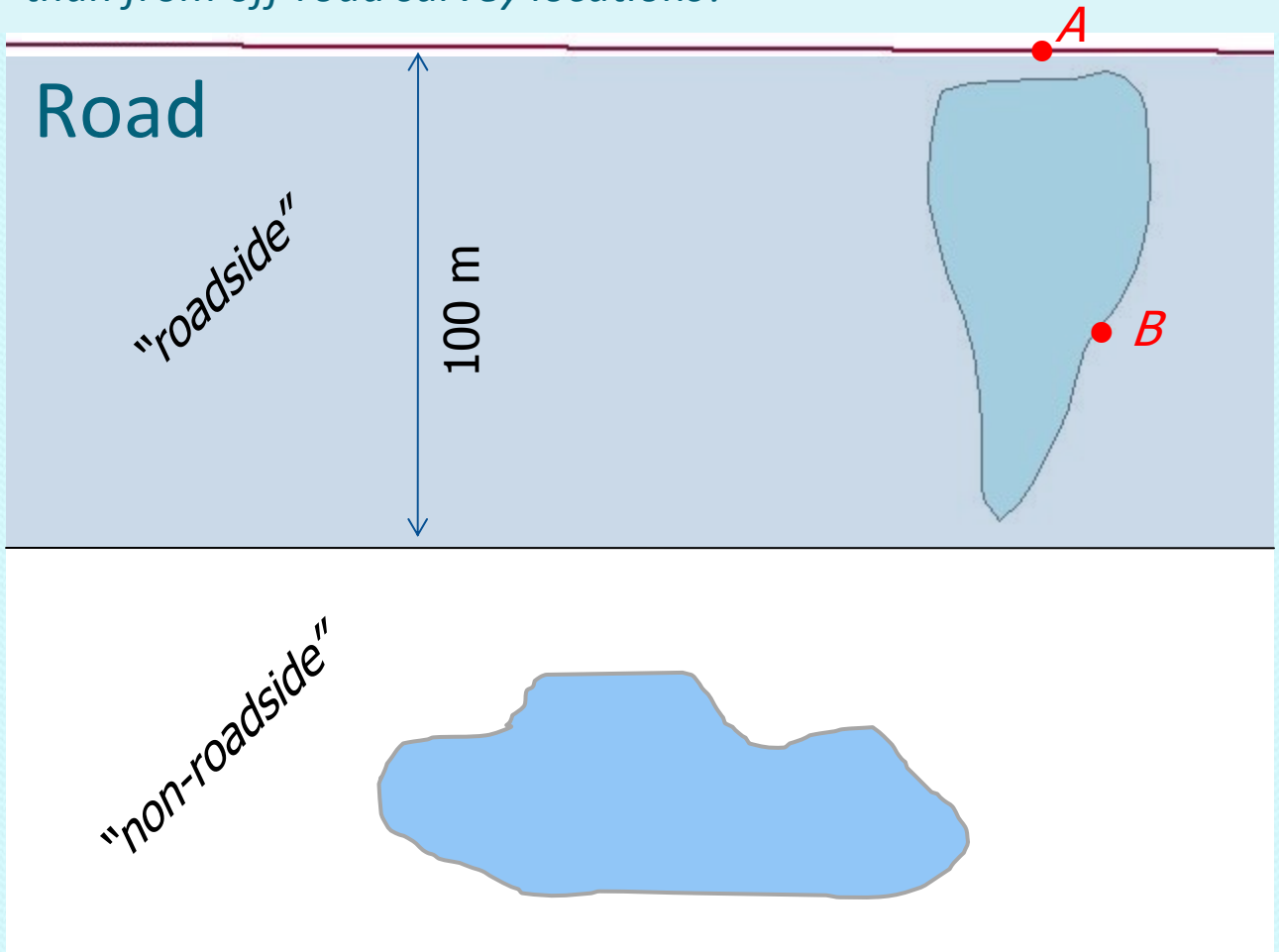
Are marsh birds more (or less) detectable from roadsides than from off-road survey locations?



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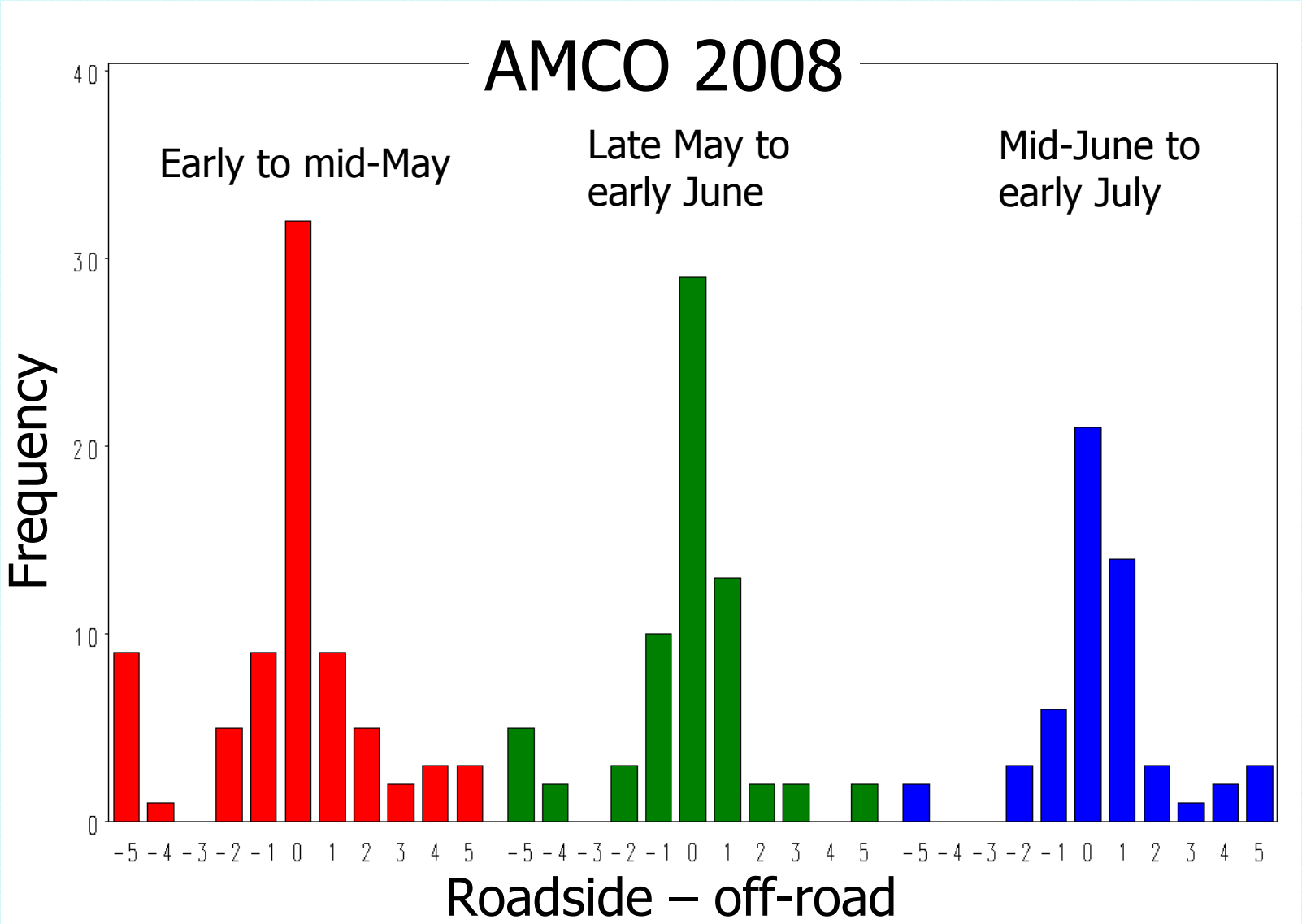
American Coot


AMCO 2008
Early to mid-May
Late May to early June
Mid-June to early July
Frequency
0
10
20
30
40
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

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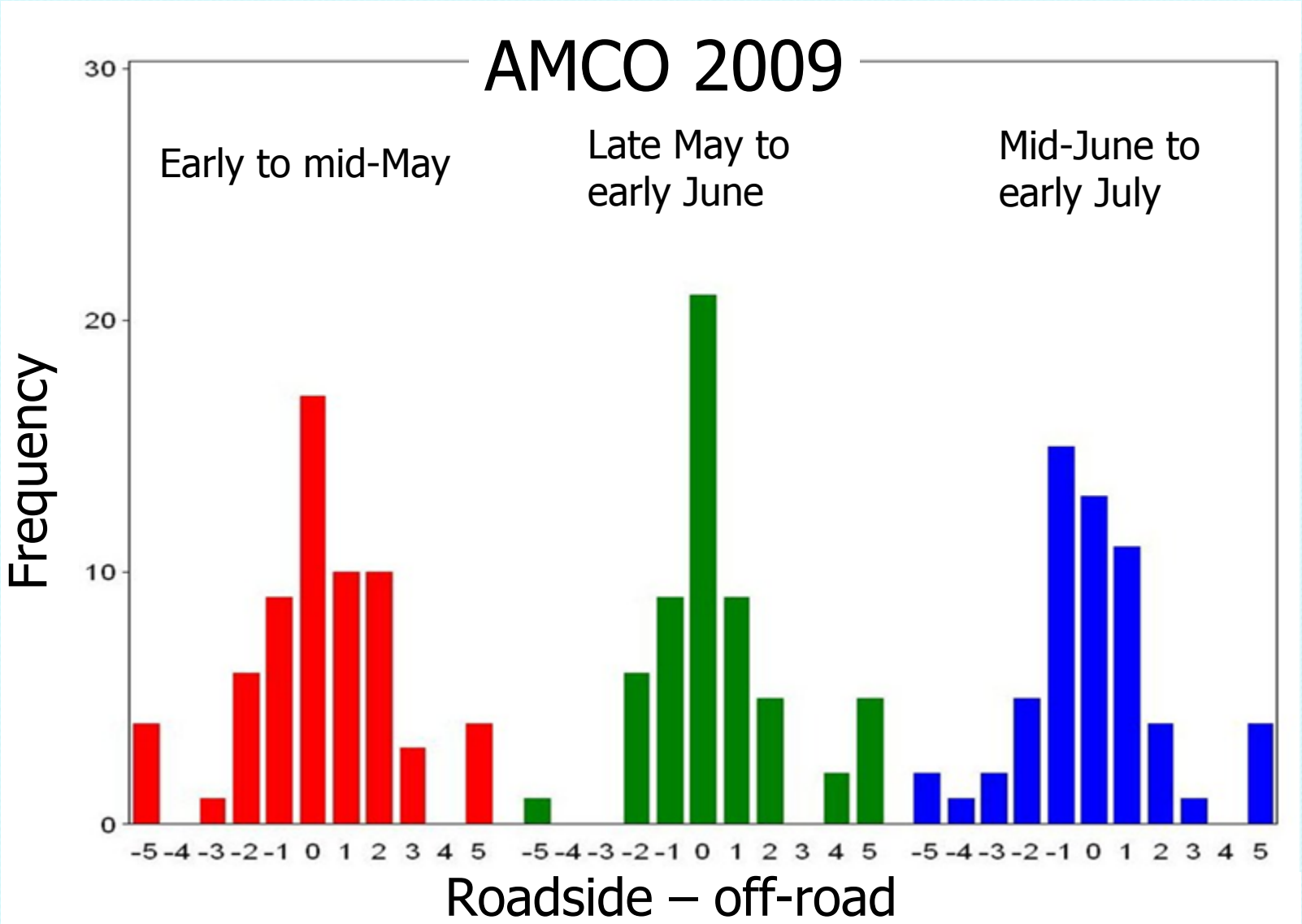
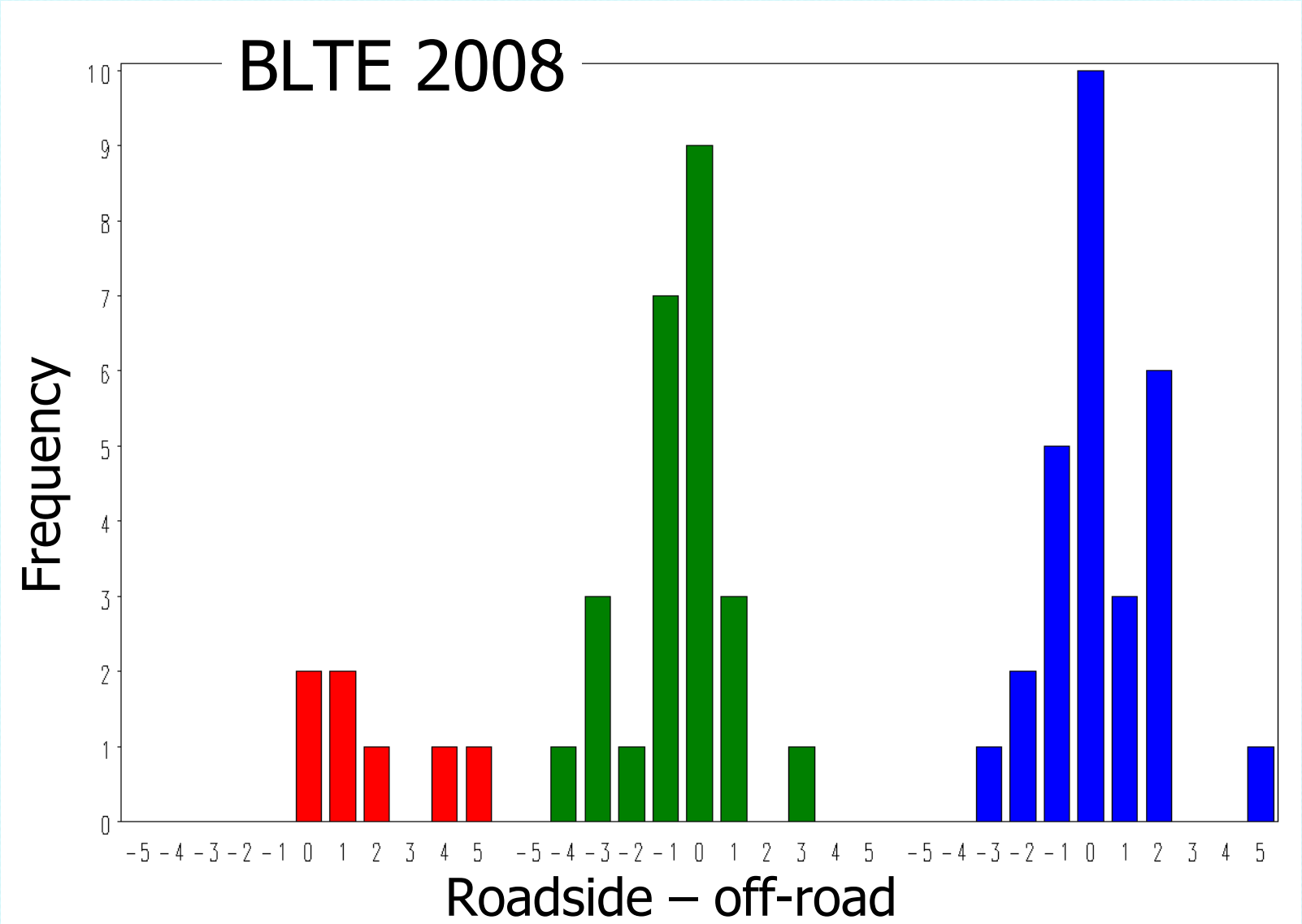

AMCO 2009
Early to mid-May
Late May to early June
Mid-June to early July
Frequency
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

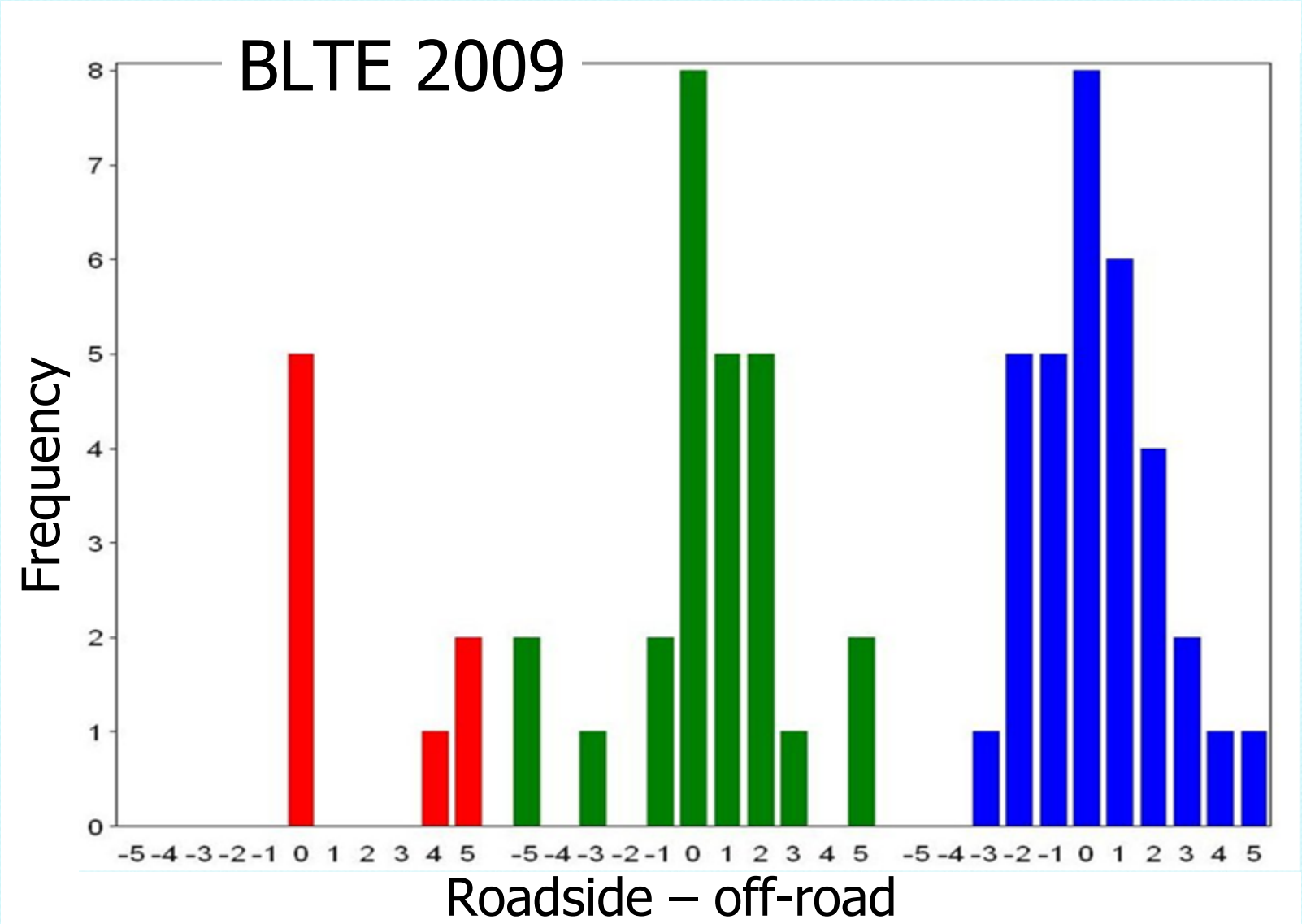
USGS

Black Tern

Photo by E. Wilson

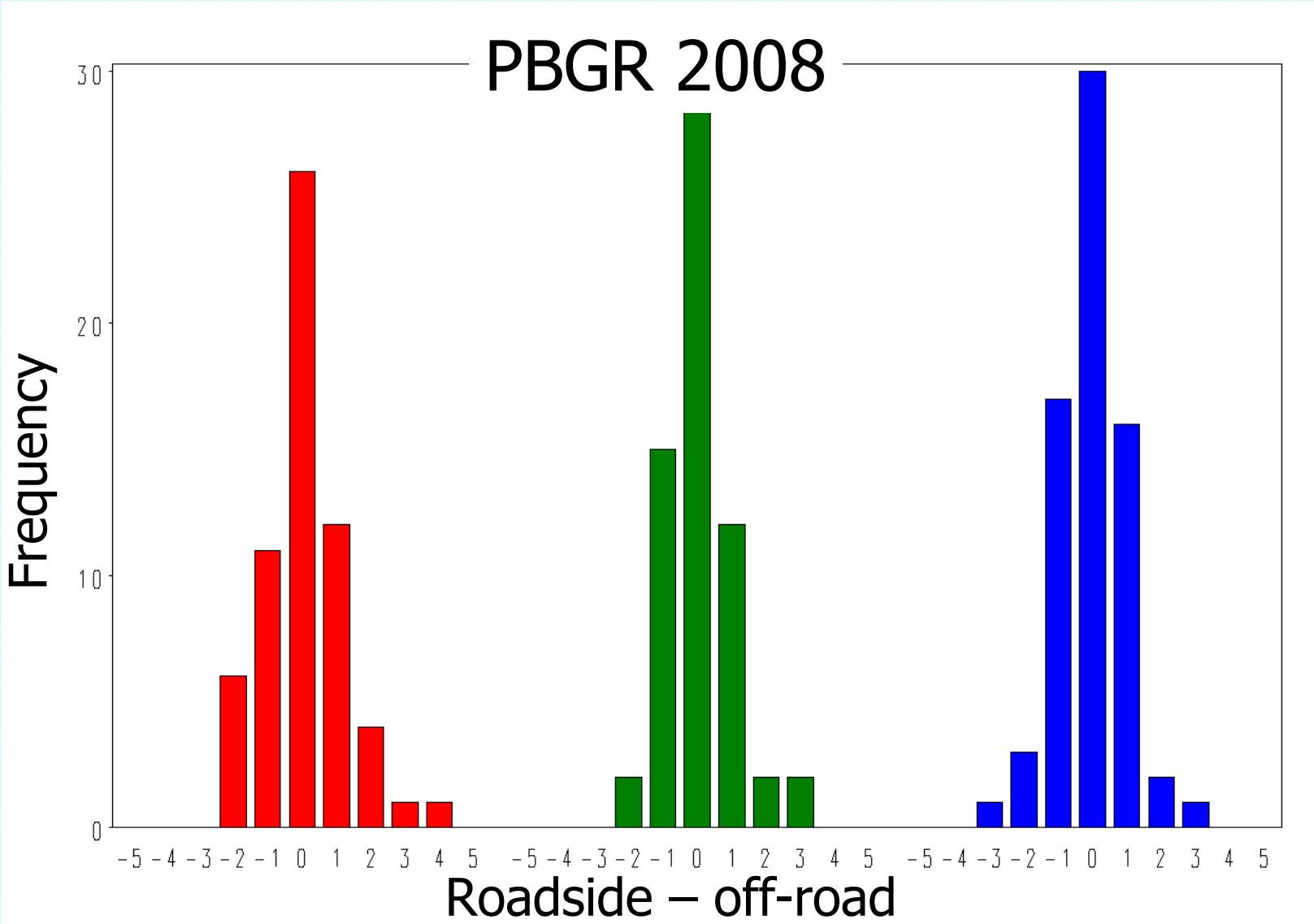

BLTE 2008
Frequency
0
1
2
3
4
5
6
7
8
9
10
-5 -4 -3 -2 -1 0 1 2 3 4 5 -5 -4 -3 -2 -1 0 1 2 3 4 5 -5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

USGS

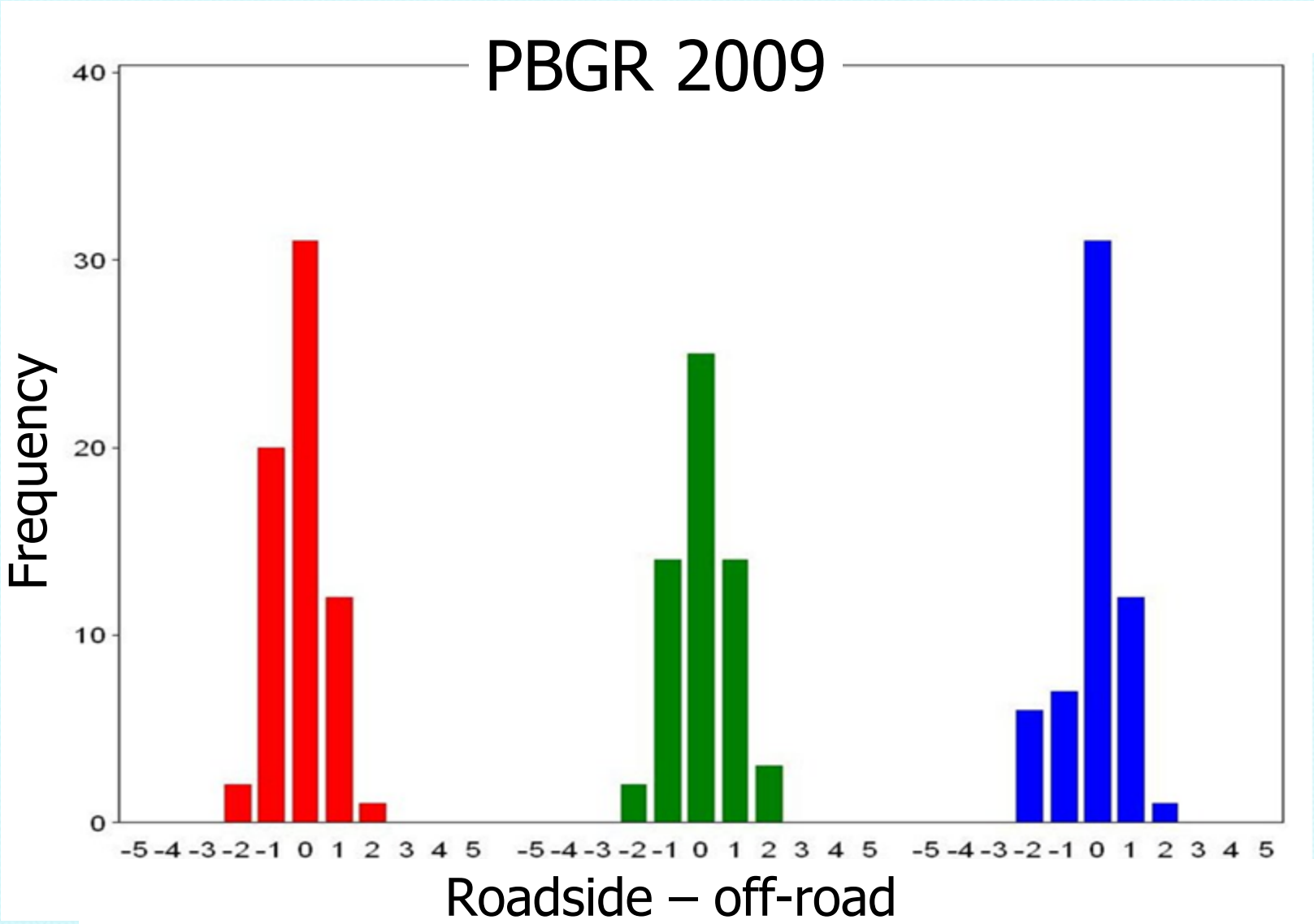

BLTE 2009
Frequency
0
1
2
3
4
5
6
7
8
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

USGS

Pied-billed Grebe

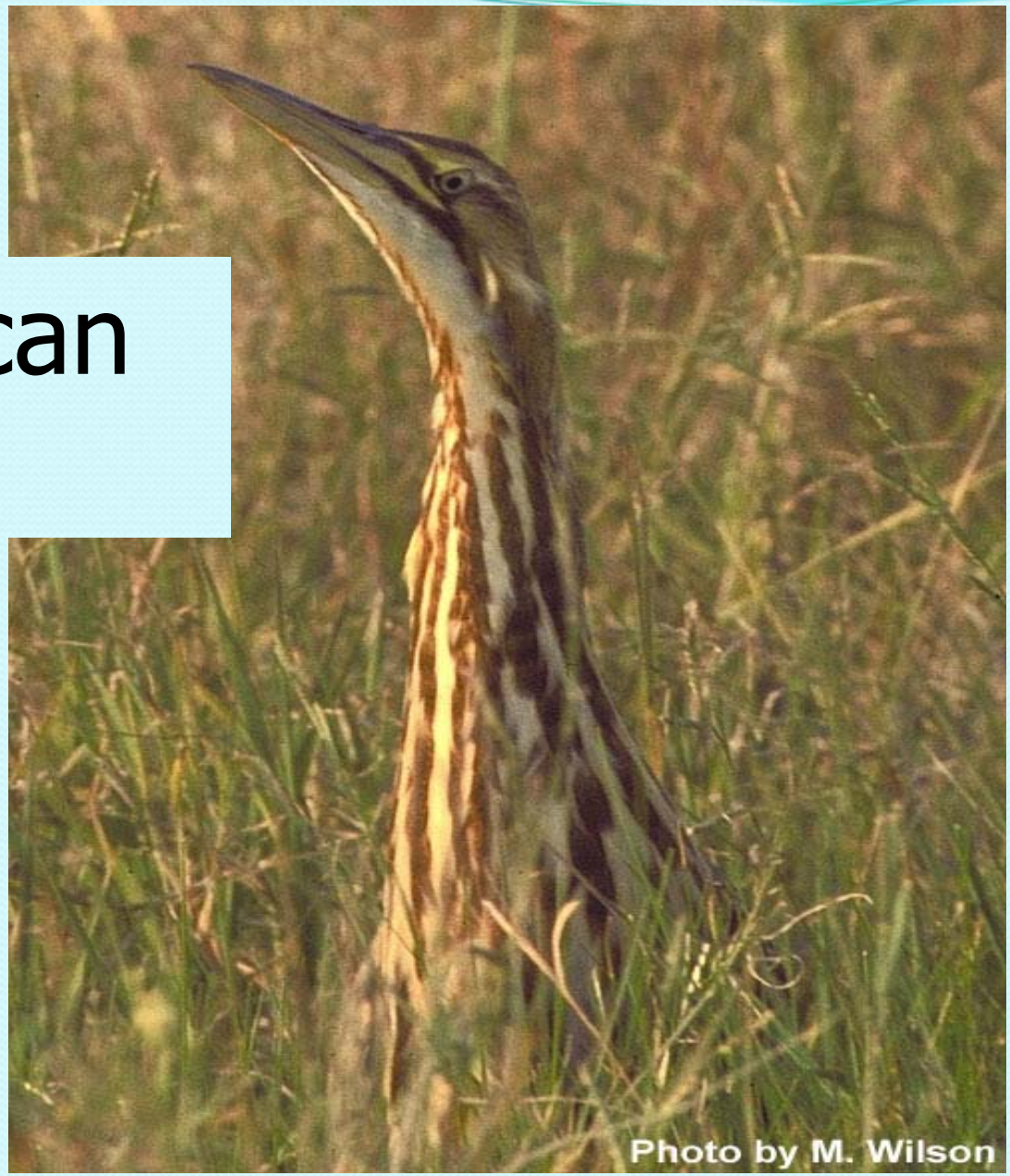

PBGR 2008
Frequency
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

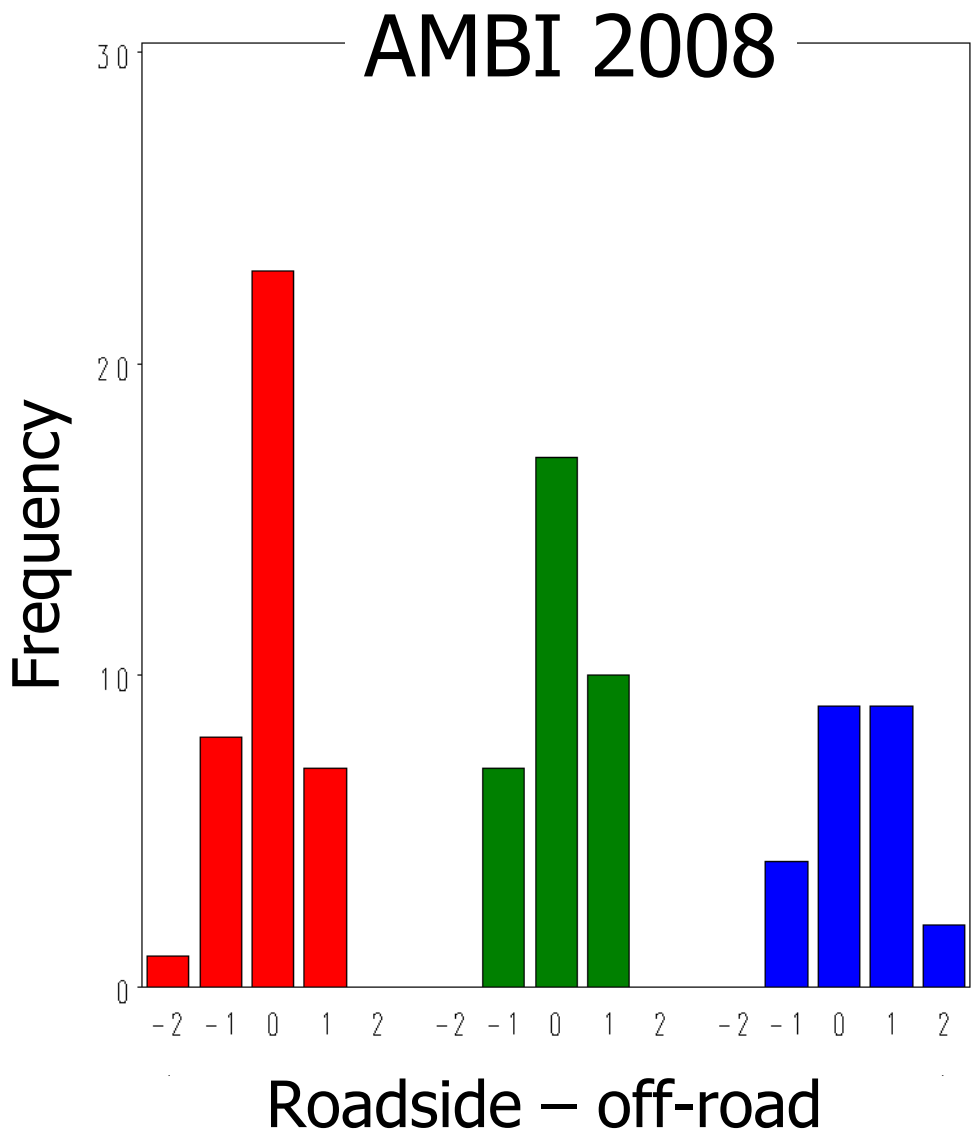
USGS


PBGR 2009
Frequency
40
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

USGS

American Bittern




AMBI 2008
Frequency
30
20
10
0
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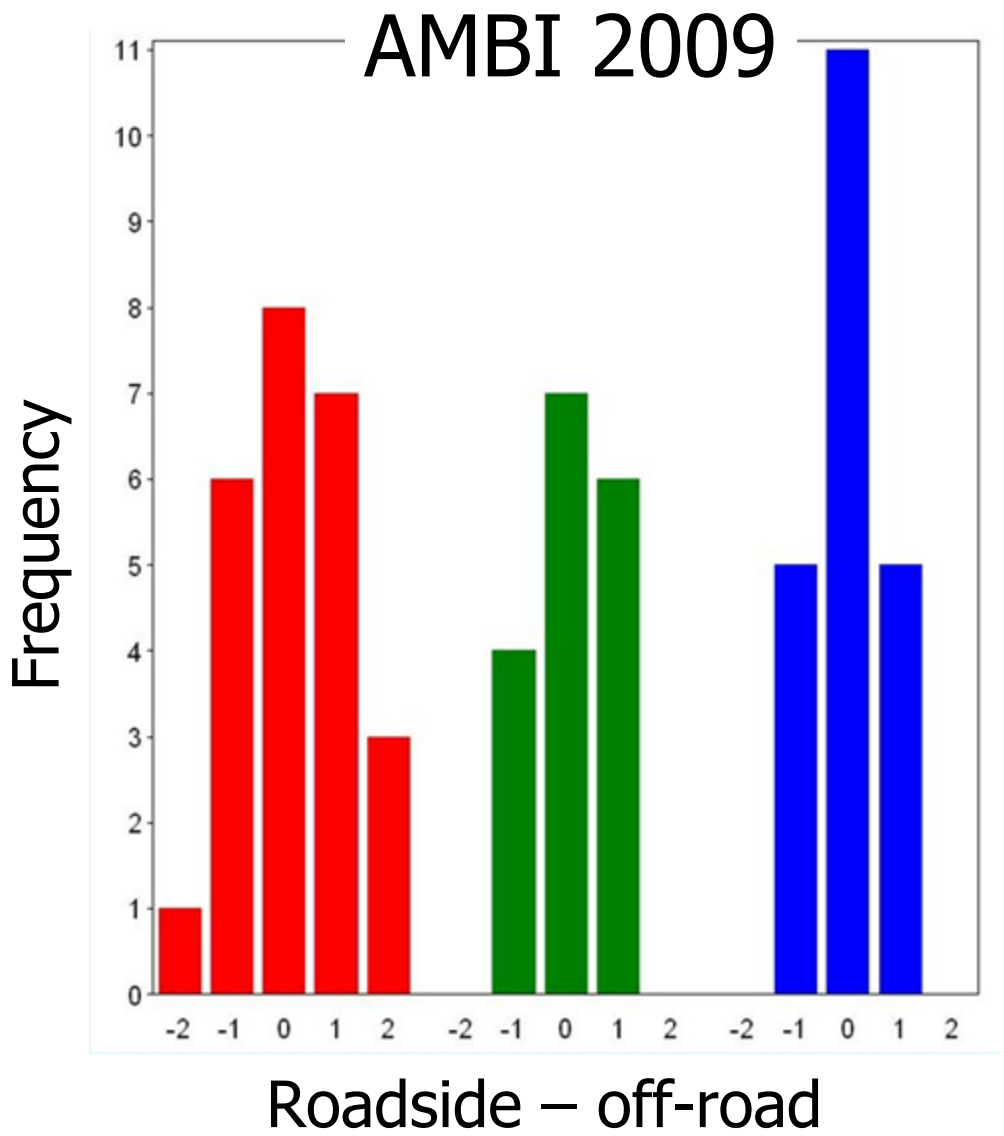
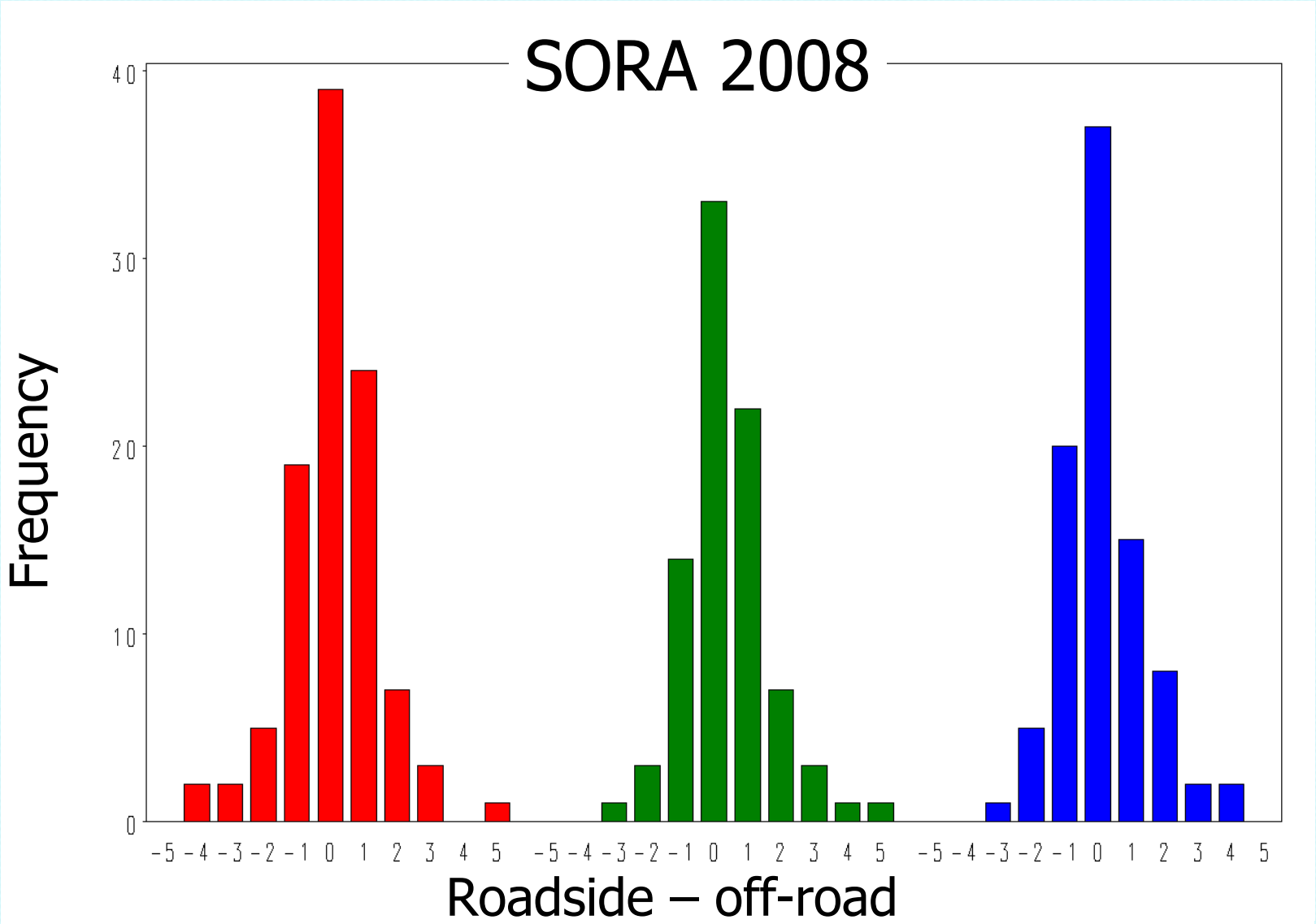
Roadside – off-road

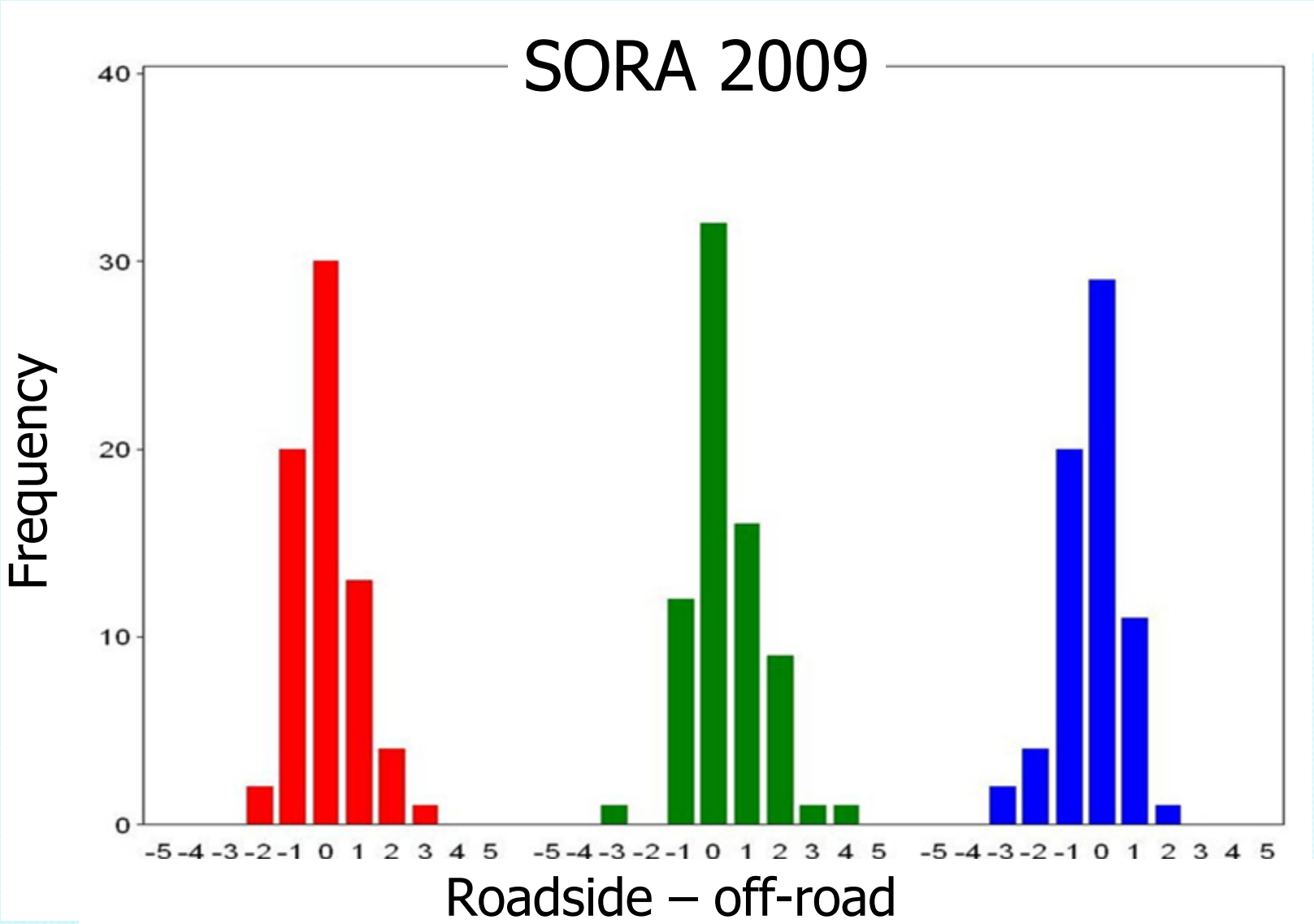

AMBI 2009
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
-2 -1 0 1 2 -2 -1 0 1 2 -2 -1 0 1 2
Roadside – off-road

USGS

Sora
Photo by R. Bohn


SORA 2008
Frequency
40
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

USGS


SORA 2009
Frequency
40
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
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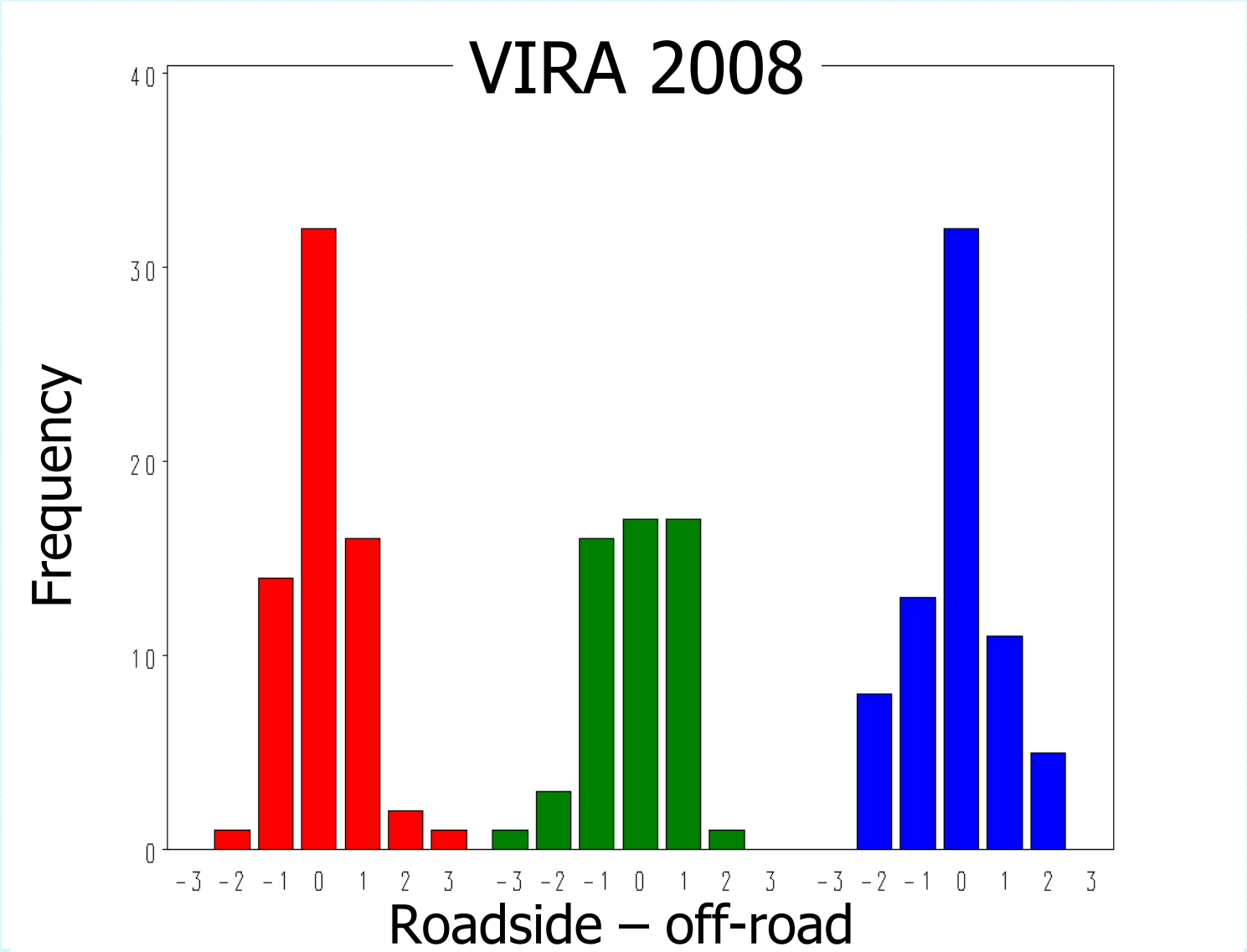
-5 -4 -3 -2 -1 0 1 2 3 4 5
Roadside – off-road

USGS

Virginia Rail


VIRA 2008
Frequency
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30
20
10
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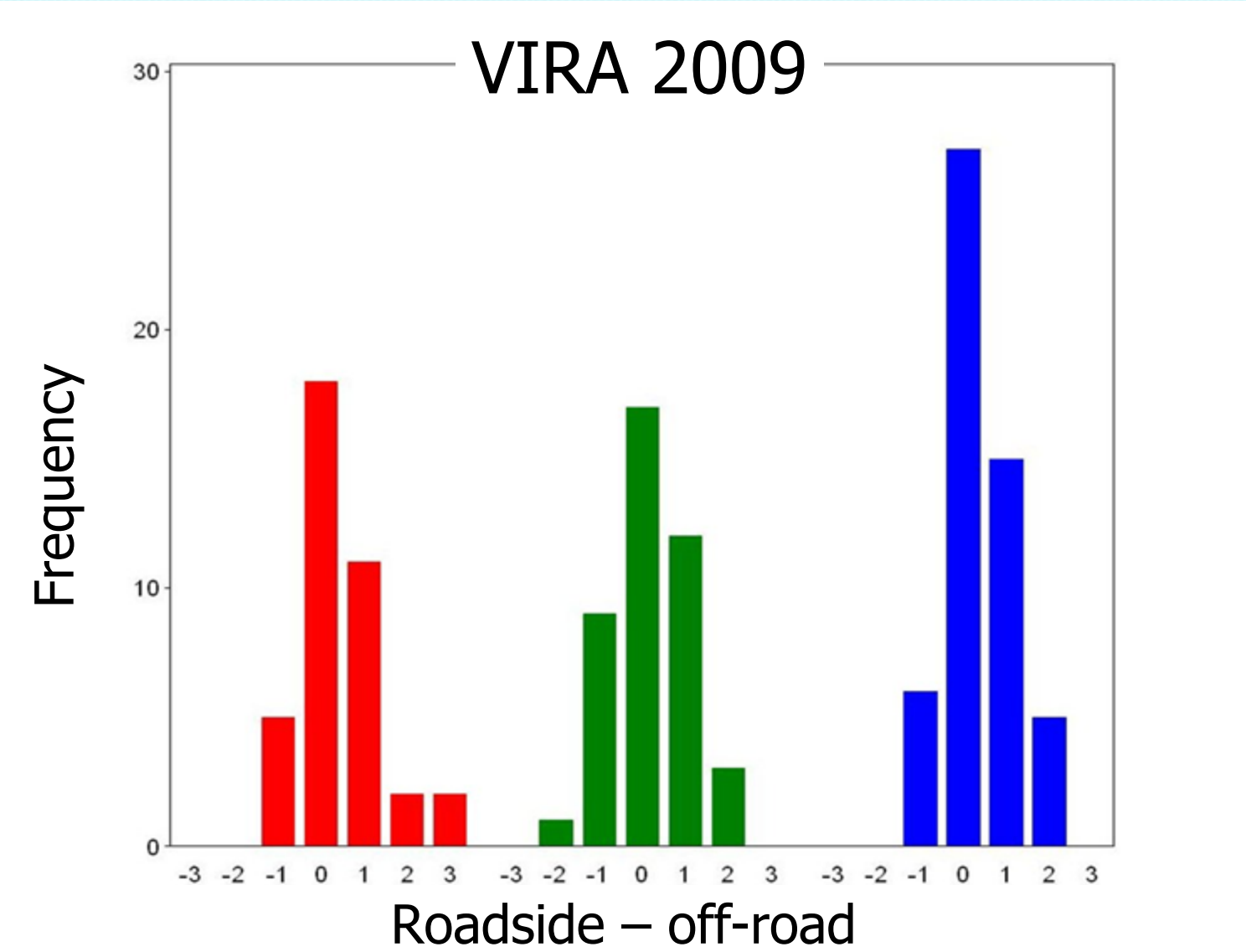
Roadside – off-road

USGS

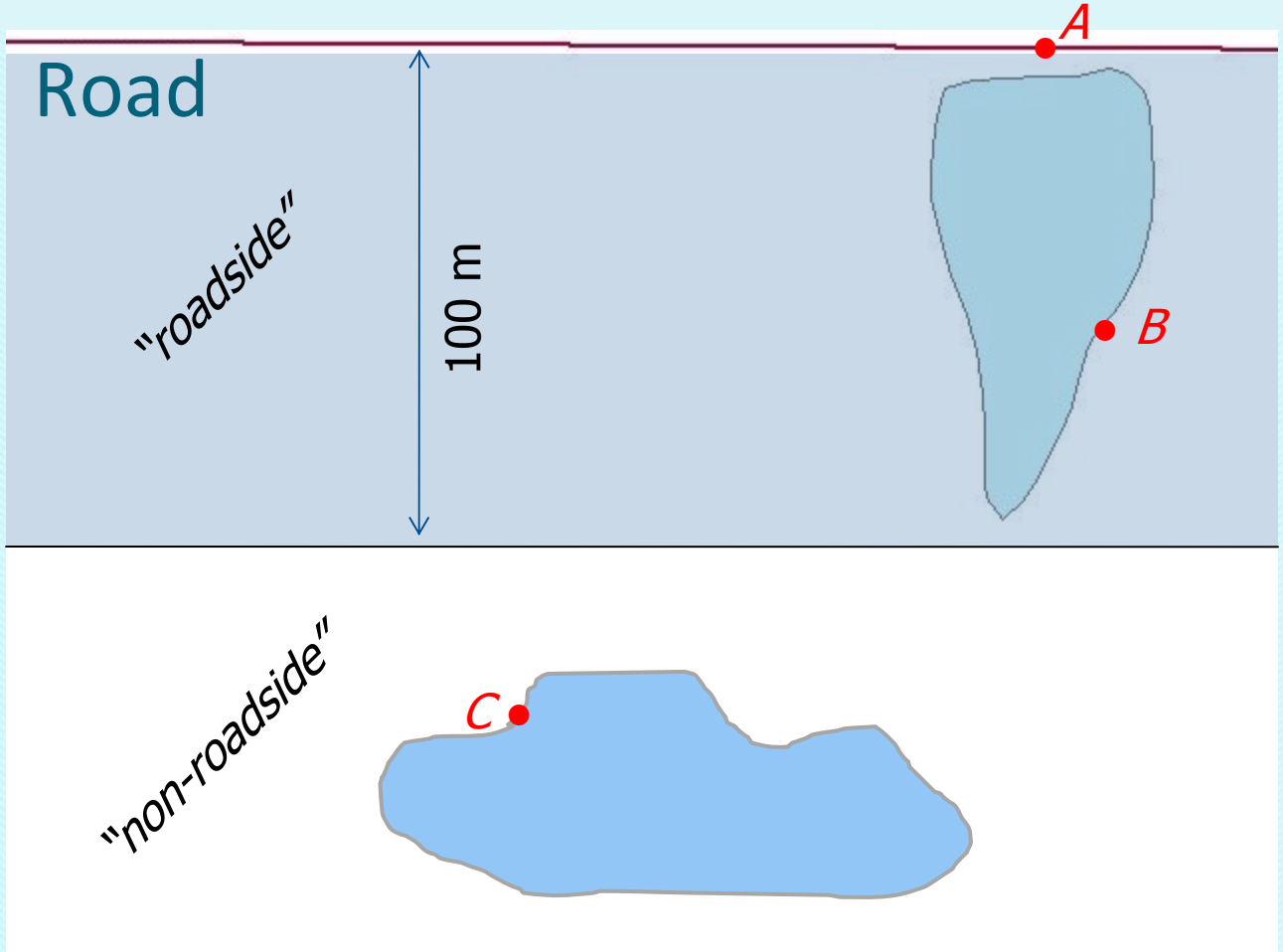

VIRA 2009
Frequency
30
20
10
0
-3 -2 -1 0 1 2 3 -3 -2 -1 0 1 2 3 -3 -2 -1 0 1 2 3
Roadside – off-road

USGS

Are marsh birds more (or less) abundant near roads than far from roads?

USGS

Are marsh birds more (or less) abundant near roads than far from roads?



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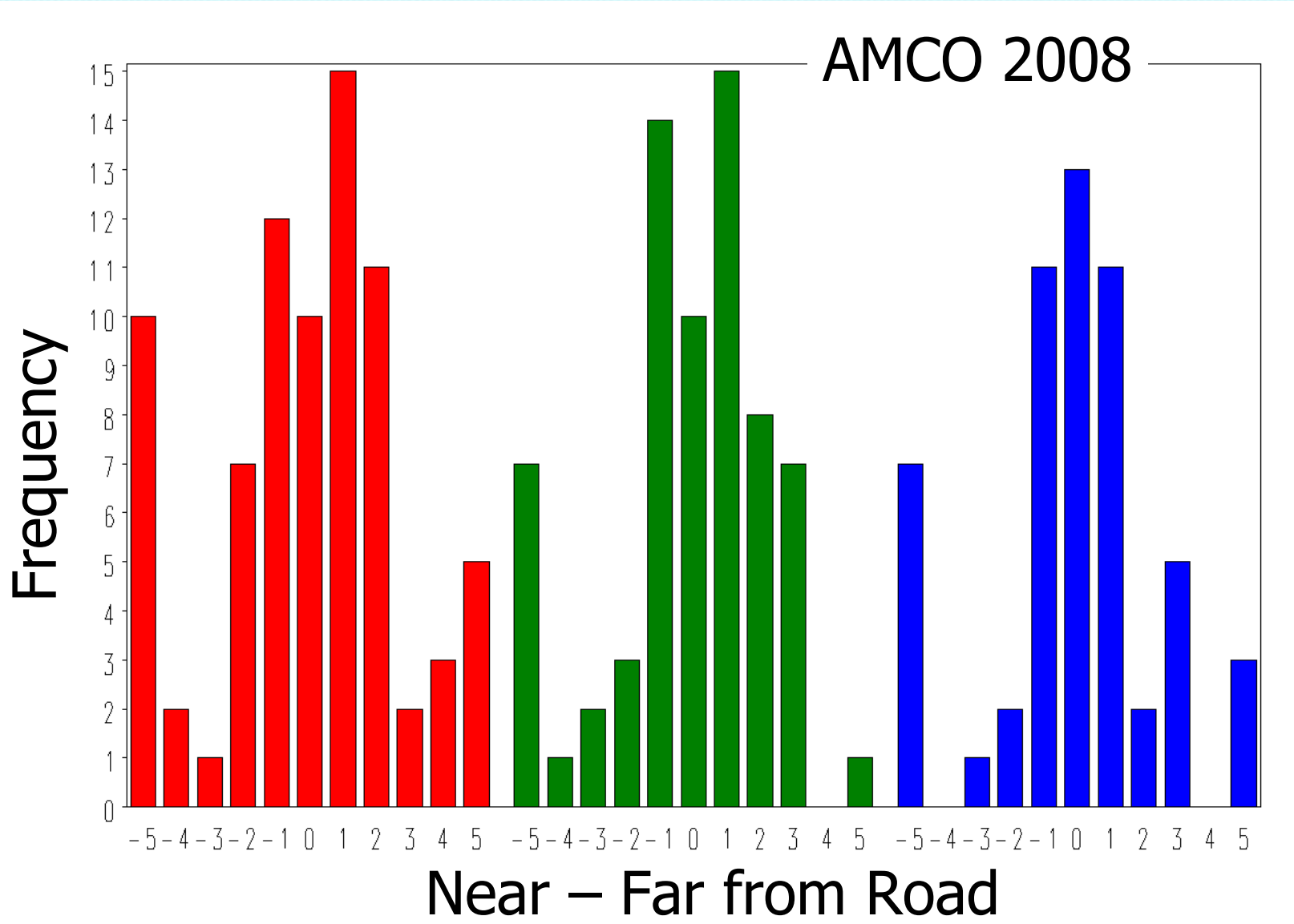
AMCO 2008
Frequency
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14
15
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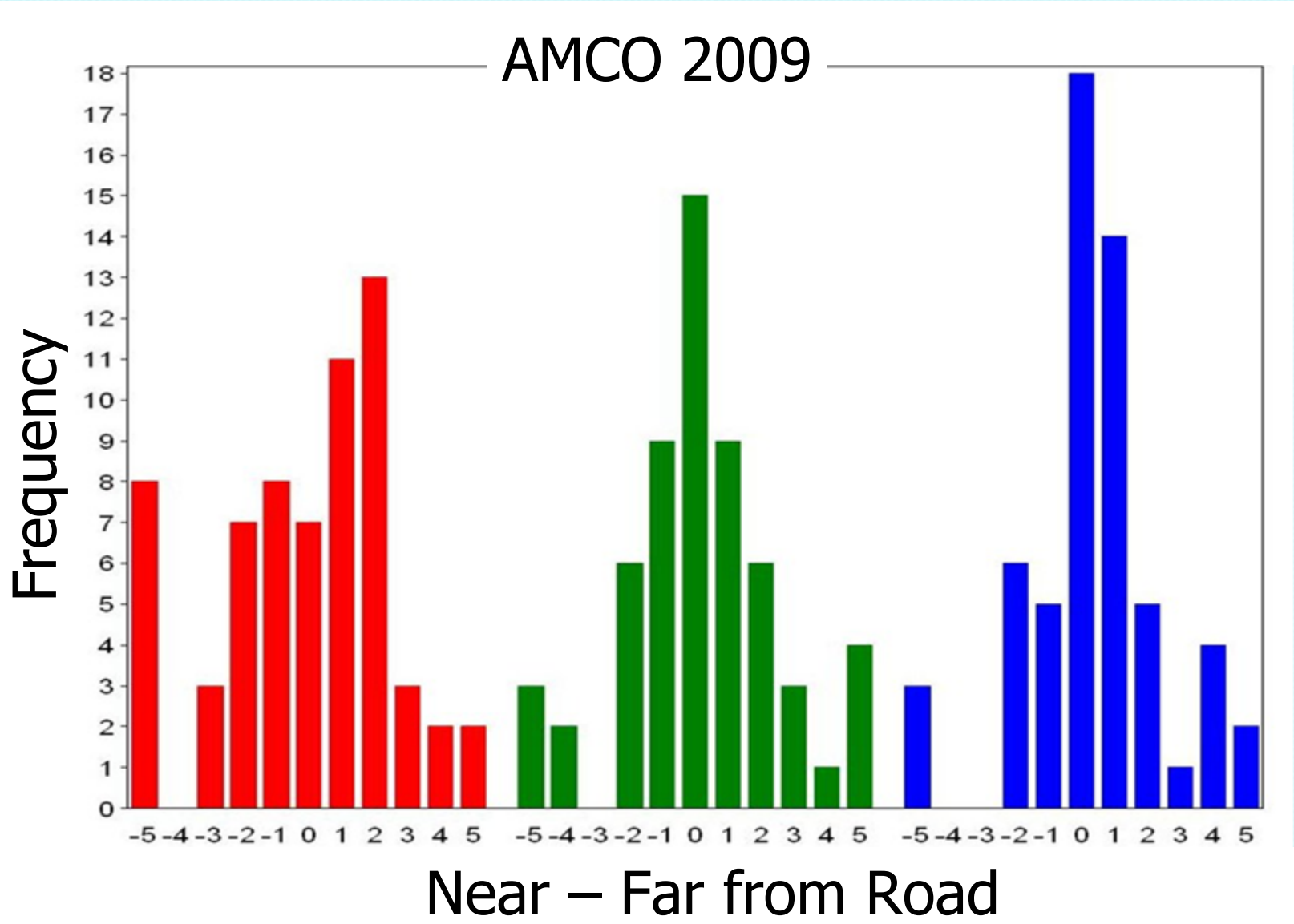
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


AMCO 2009
Frequency
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14
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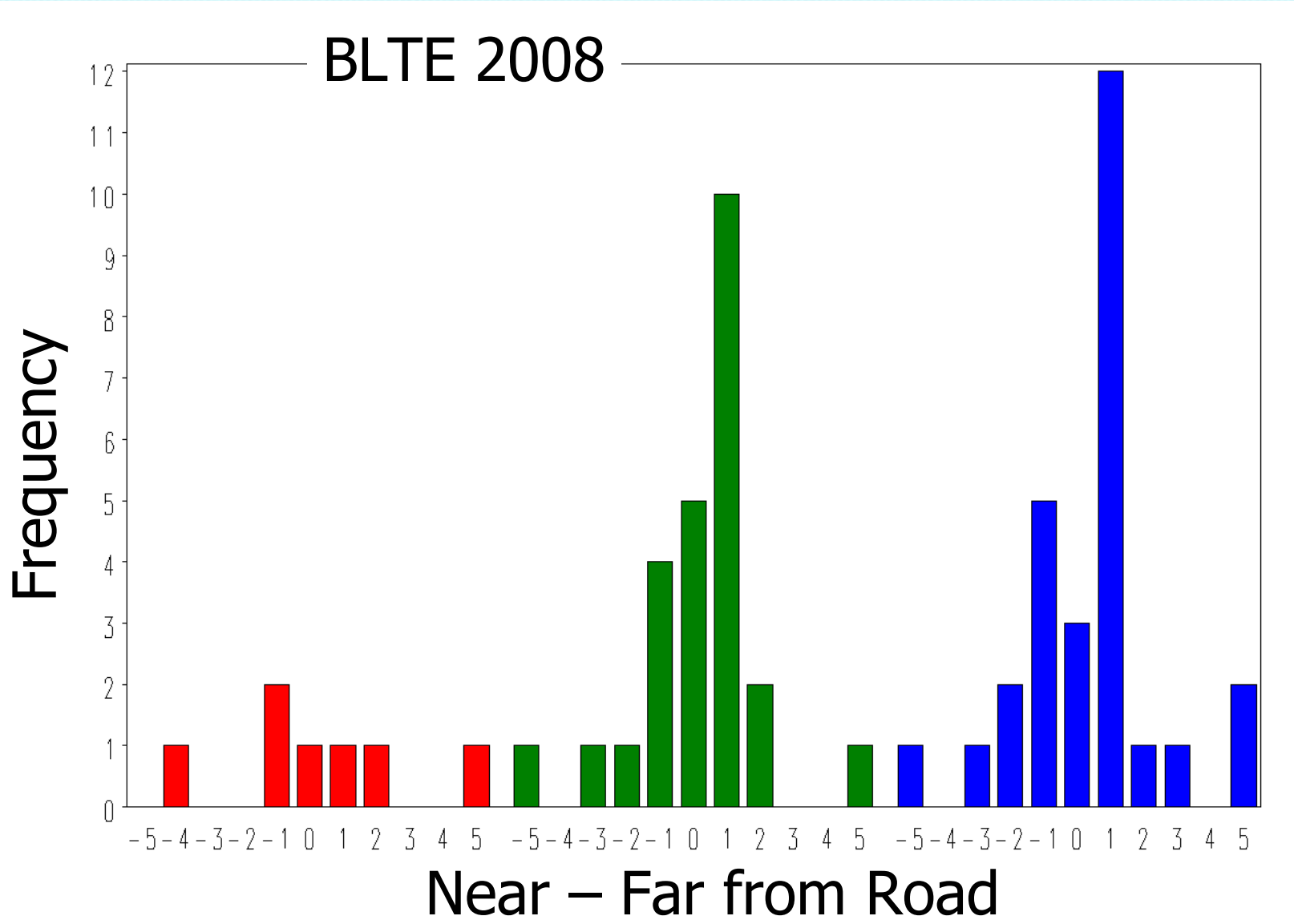
16
17
18
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


BLTE 2008
Frequency
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1
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3
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10
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12
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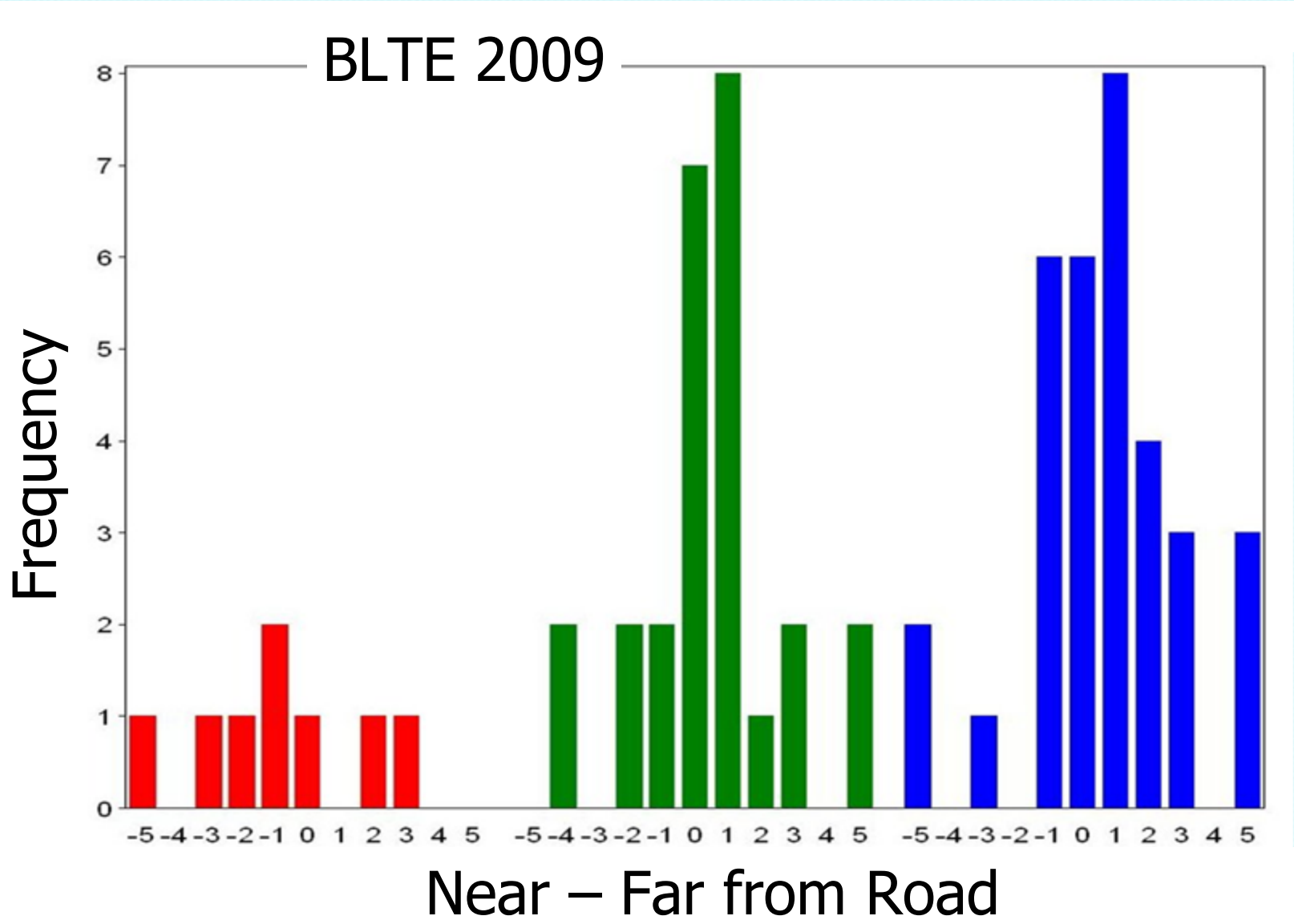
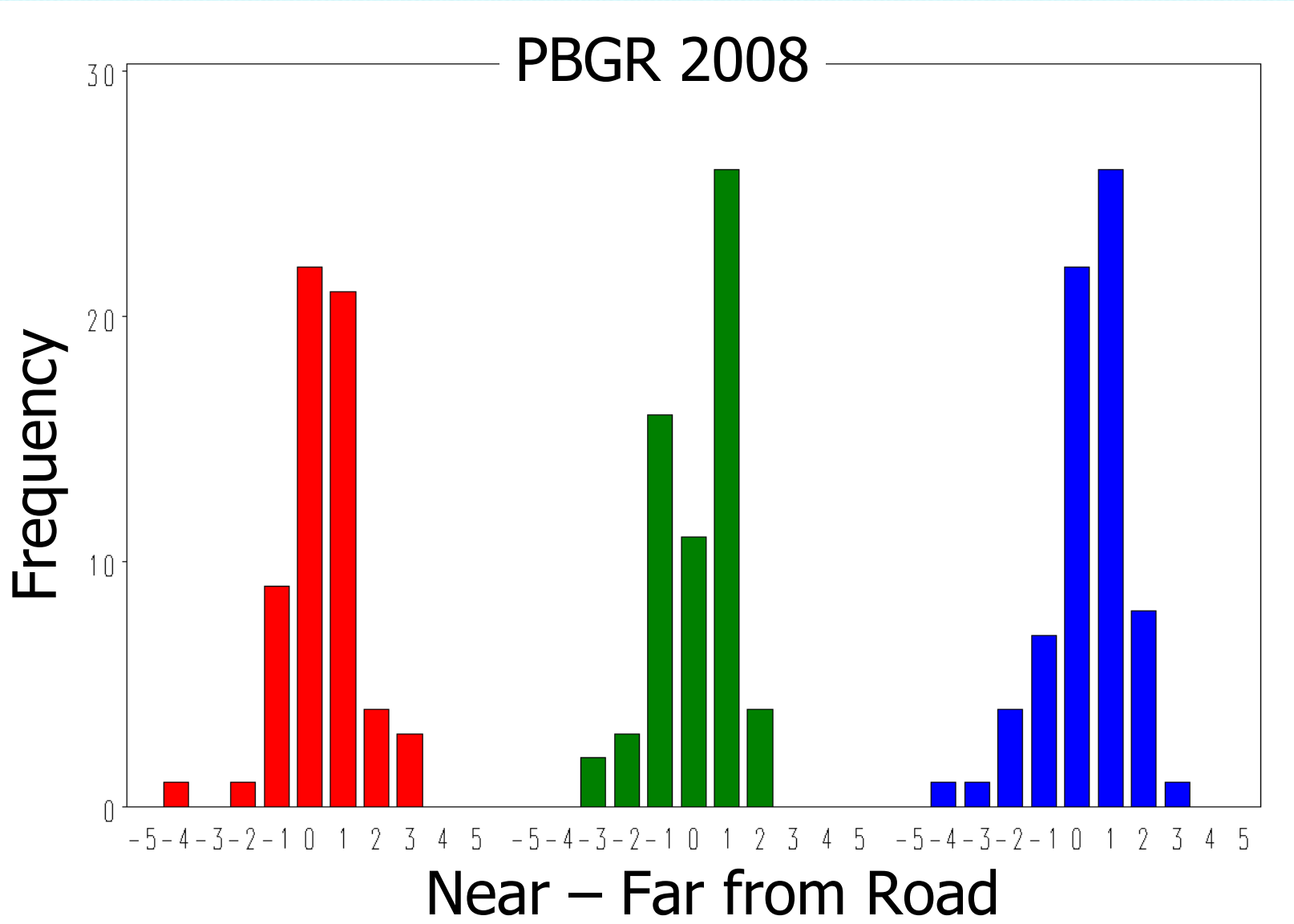
Near – Far from Road

USGS


BLTE 2009
Frequency
0
1
2
3
4
5
6
7
8
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


PBGR 2008
Frequency
30
20
10
0
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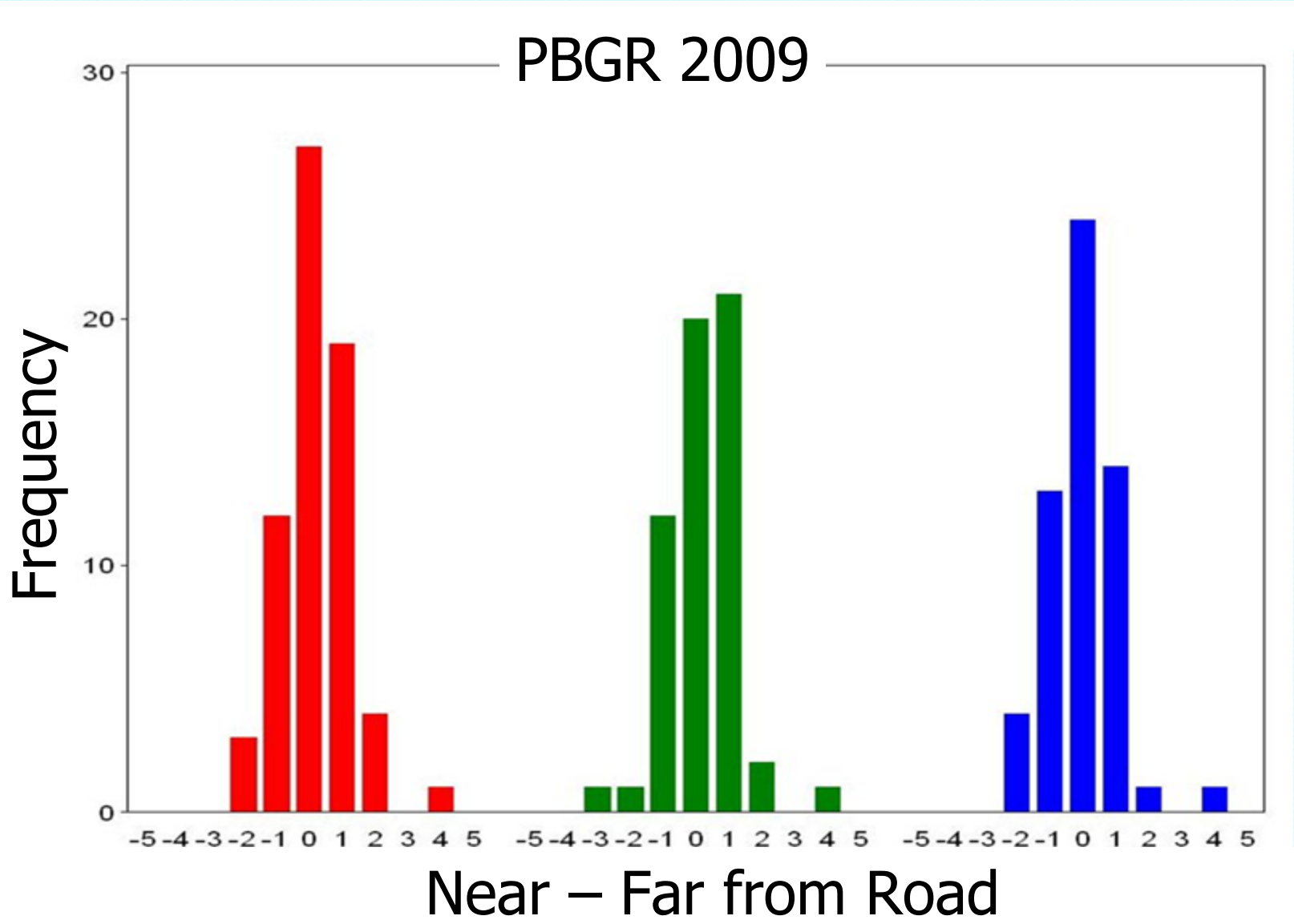
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


PBGR 2009
Frequency
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20
10
0
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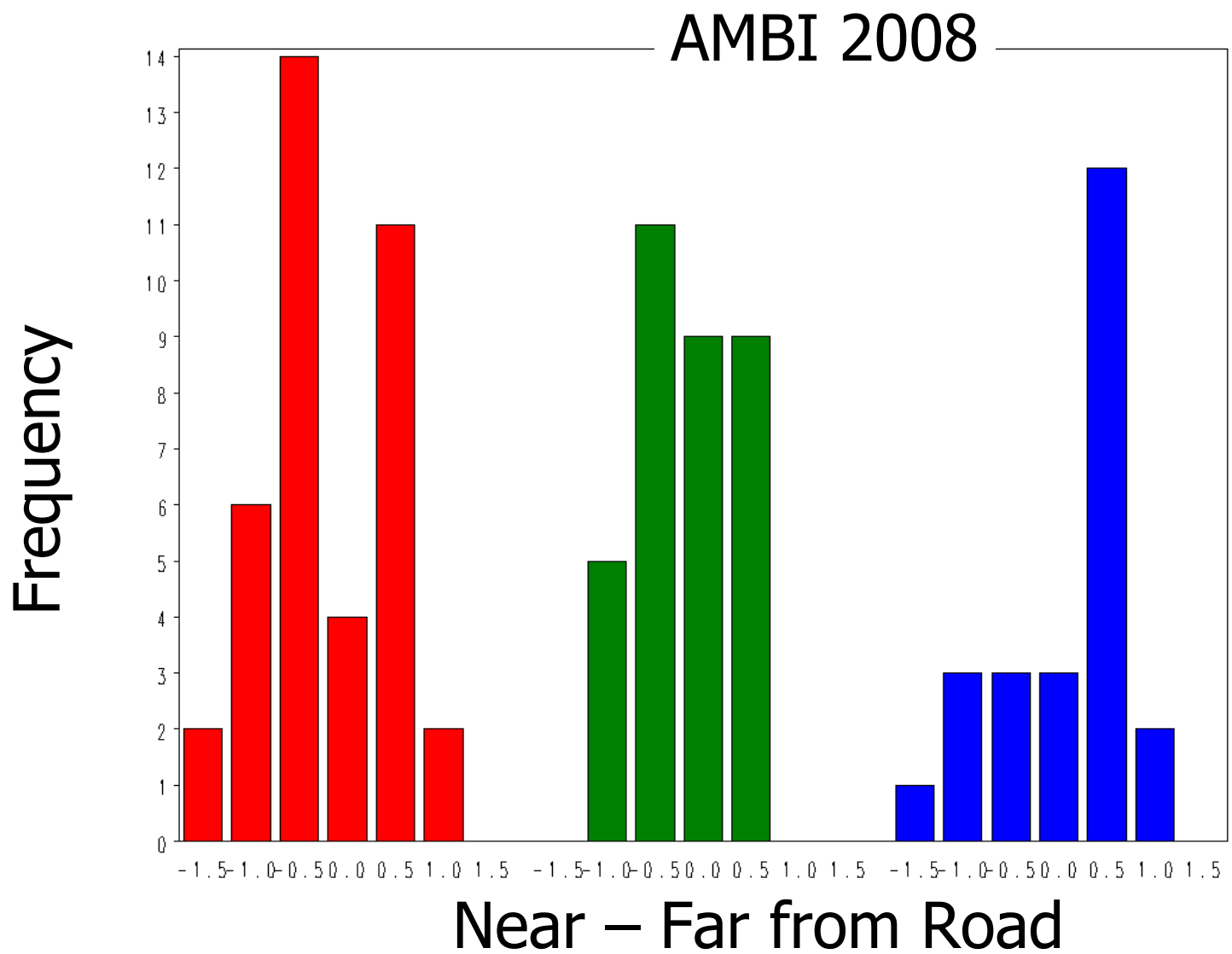
-5 -4 -3 -2 -1 0 1 2 3 4 5
-5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


AMBI 2008
Frequency
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2
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4
5
6
7
8
9
10
11
12
13
14
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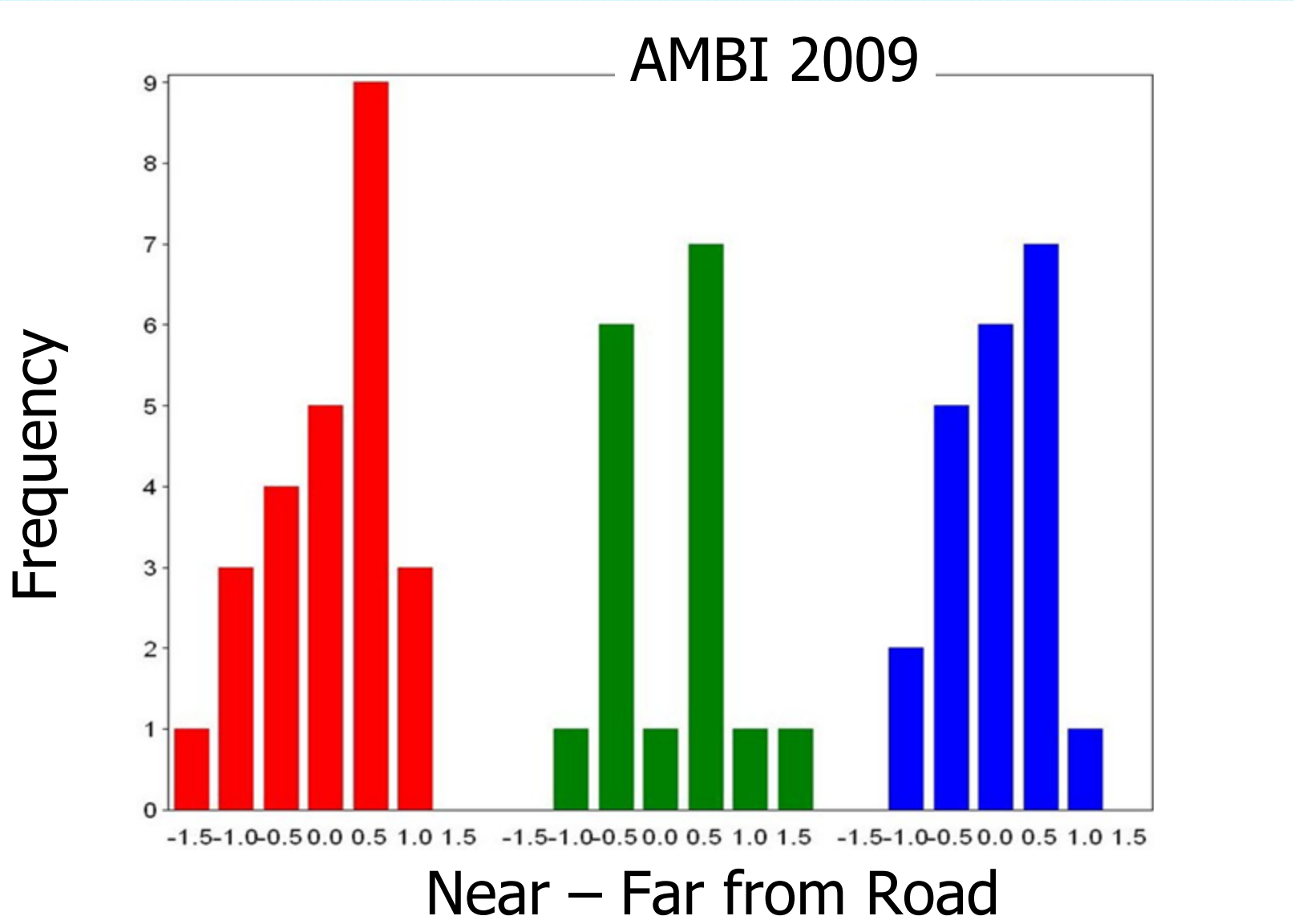
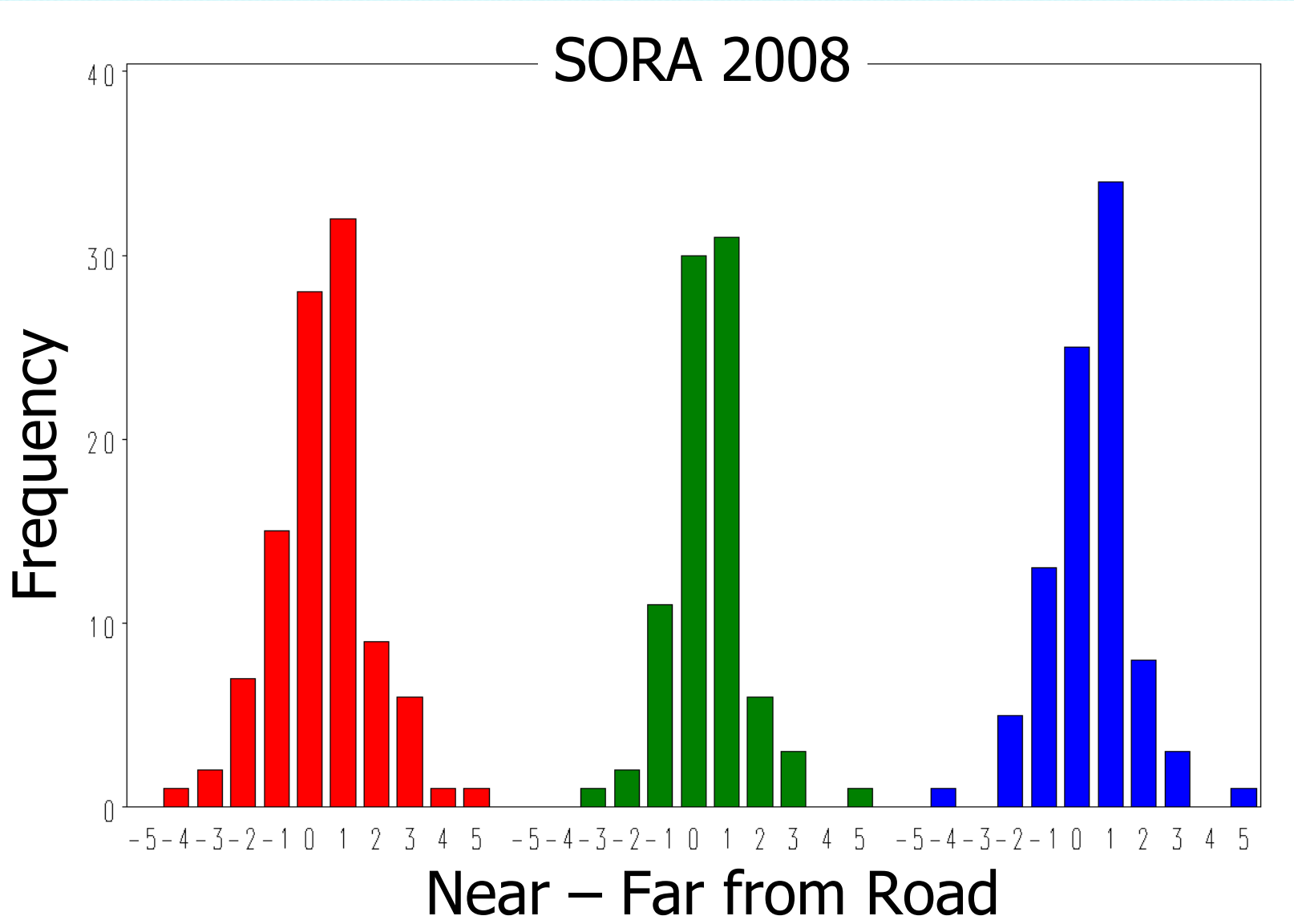
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5
Near – Far from Road

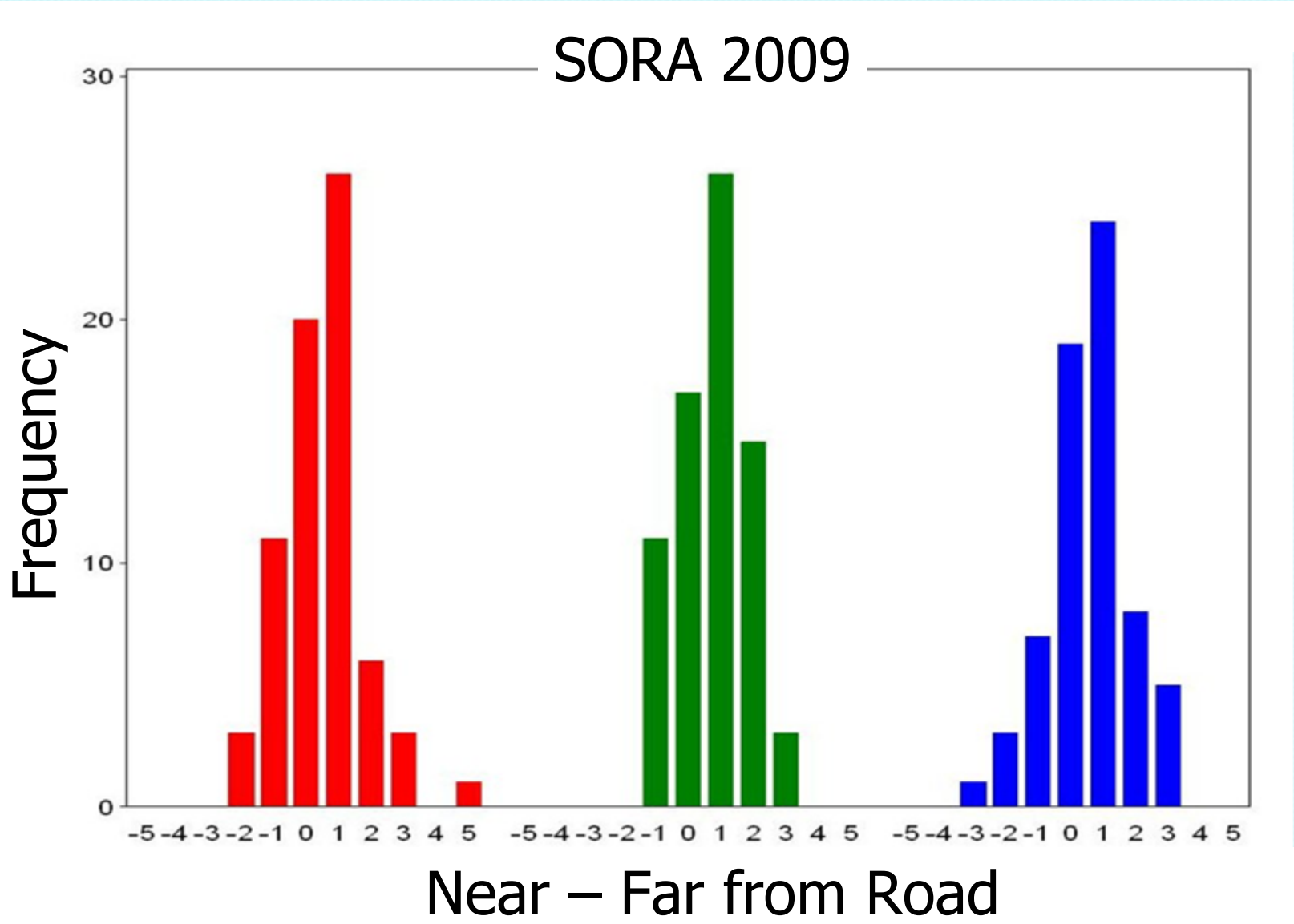
USGS


AMBI 2009
Frequency
0
1
2
3
4
5
6
7
8
9
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5
Near – Far from Road

USGS


SORA 2008
Frequency
40
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5 -5 -4 -3 -2 -1 0 1 2 3 4 5 -5 -4 -3 -2 -1 0 1 2 3 4 5
Near – Far from Road

USGS


SORA 2009
Frequency
30
20
10
0
-5 -4 -3 -2 -1 0 1 2 3 4 5
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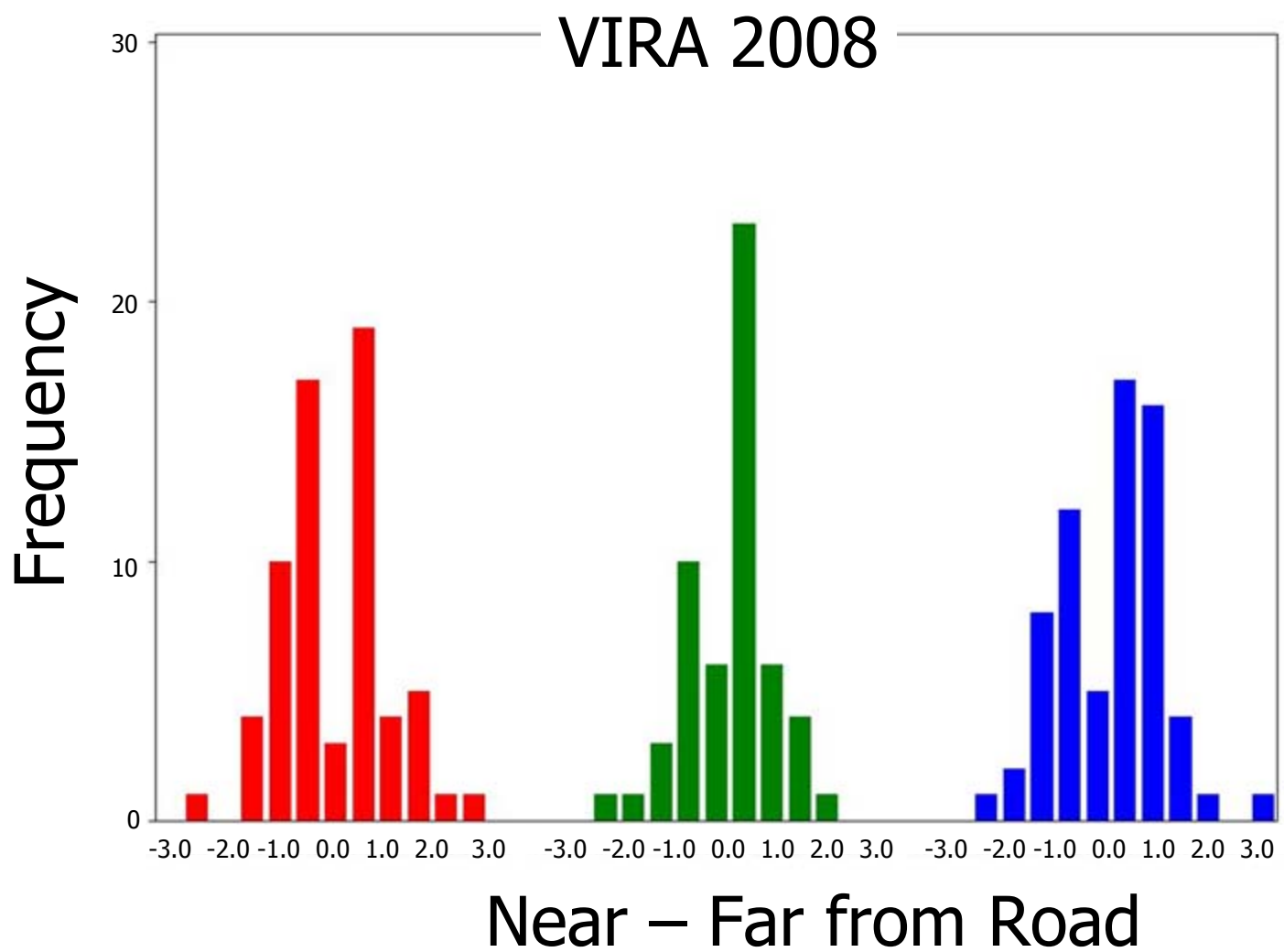
Near – Far from Road

USGS


VIRA 2008
Frequency
30
20
10
0
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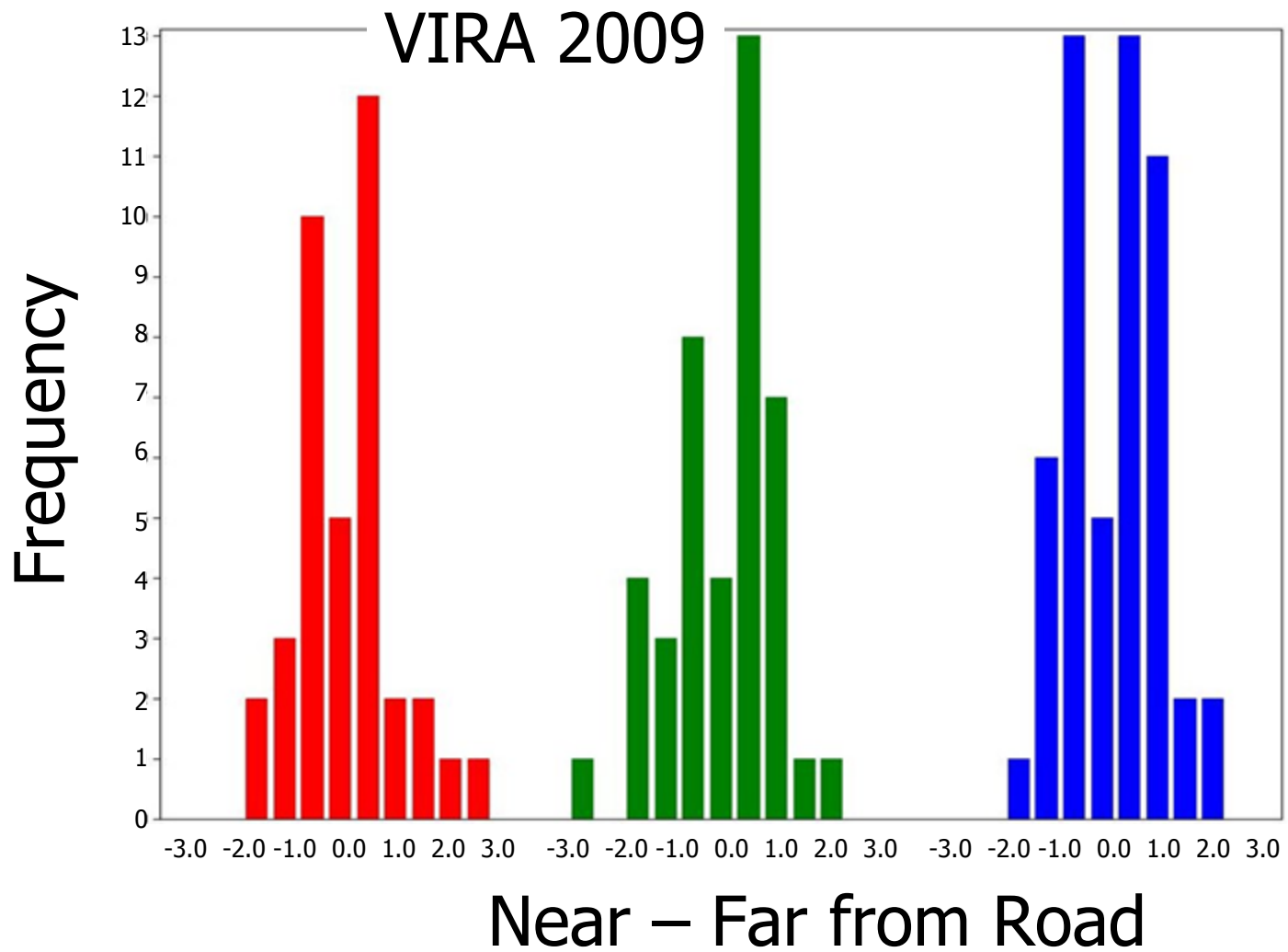
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0
Near – Far from Road

USGS


VIRA 2009
Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0
-3.0 -2.0 -1.0 0.0 1.0 2.0 3.0
Near – Far from Road

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Next steps

- Conduct formal “occupancy” analysis
  - Estimate detection probability
    - On-road survey
    - Off-road survey “near” road
    - Off-road survey “far” from road
  - Estimate probability of occupancy in relation to distance from road to survey location

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Monitoring Implications (preliminary)

1. Roadside surveys provide a logistically feasible means for tracking changes in marsh bird populations
2. Results from roadside surveys can be used interchangeably with results from off-road surveys.
3. Roadside bias, if it exists, likely is small.

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