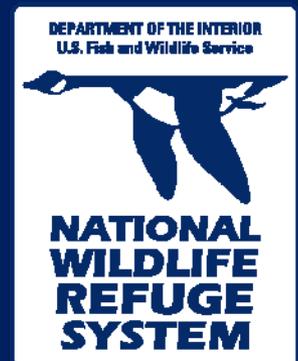


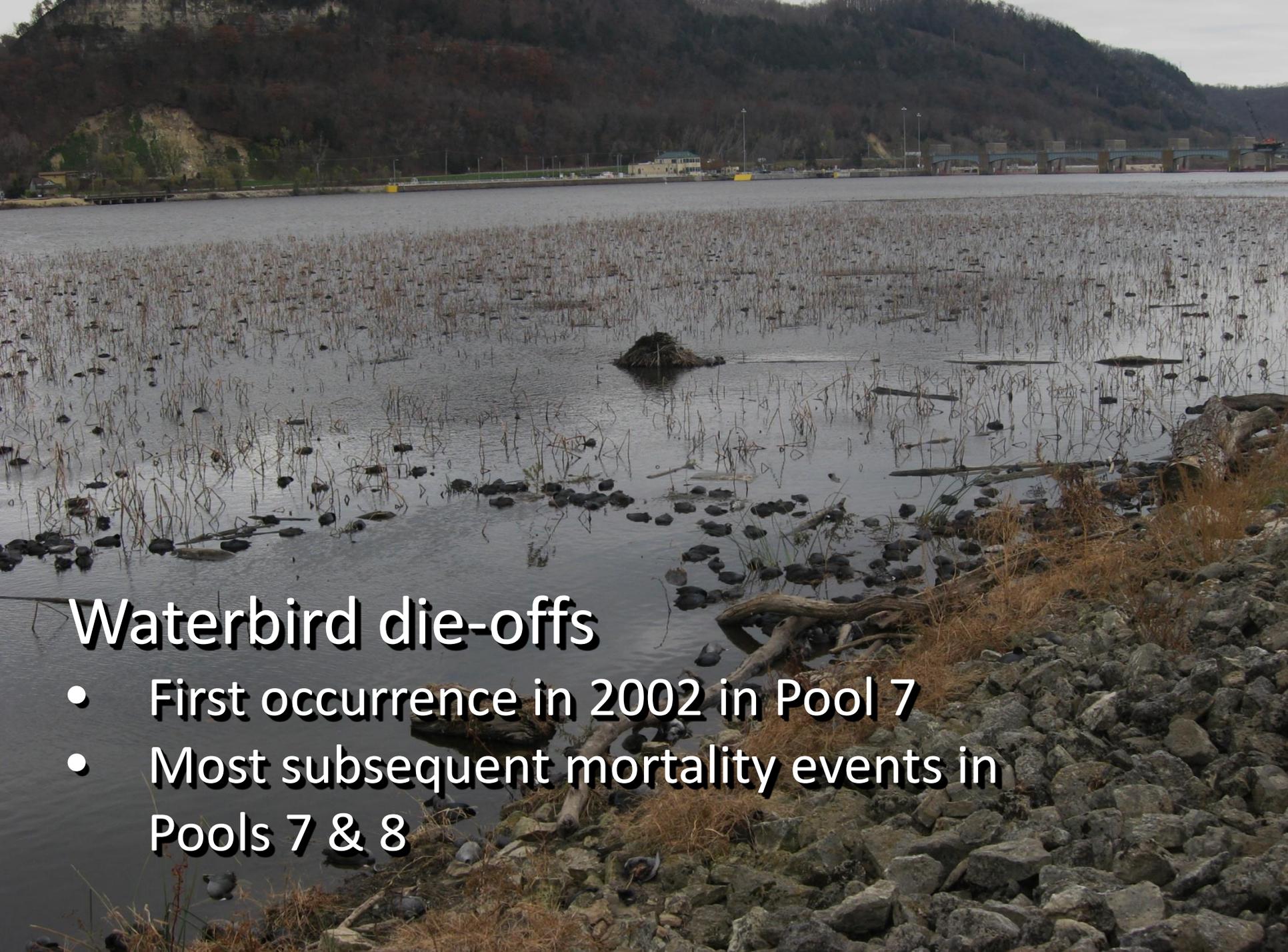
Waterbird Mortality Surveys on the Upper Mississippi River National Wildlife and Fish Refuge

Monitoring the Impact of Trematodiasis



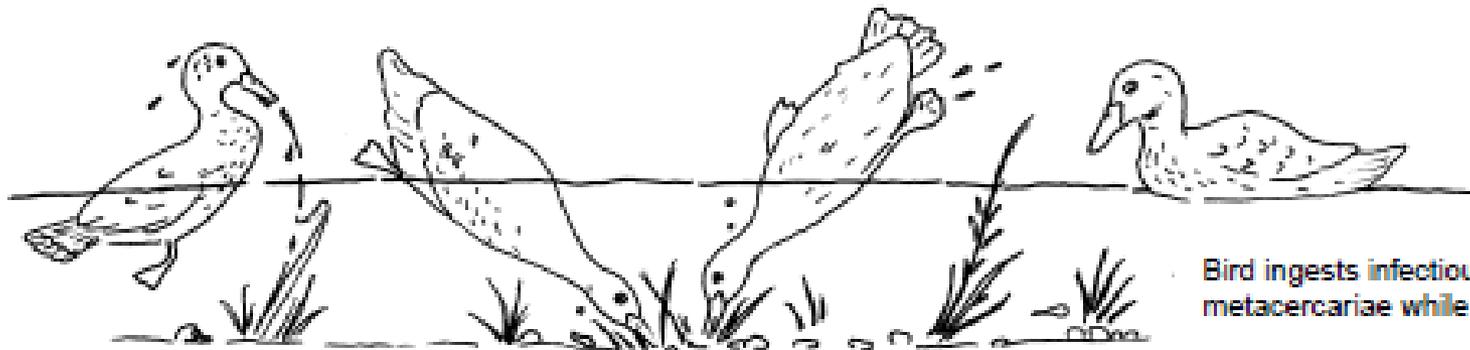
S. Winter, B. Stemper, C. Gehri, W. Woyczic,
K. Niemec, and D. Hoffman





Waterbird die-offs

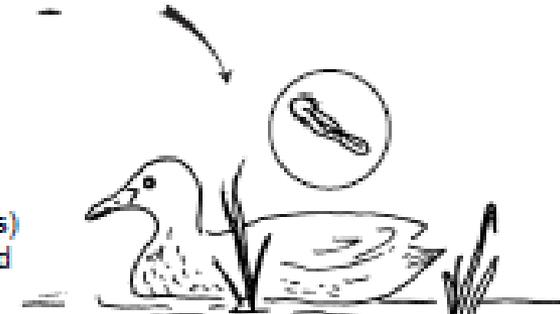
- First occurrence in 2002 in Pool 7
- Most subsequent mortality events in Pools 7 & 8



Bird ingests infectious metacercariae while feeding

Ingestion of infective parasite by new bird hosts continues the life cycle

Metacercariae develop into adult trematodes (flukes) within the host and produce eggs



Eggs are shed via bird's feces



Eggs embryonate and produce a free-swimming miracidium which is ingested by the first intermediate host



First intermediate host

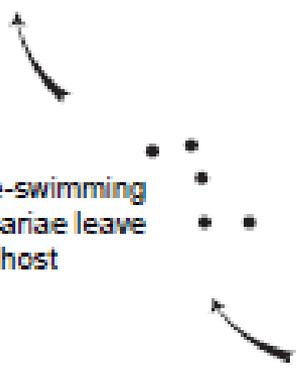
Further development of the parasite occurs in first intermediate host

Second intermediate host

Cercariae become encysted as metacercariae on or in second intermediate host

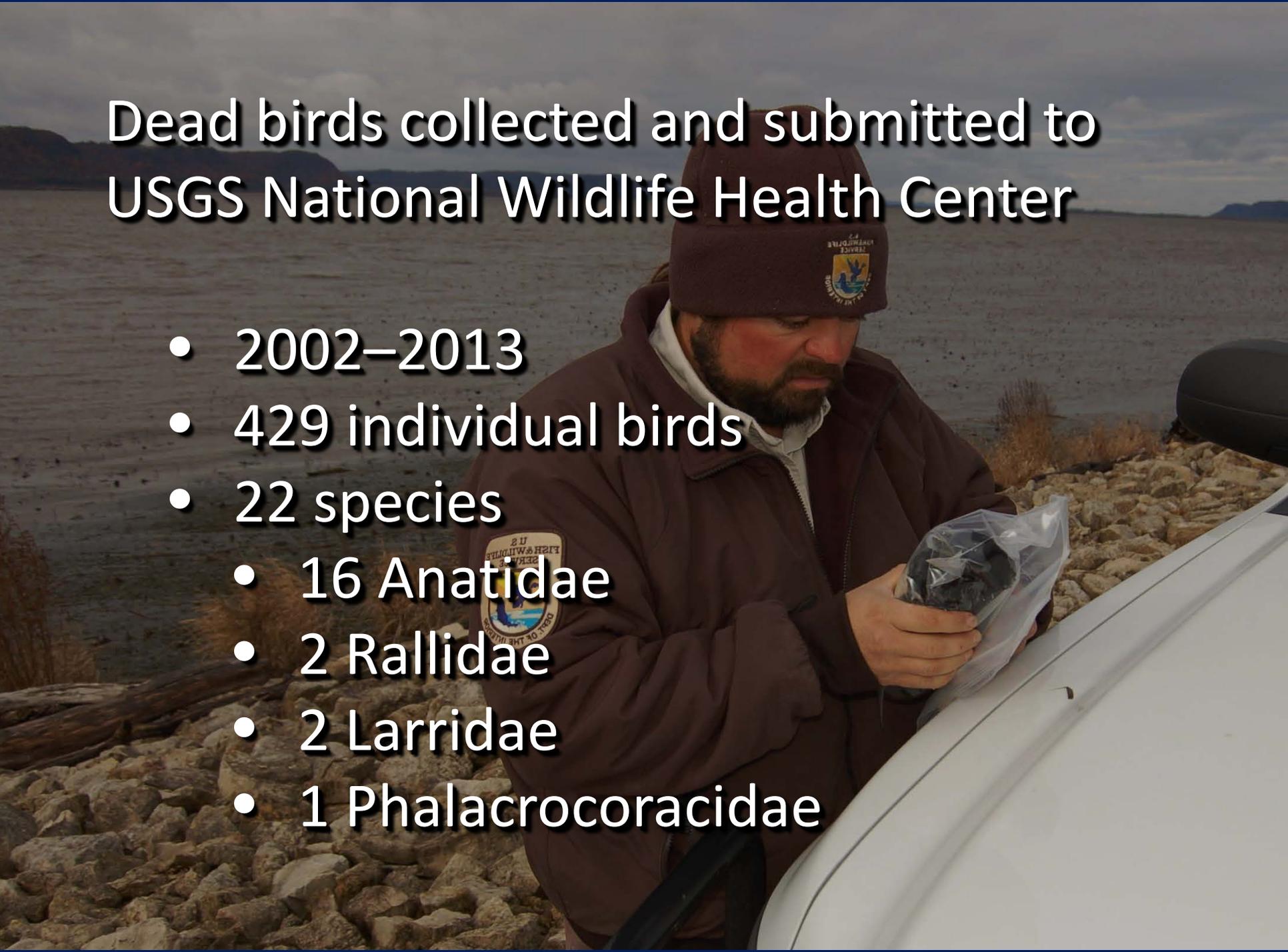


Free-swimming cercariae leave first host



Dead birds collected and submitted to USGS National Wildlife Health Center

- 2002–2013
- 429 individual birds
- 22 species
 - 16 Anatidae
 - 2 Rallidae
 - 2 Larridae
 - 1 Phalacrocoracidae



Collected and Tested Positive

Date of first collection	Species	Pool
fall, 2002	American coot	7
fall, 2002	lesser scaup	7
fall, 2003	mallard	7
fall, 2003	ruddy duck	7
spring, 2004	ring-necked duck	7
fall, 2004	American black duck	7
spring, 2005	bufflehead	7
fall, 2005	blue-winged teal	7
fall, 2005	canvasback	7
fall, 2005	northern pintail	8
fall, 2005	redhead	9
fall, 2006	northern shoveler	7
fall, 2012	sora	8

Collected and Tested Negative

- Double-crested cormorant
- Lesser snow goose
- American wigeon
- Wood duck
- Common goldeneye
- Herring gull
- Ring-billed gull



Surveys

- Approximately weekly
- Spring (March–May)
 - 4–7 surveys/season
- Fall (August–December)
 - 8–14 surveys/season



Survey Segments

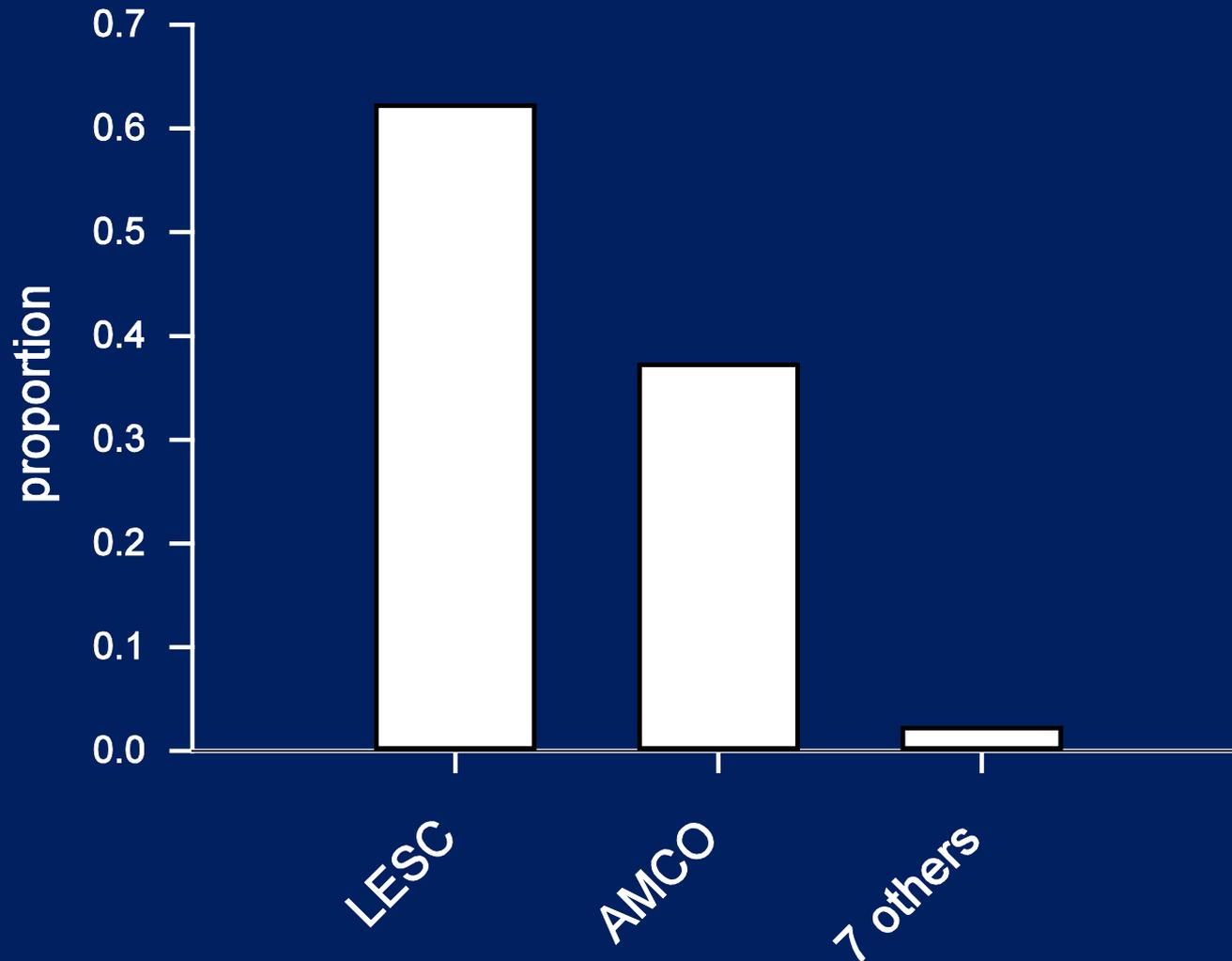
- Pool 7 - surveys by boat
 - Arrowhead Island
 - Broken Gun Island
 - A, B, and C Islands
- Pool 8 - surveys by truck
 - Lock & Dam 8
- All dead (but “fresh”) birds observed along survey segments



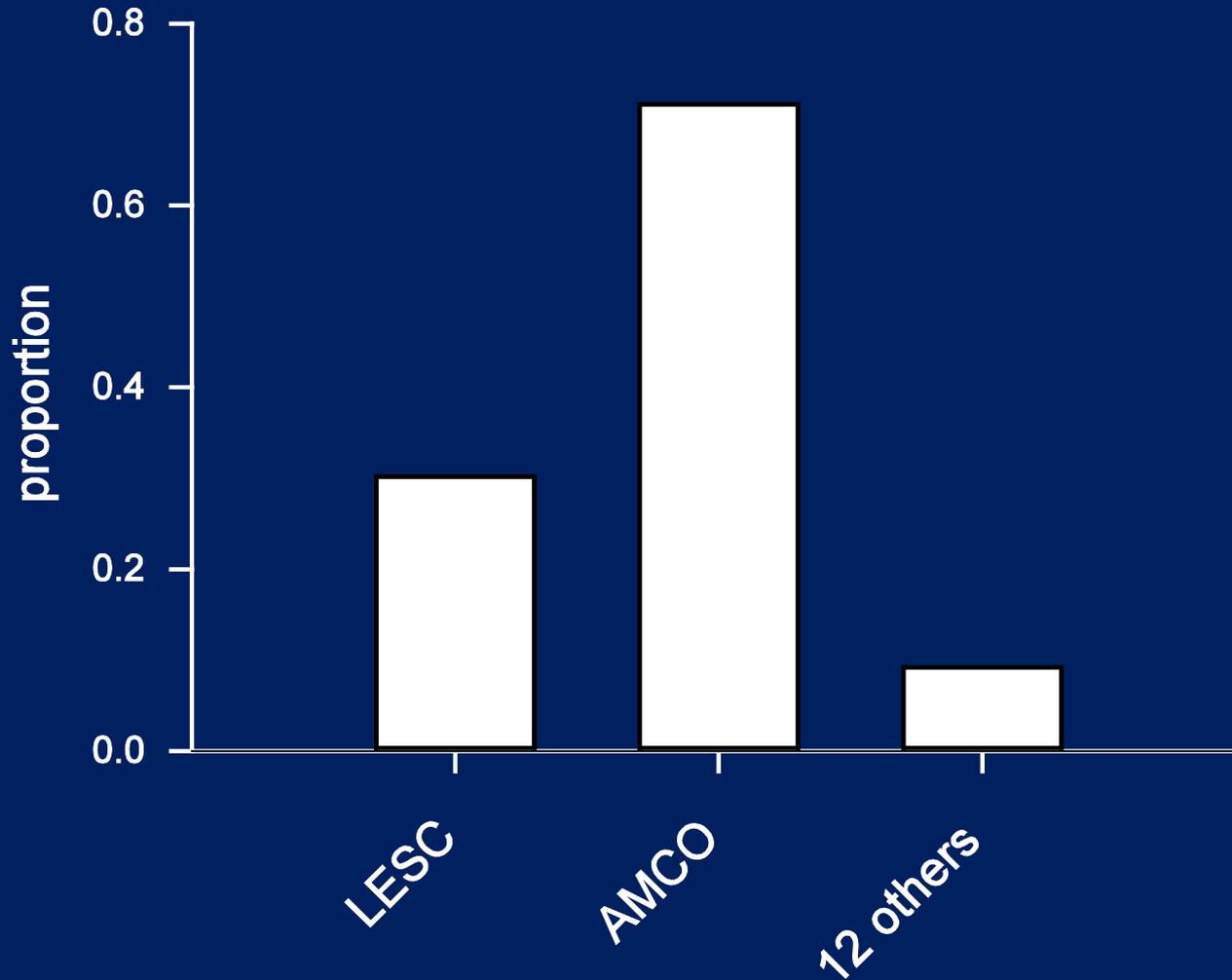
0 500 1,000 2,000 3,000 4,000 Meters



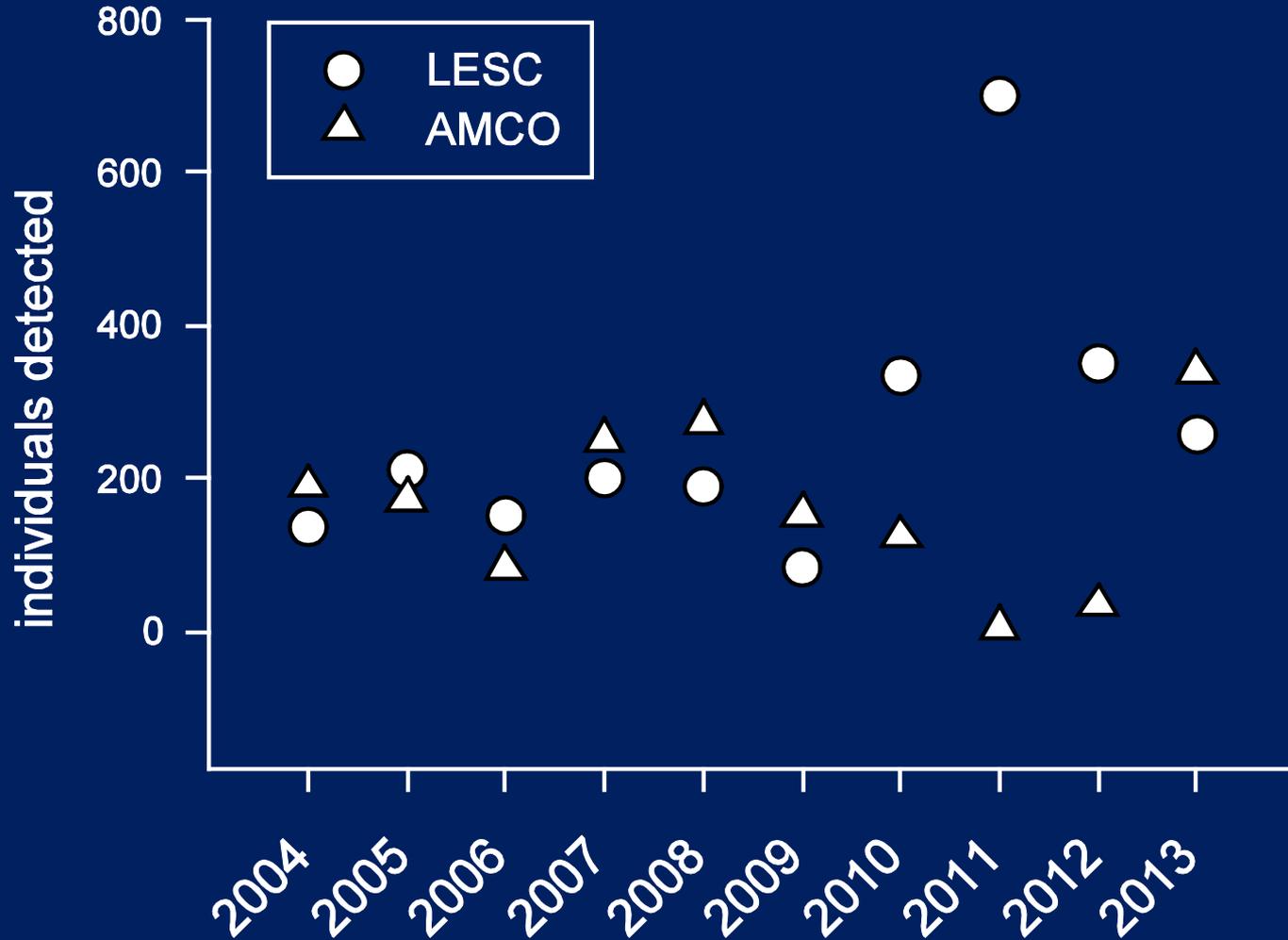
Spring Proportions 2004–2013



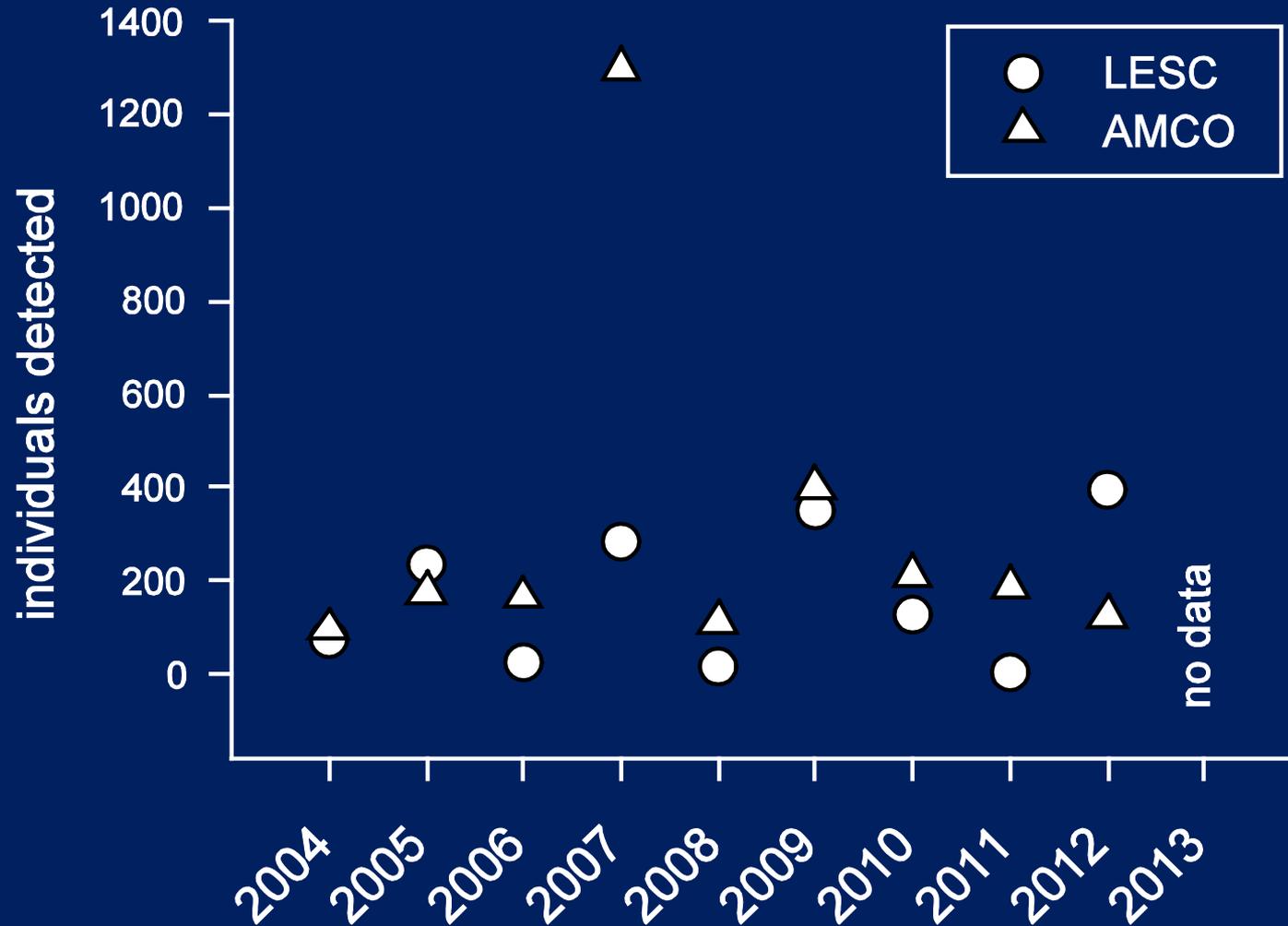
Fall Proportions 2004–2013



Spring One-day Peak



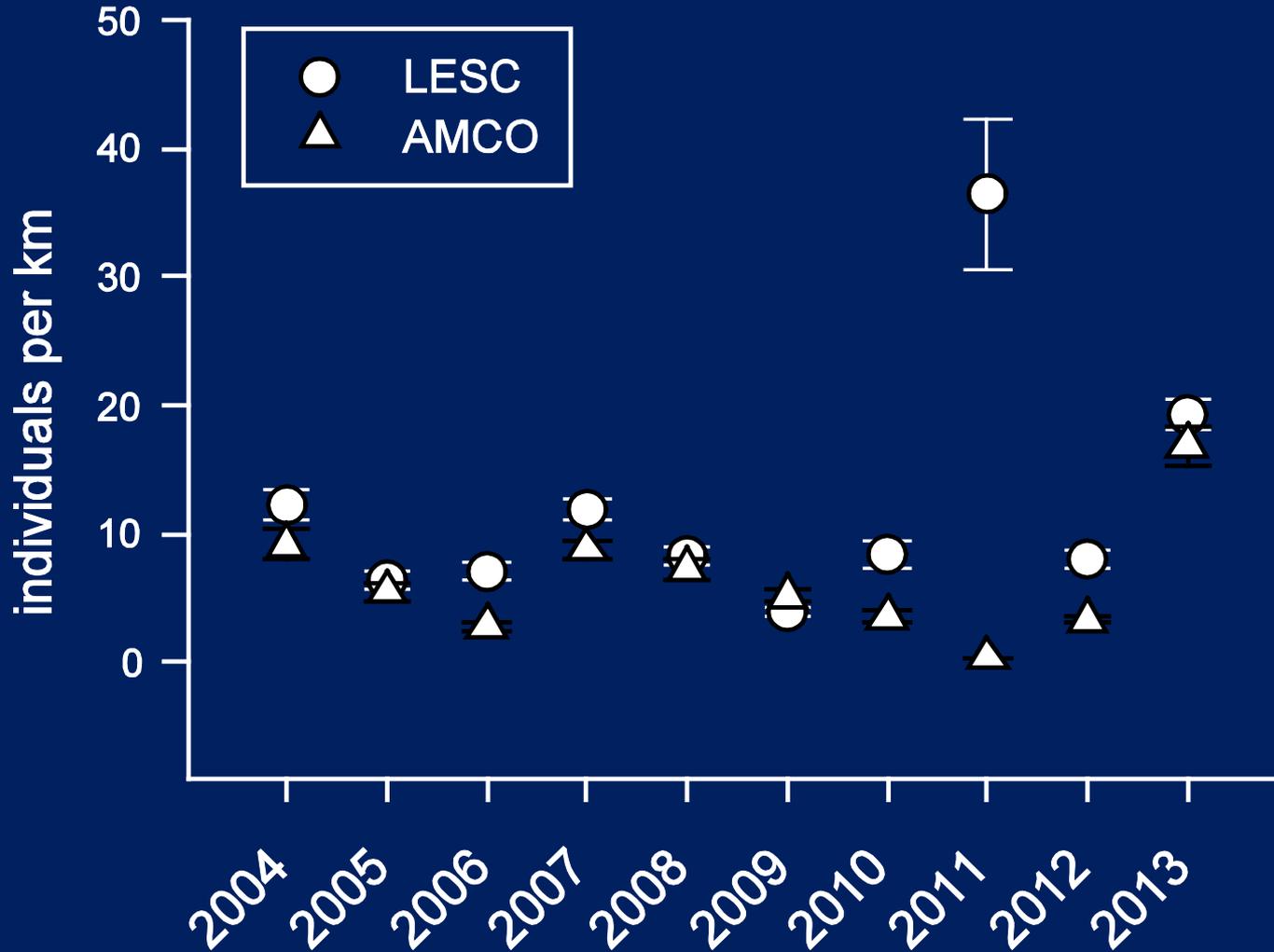
Fall One-day Peak



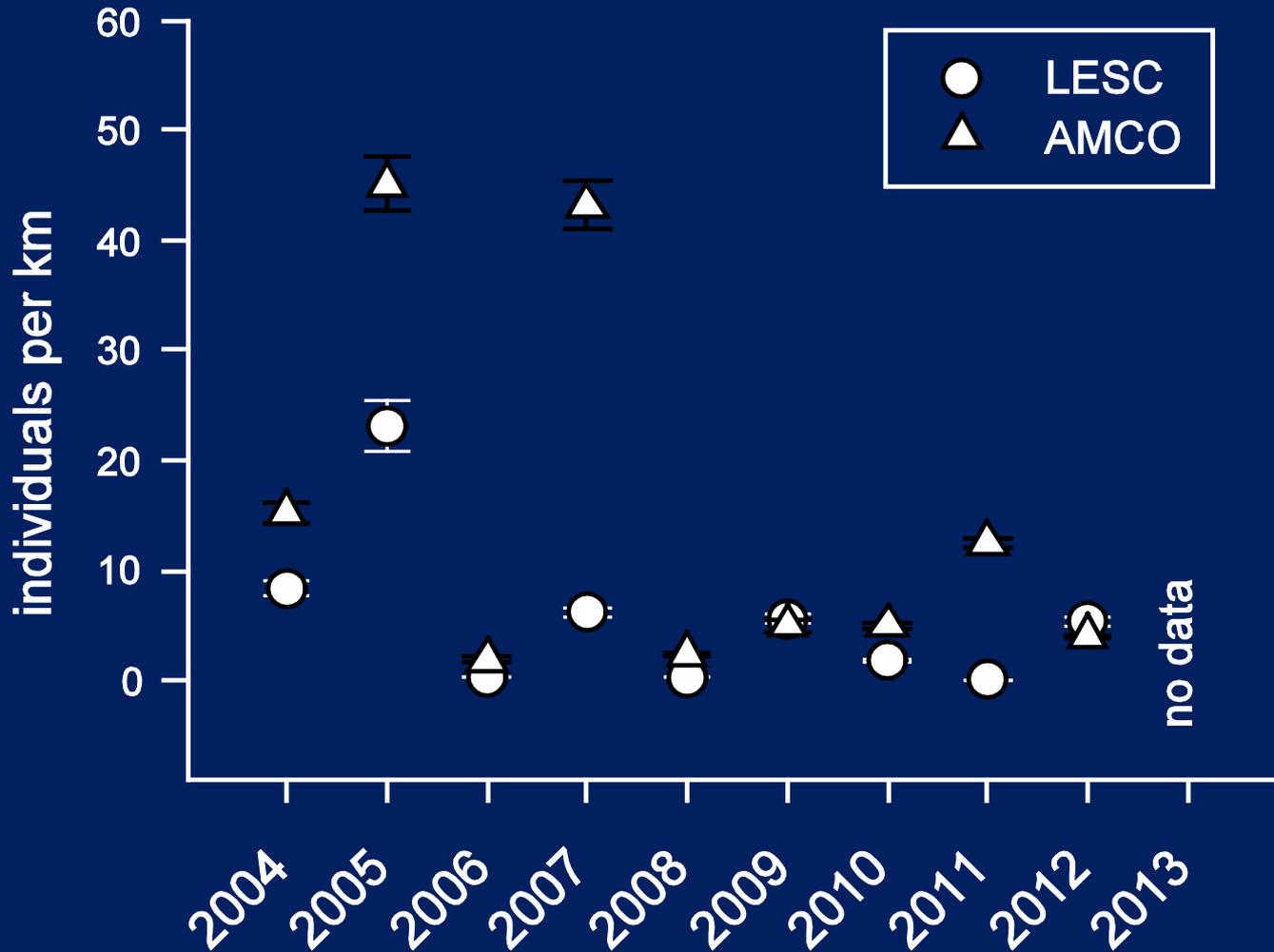
Index of mortality

- Pool 7 – surveyed by boat
 - Arrowhead Island = 1.0 km
 - Broken Gun Island = 1.0 km
 - Islands A, B, C = 3.9 km
- Pool 8 – surveyed by vehicle
 - Lock & Dam 8 = 5.3 km
- Individuals per km of survey route

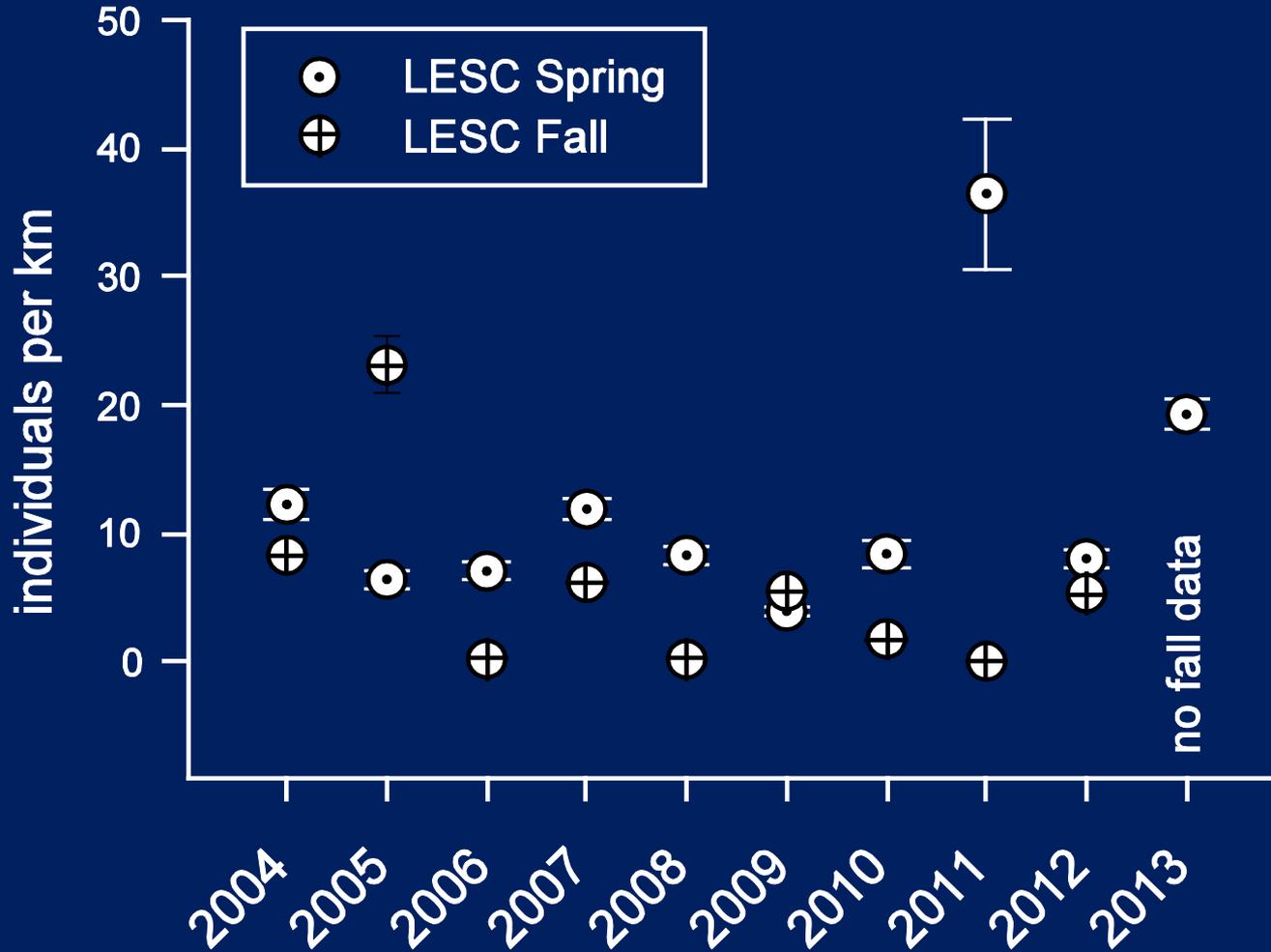
Spring Mortality Index



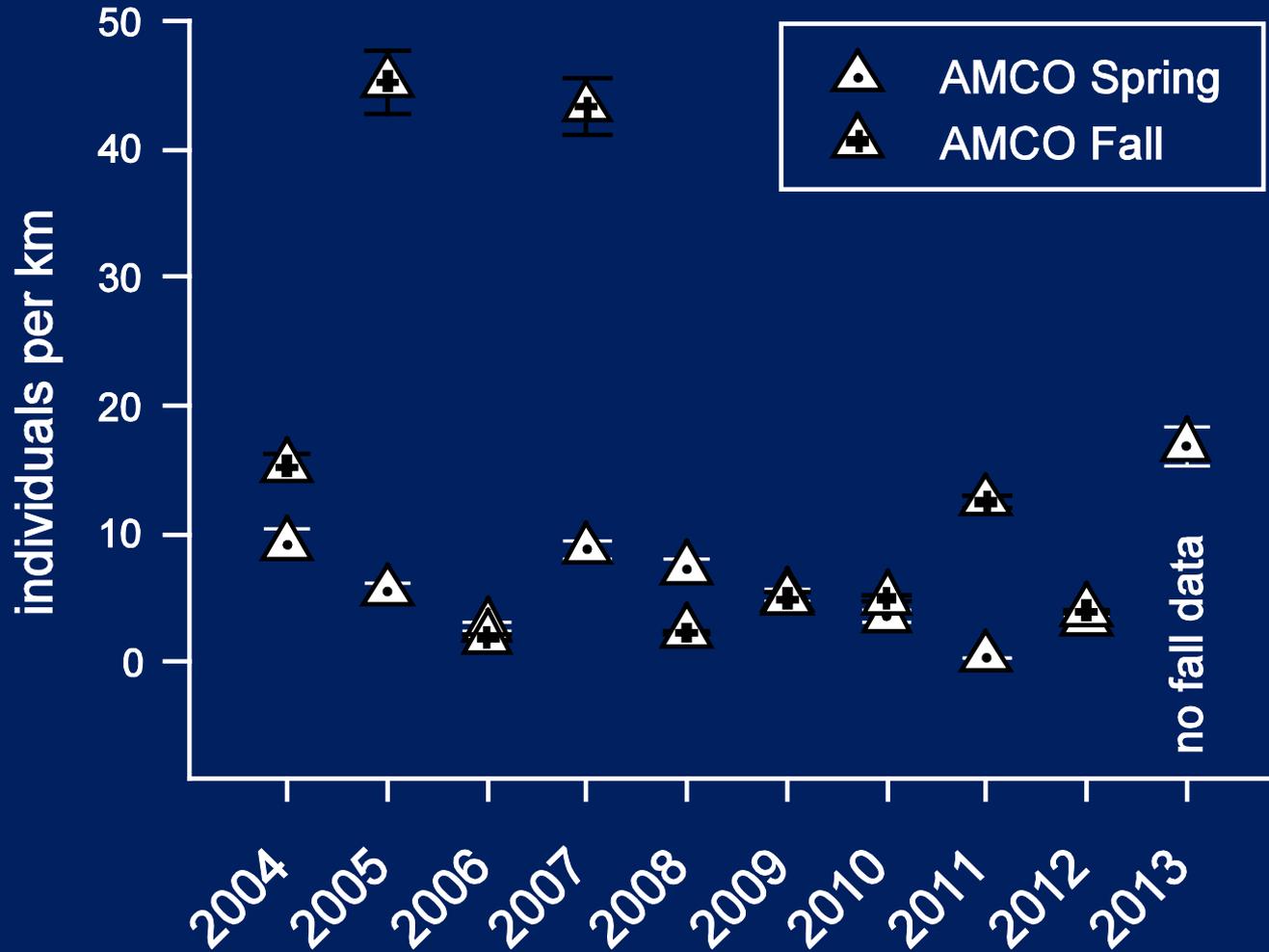
Fall Mortality Index



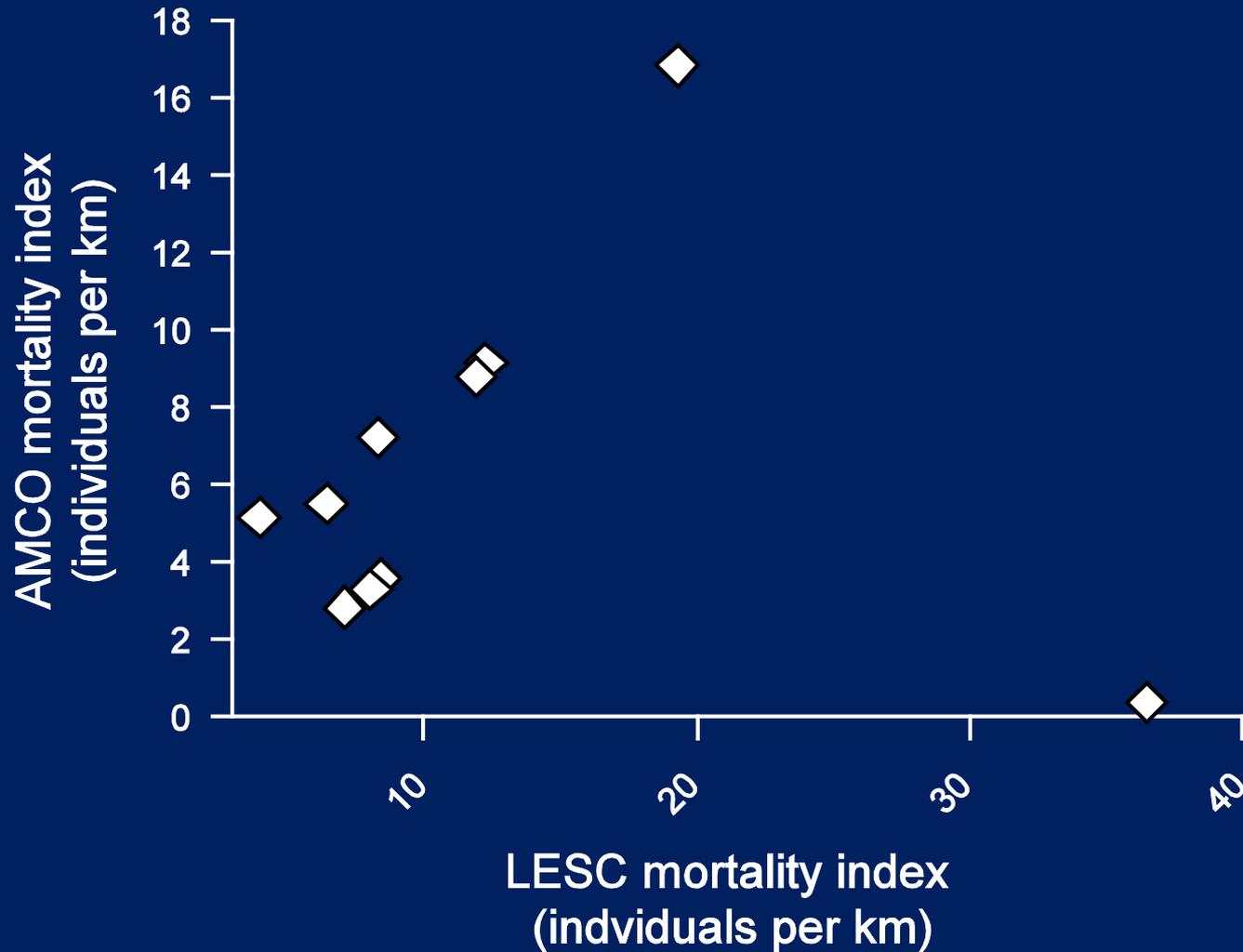
LESC Mortality Index



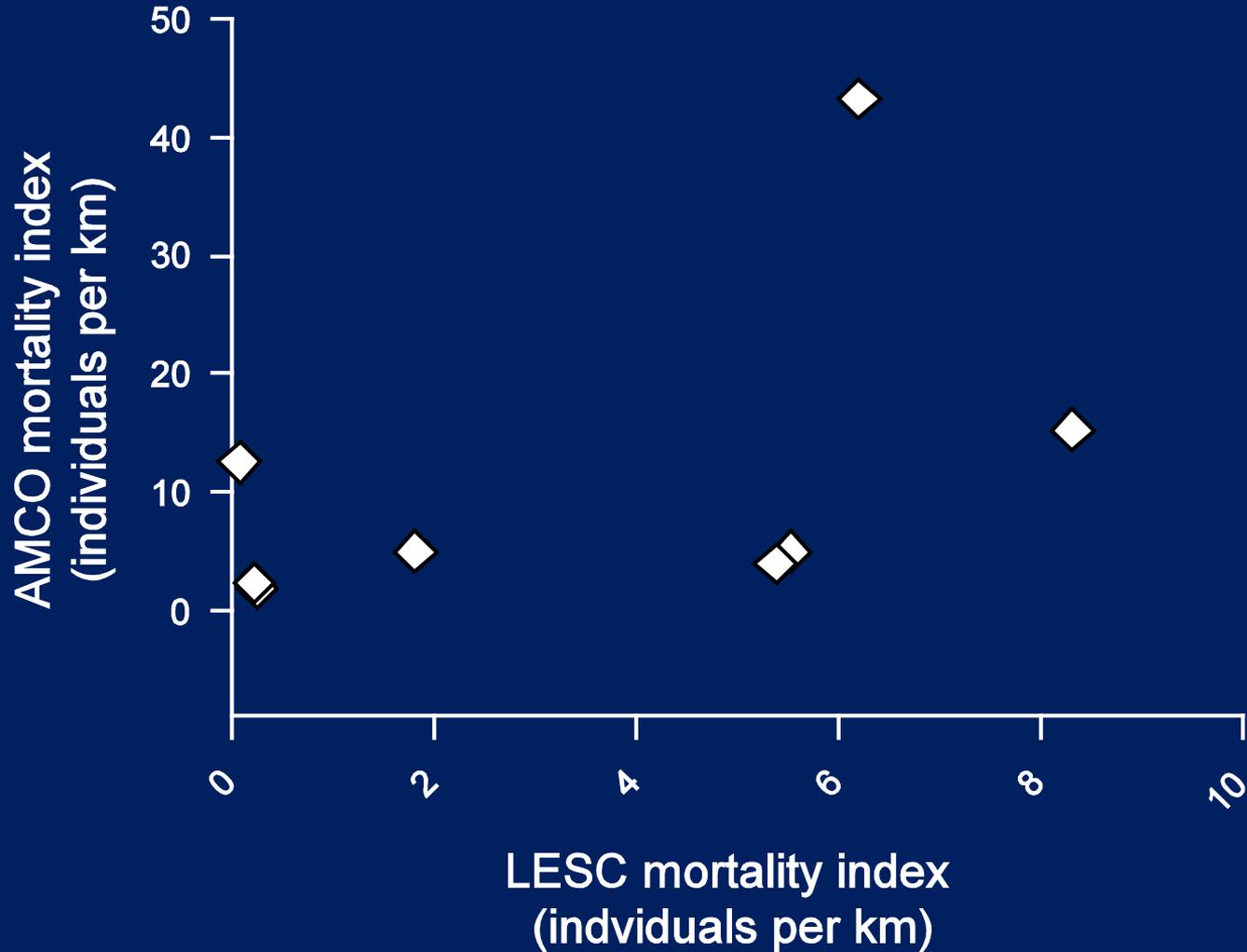
AMCO Mortality Index



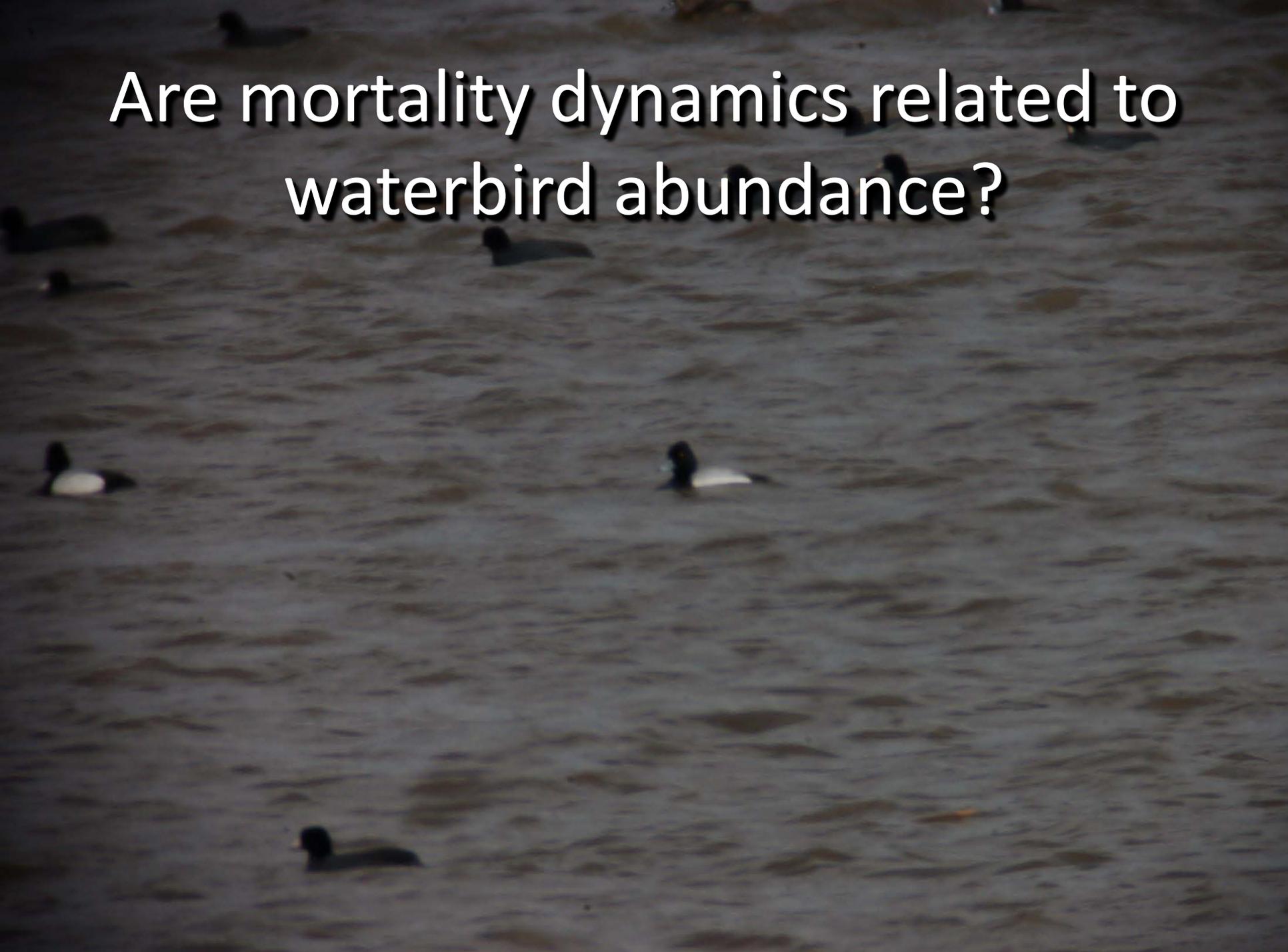
Spring Mortality Index



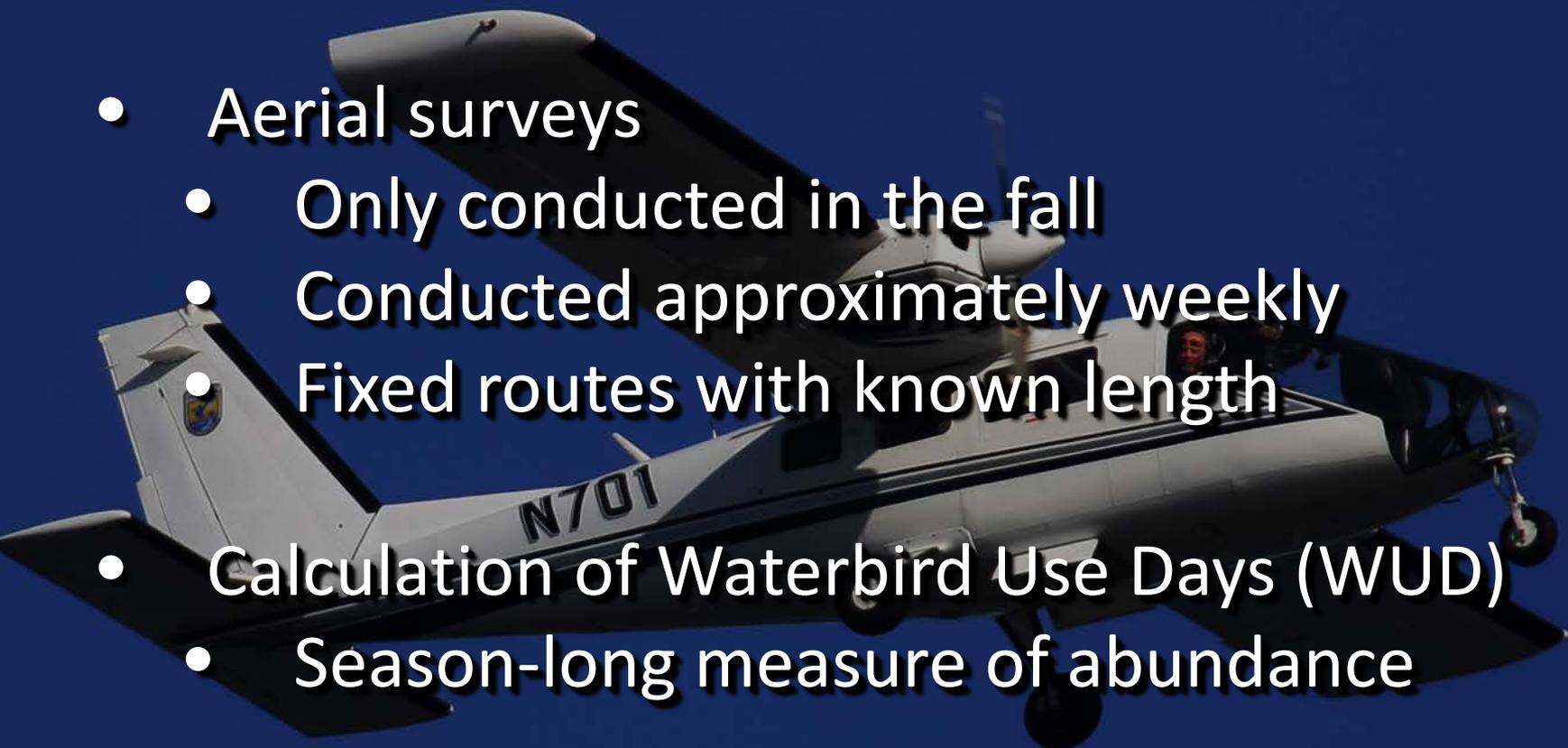
Fall Mortality Index



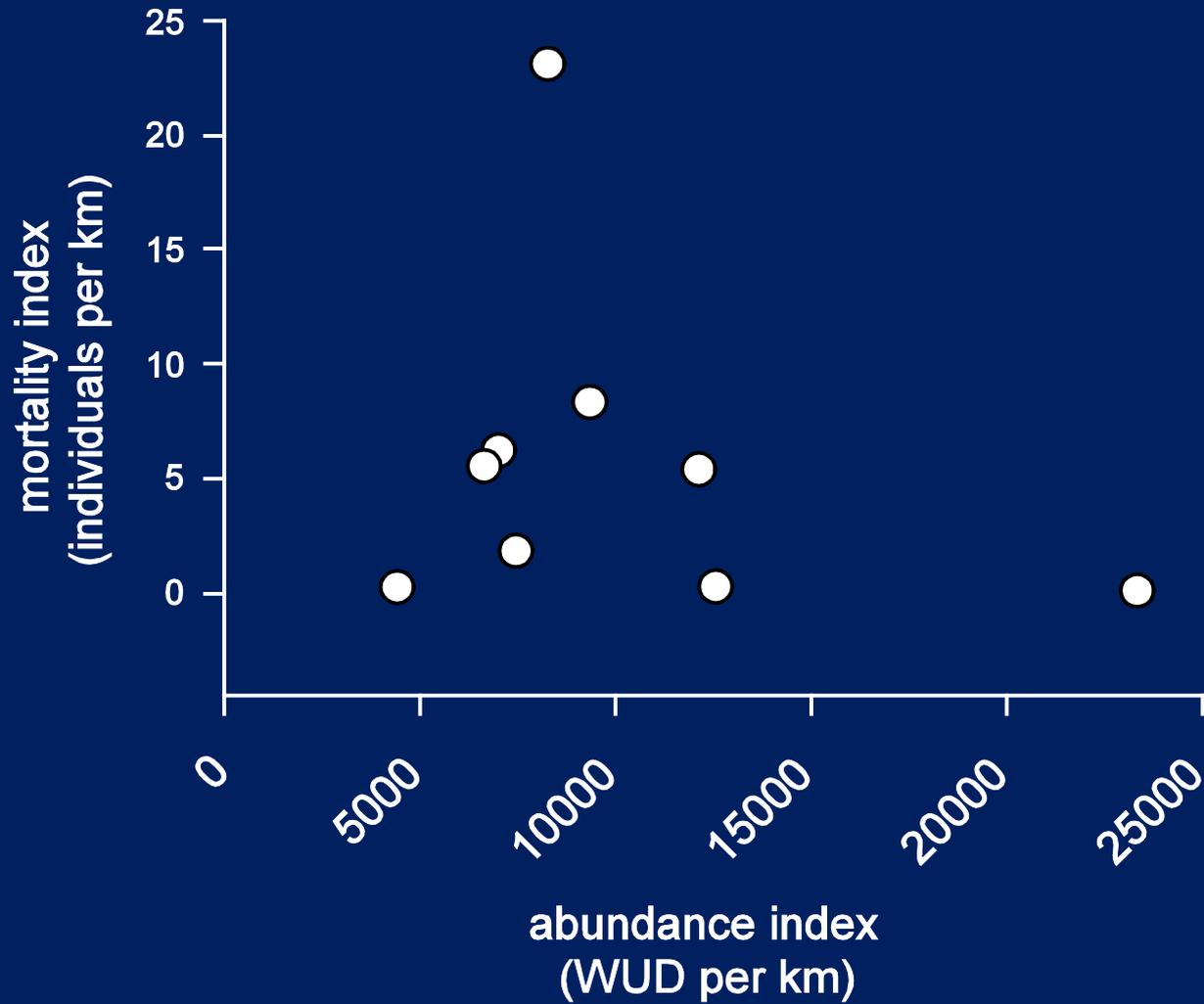
Are mortality dynamics related to
waterbird abundance?



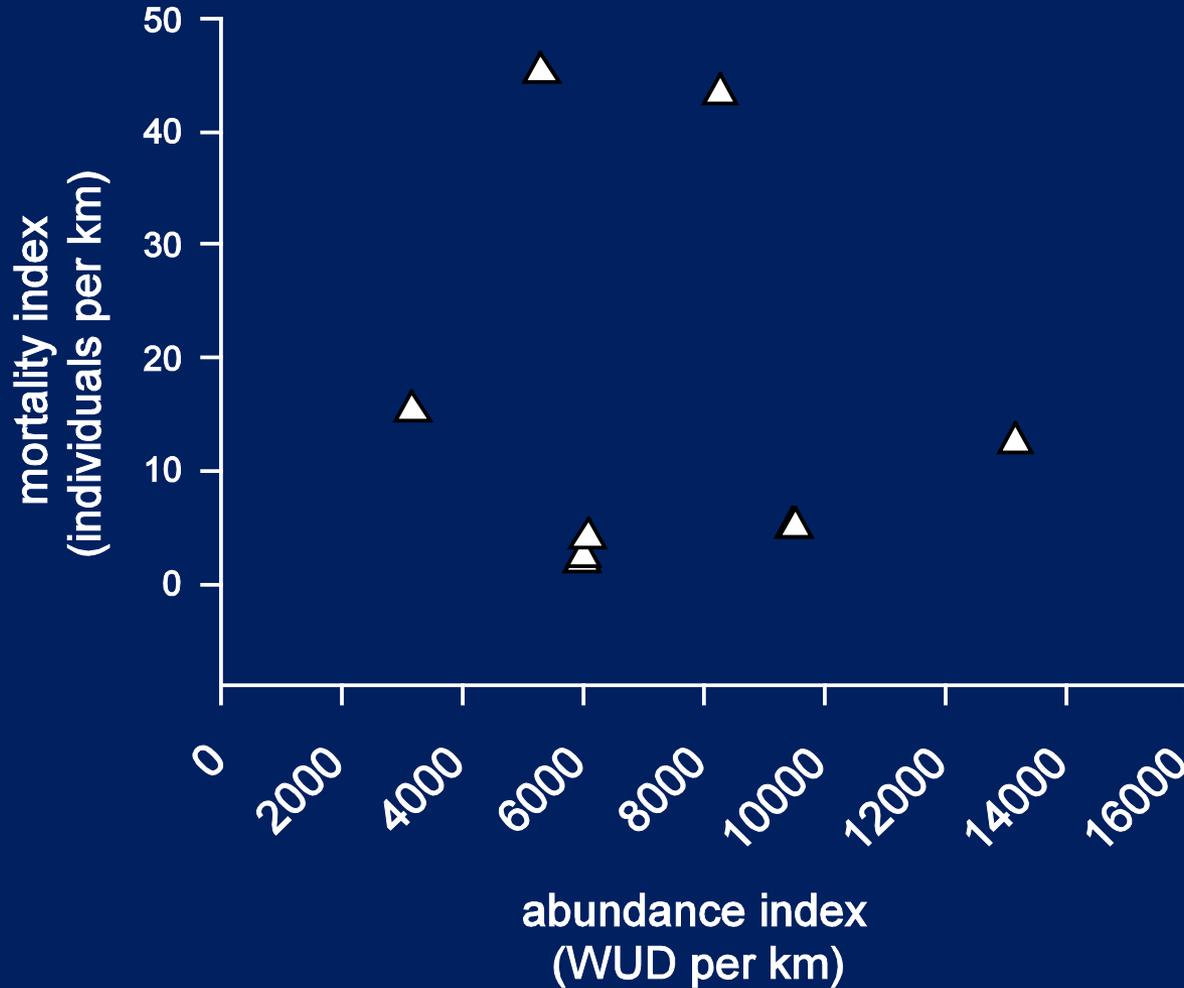
Index of fall abundance

- Aerial surveys
 - Only conducted in the fall
 - Conducted approximately weekly
 - Fixed routes with known length
 - Calculation of Waterbird Use Days (WUD)
 - Season-long measure of abundance
 - WUD per km of survey route
- 

Fall LESC



Fall AMCO

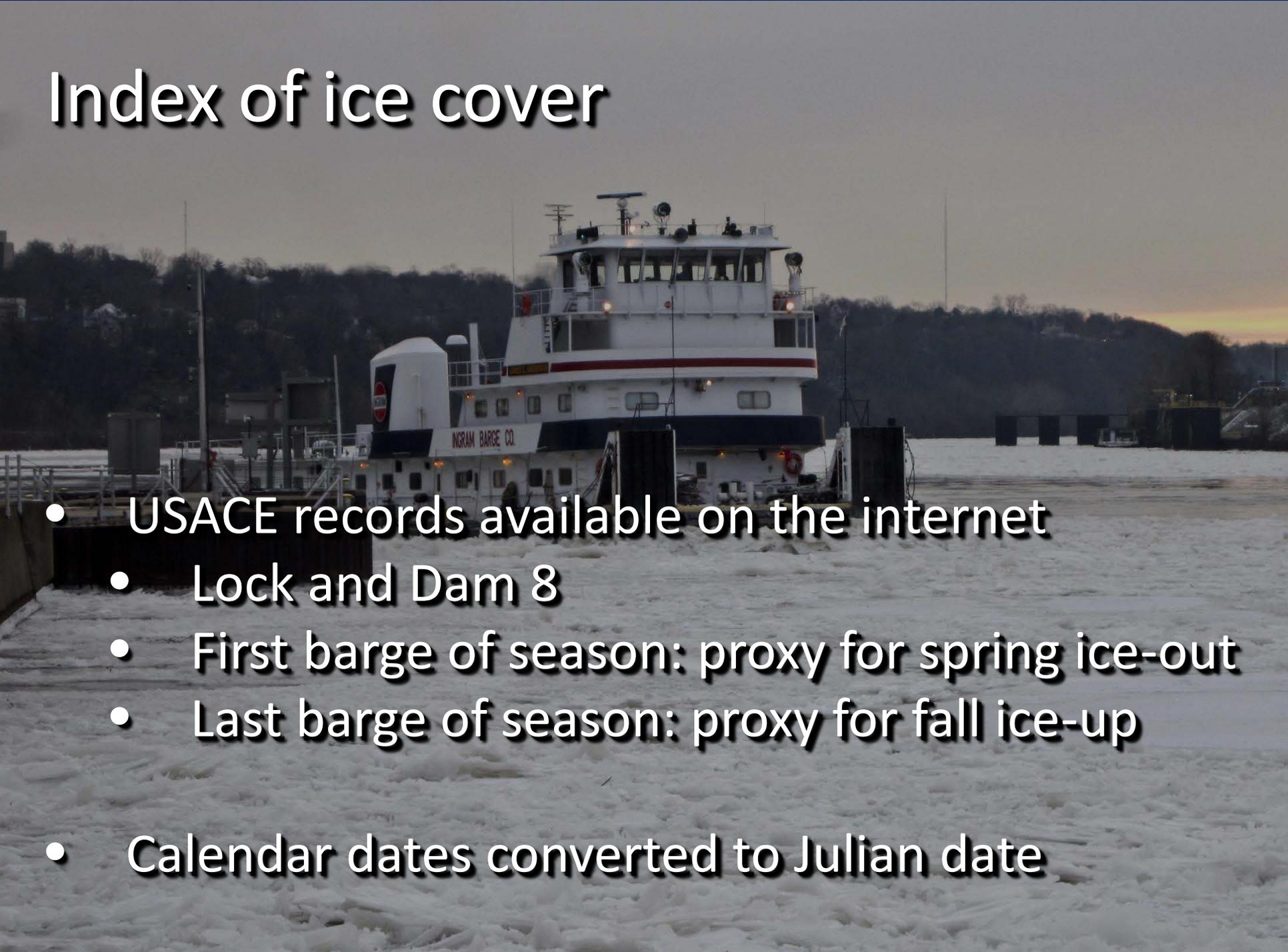


**Are mortality dynamics related to
ice cover?**

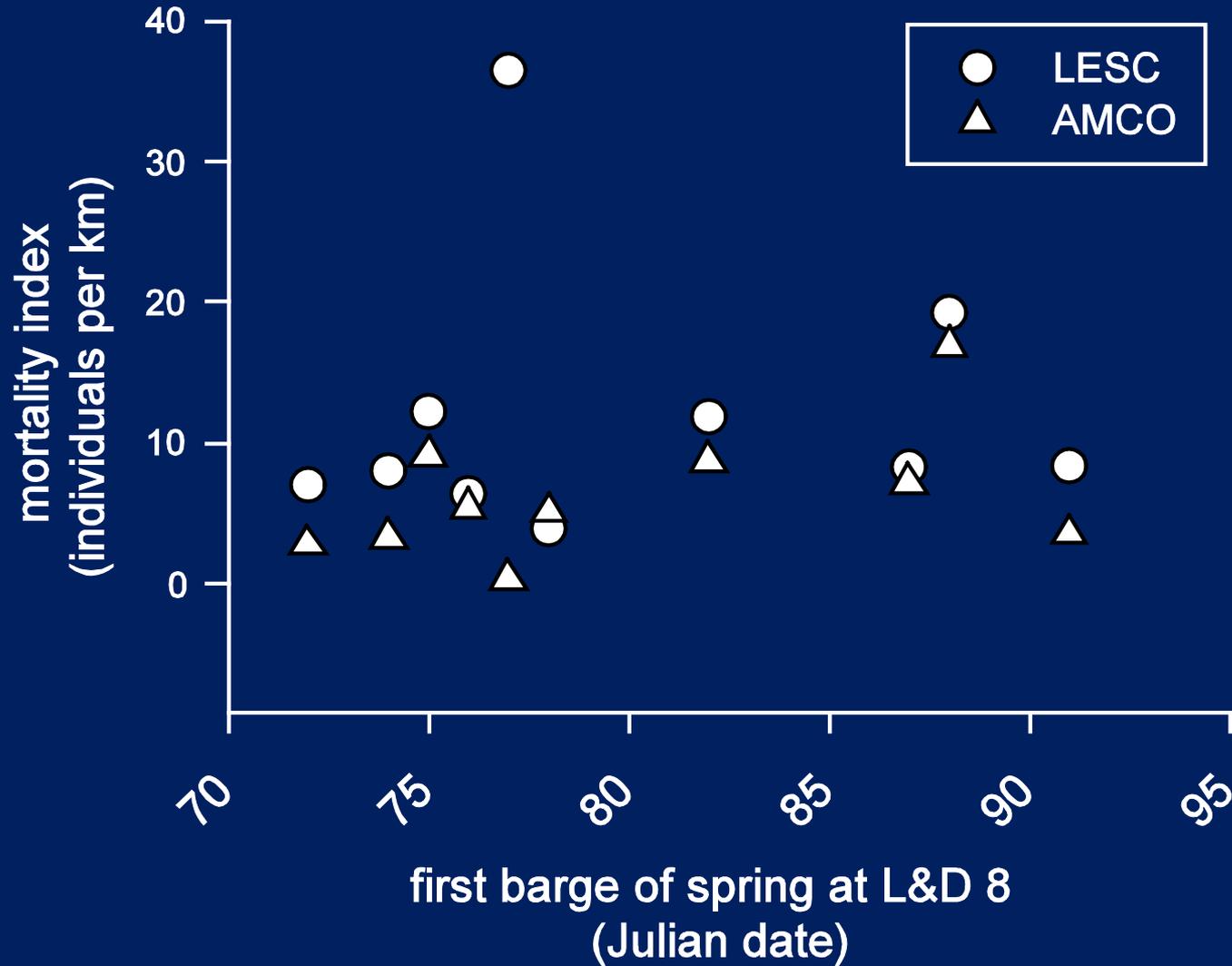


**A big shout-out to Charlotte
Roy, MN DNR, for this idea**

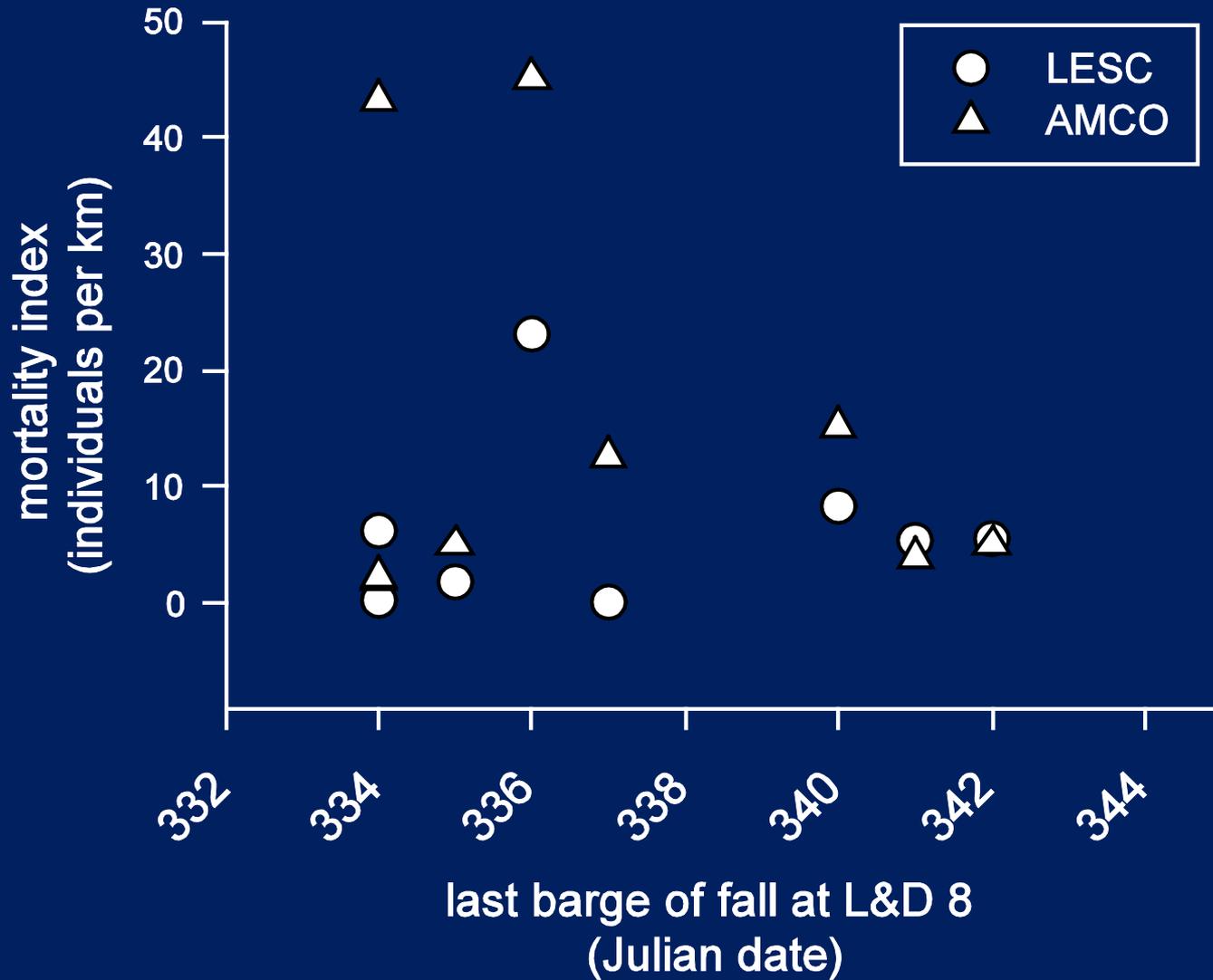
Index of ice cover

- 
- USACE records available on the internet
 - Lock and Dam 8
 - First barge of season: proxy for spring ice-out
 - Last barge of season: proxy for fall ice-up
 - Calendar dates converted to Julian date

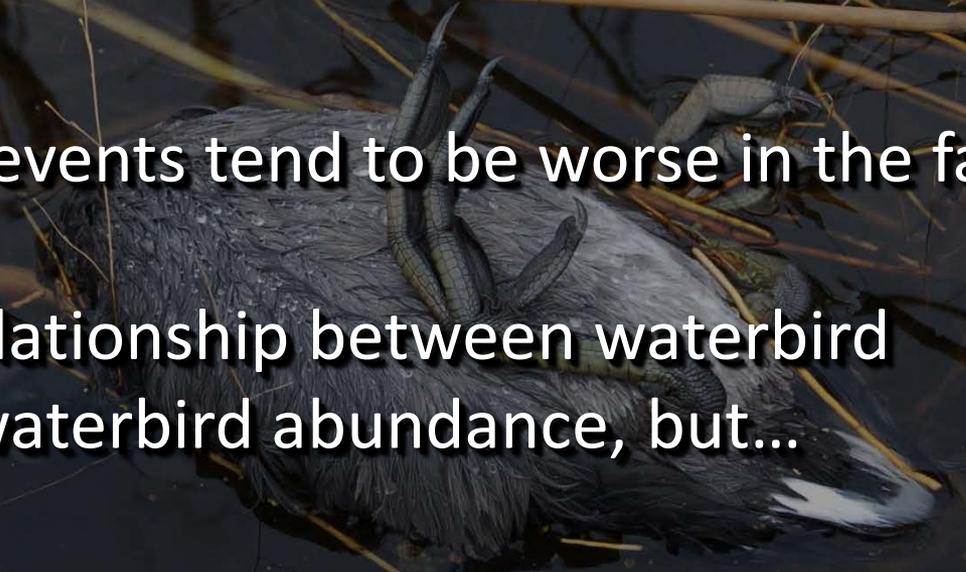
Spring



Fall



Discussion

- Scaup mortality events tend to be worse in the spring
 - Coot mortality events tend to be worse in the fall
 - No apparent relationship between waterbird mortality and waterbird abundance, but...
 - No apparent relationship between waterbird mortality and a proxy for ice cover, but...
- 
- A photograph of a dead waterbird, likely a scaup, lying on its back in a body of water. The bird is surrounded by a dense thicket of dry, brown reeds and grasses. The water is dark and still. The bird's body is the central focus, with its head to the right and tail to the left. The text of the slide is overlaid on the left side of the image.

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