



# USGS Nonindigenous Aquatic Species Aquatic Risk Mapper (NAS ARM)

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1- Cherokee Nation Technology

2- US Geological Survey

# NAS Alert system

- **The Nonindigenous Aquatic Species (NAS) Alert System**
  - Provides a framework for the rapid dissemination of new invasions
  - Notifies registered users of new sightings
  - Part of a national early detection/rapid response system



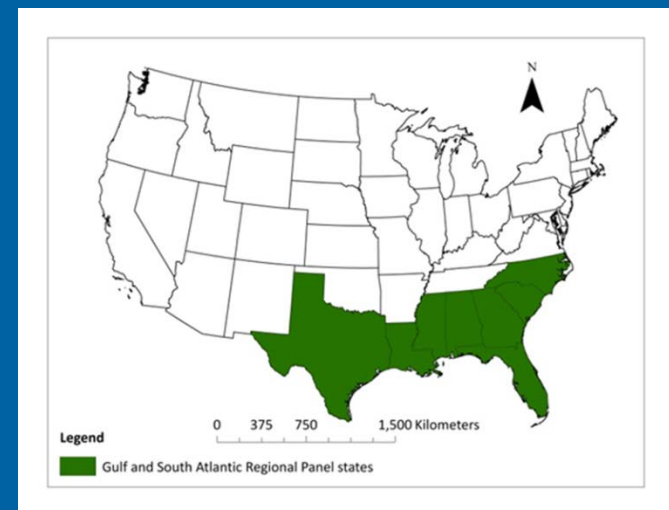
# Improving the NAS Alert system

- **Finer scale view of the location of the sighting**
- **Barriers within the drainage that can limit spread**
- **Information on species distribution ability in the drainage**
- **Identify when a species had the potential to move outside the initial sighting drainage.**
  - **Through vectors or life history**

# Pilot program- NAS ARM

- The goal of this project-
  - Combine NAS Alert System with a new NAS Alert Risk Mapper (NAS ARM)
  - To inform stakeholders of which waterbodies or river reaches could be at risk based on a new sighting of a nonindigenous species within a Gulf and South Atlantic regional panel area.

Gulf and South Atlantic states

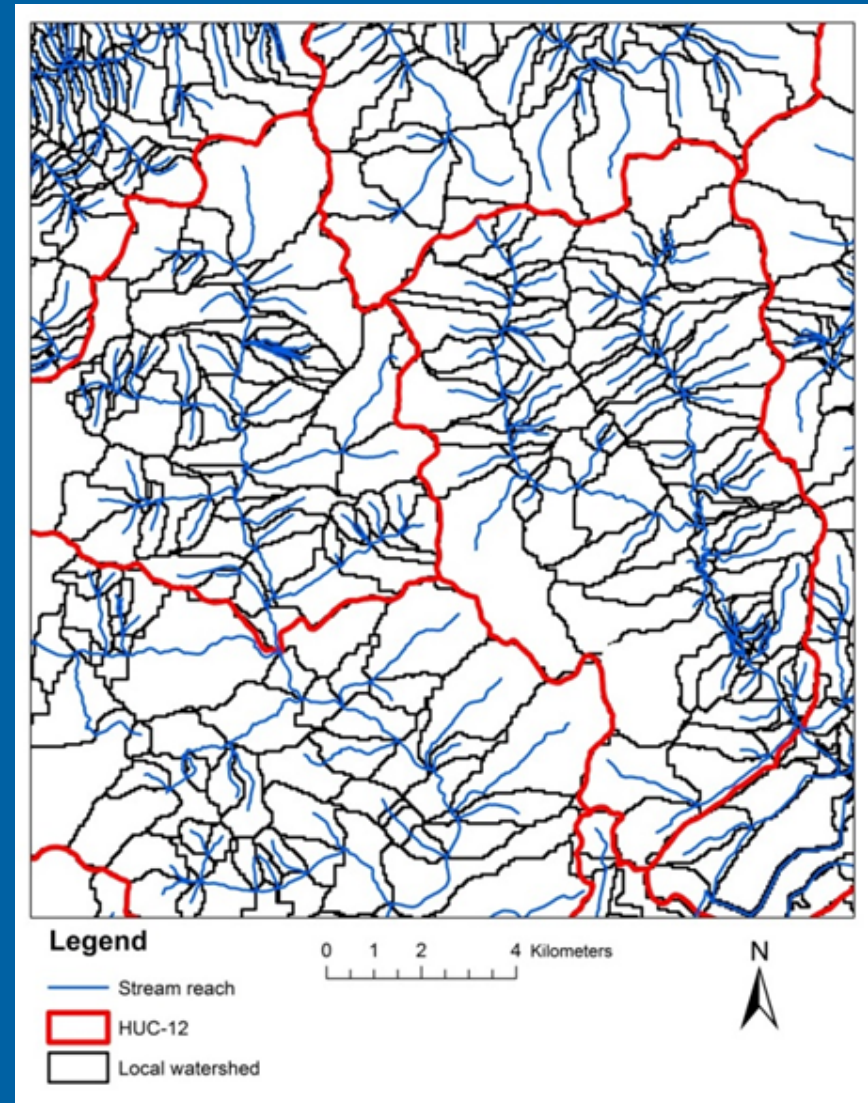


# Overview- NAS ARM

- Utilize the existing alert system
- Add a map of waterbodies or river reaches within a drainage are at risk (Alert Risk Maps)
- Maps will include:
  - A finer scale layer of rivers (NHDPlusV2) and lakes
  - Map of barriers (large dams)
  - Algorithm to determine the species-specific distribution potential of nonindigenous species

# NHDPlus Version 2- stream network

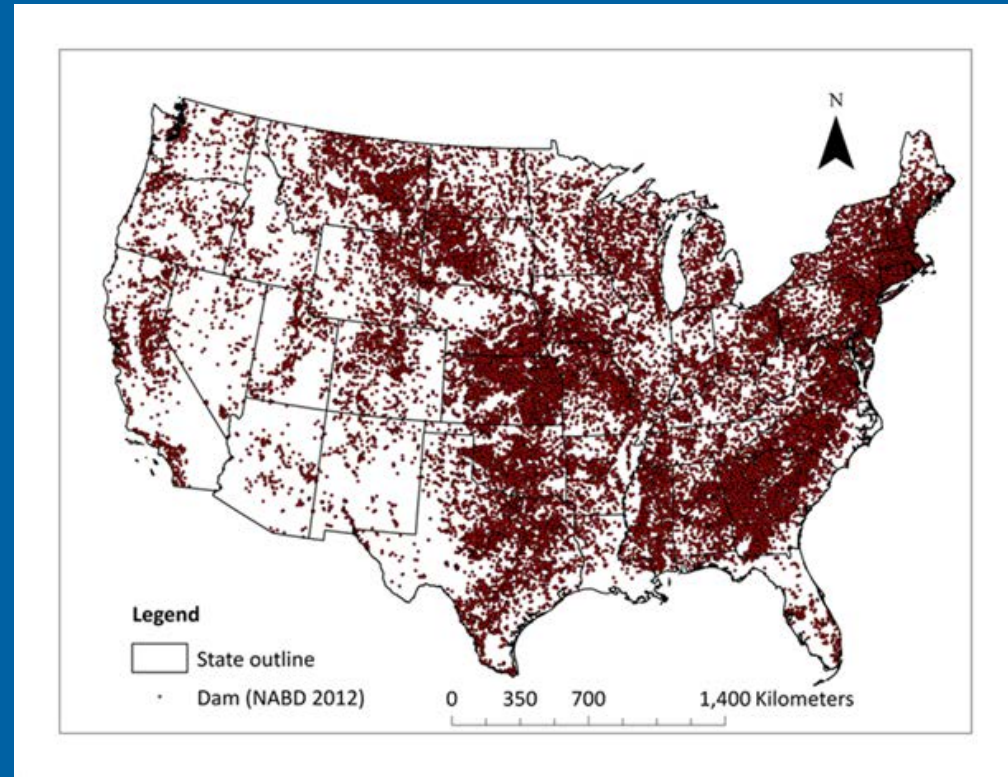
- An HUC-12 contains many local drainages.
- National Hydrography Dataset Plus (NHDPlusV2 2017)
- stream reach = confluence to confluence segments





# National Anthropogenic Barriers Dataset (NABD)

- Includes >56,000 large dams
- Generally > 2 m in height
- (Ostroff et al. 2013)



# National Anthropogenic Barriers Dataset (NABD)

- 6,007 drainage boundaries in the absence of large dams
- 54,120 drainage boundaries with large dams
  - “segments”
- (Cooper et al. 2017)





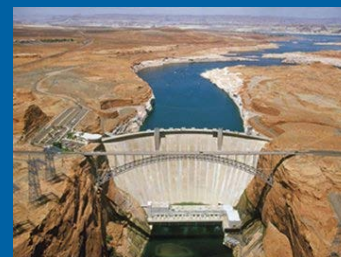
# National Anthropogenic Barriers Dataset (NABD)

- 10 large dams on the mainstem of both rivers
- 100's of sub-basin “segments”

Tombigbee River



Alabama River



# Distribution potential of a species

- 1) Help determine the directionality of movement (downstream, upstream, or over-land) of a species within a drainage if unobstructed.
- 2) Initial dichotomy
  - Passive movers (plants and *Dreissena* sp.)
  - Active movers (fishes and crayfishes)
- 3) More complexity will be added (next steps)

# Orconectus causeyi sighting alert

N



## NAS ARM Legend

- Sighting alert

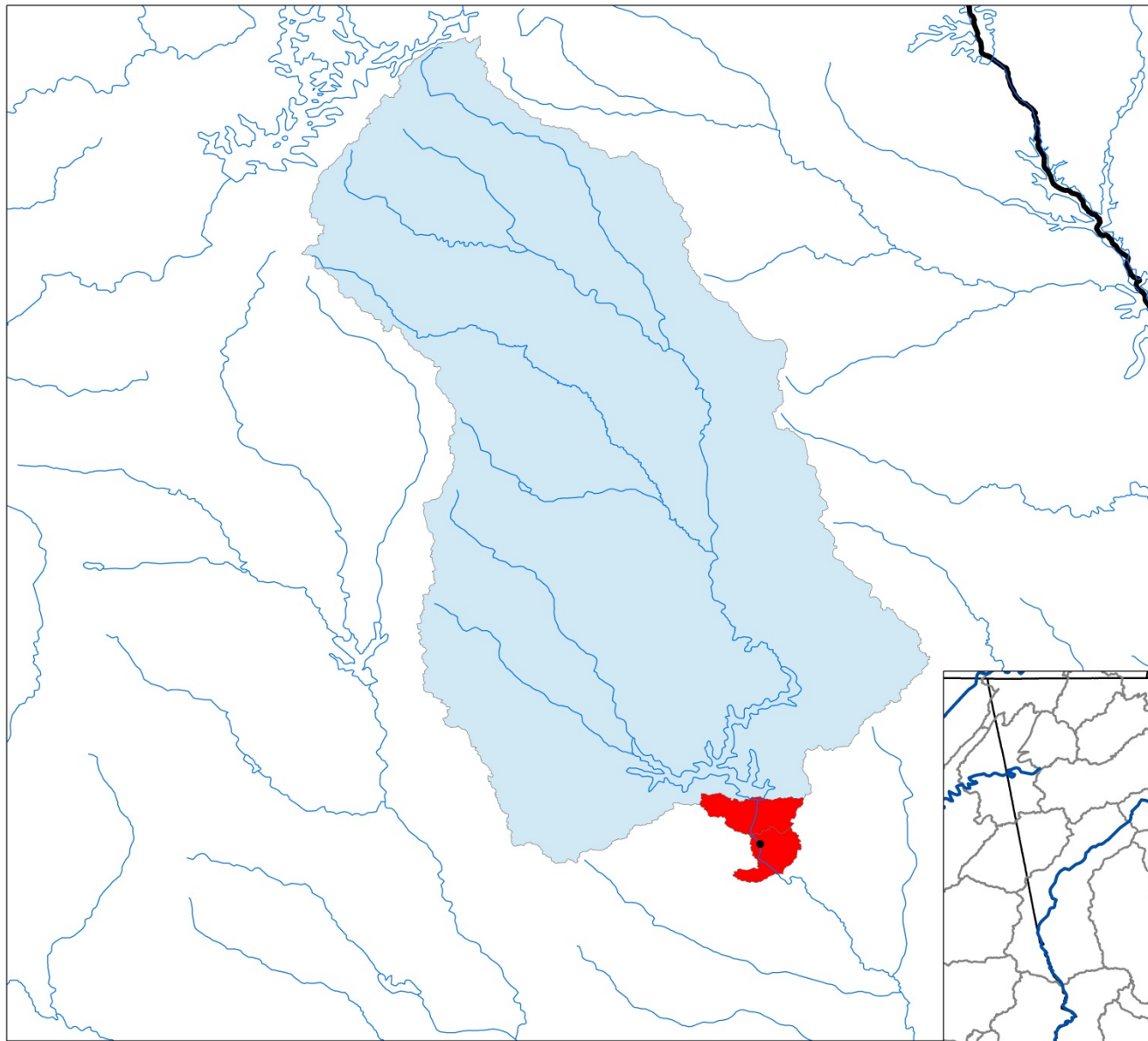
— River

■ Areas at risk

■ Introduced range

□ State outline

HUC 8 hydrologic units



# Future enhancements to NAS ARM

- Expand the mapper nationally to include the entire contiguous US and Hawaii.
- Integrate additional barriers to species dispersal (waterfalls and salinity).
- Add species-specific life history traits from the literature to aid in the determination of distribution potential of nonindigenous species.
- Create and integrate a national boat ramp database to account for the risk of boat vectored spread.
- Automate the map making process of NAS ARM to improve effectiveness and speed of dissemination of information.

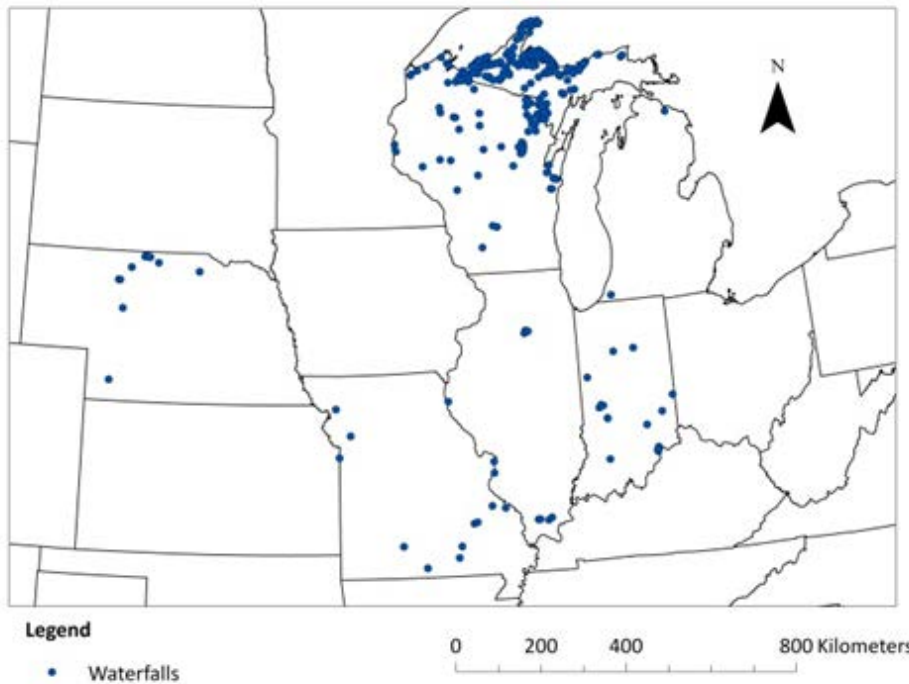
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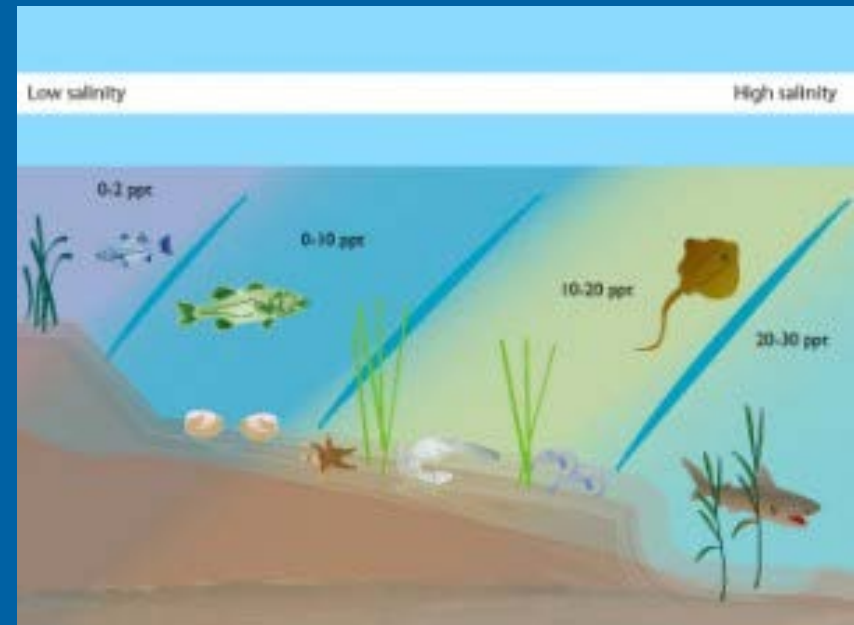
# Integrate additional barriers to species dispersal

National waterfalls layer



Map of Wieferich (2016) waterfall dataset for six states of the Midwest.

Coastal salinity



# When available...



Culvert road crossings



Small dams

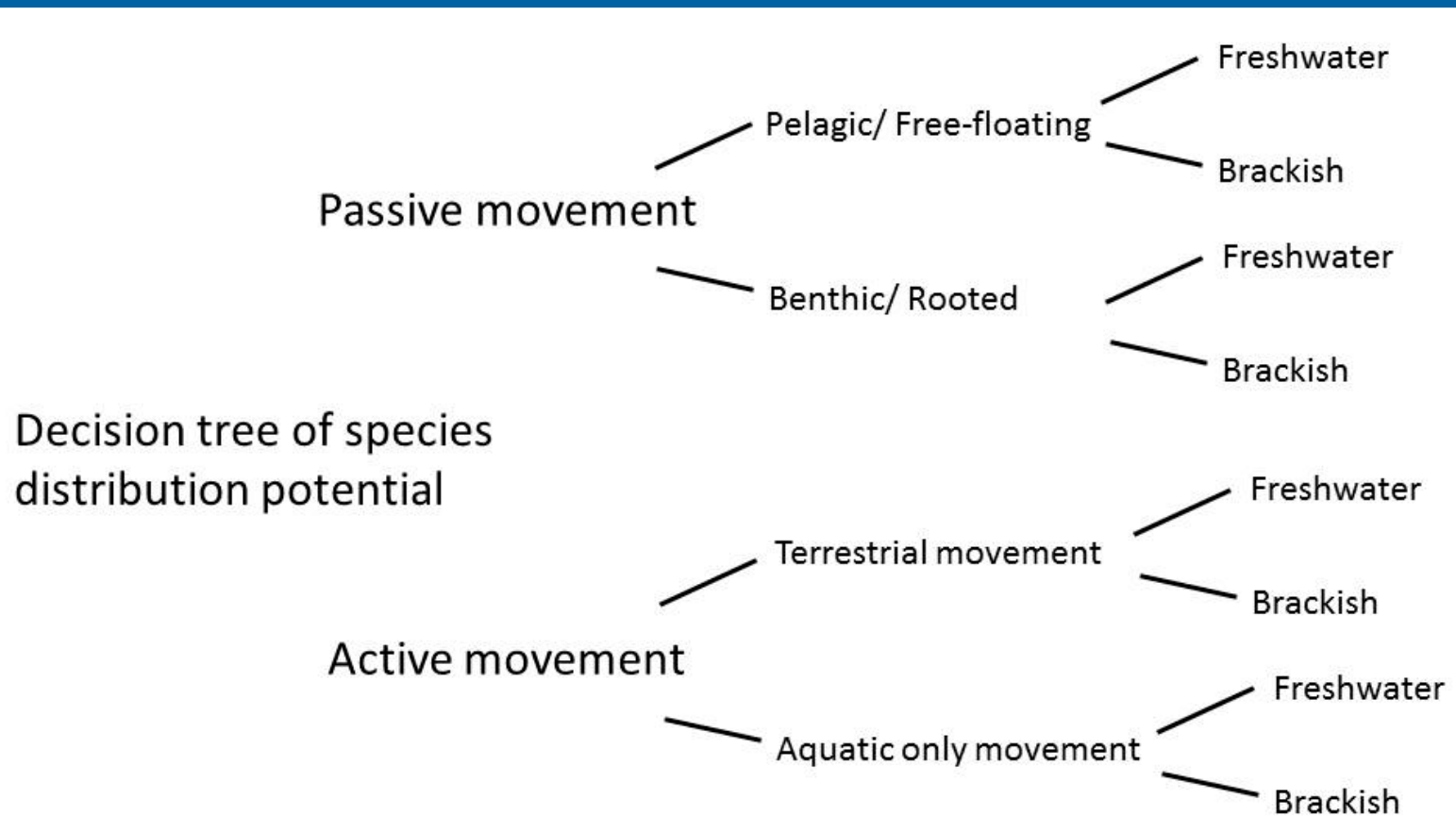
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# Develop of a species-specific distribution potential decision tree

Active moving species	Passive moving species
Possible terrestrial movement	Habitat preference (lentic vs. lotic)
Stream order preferences	Growth habit (floating vs. rooted)
Salinity tolerance	Salinity tolerance
Jumping or climbing ability	Seed dispersal (air, water, animal)
Home range	Reproduction (clonal vs. sexual)

# Develop of a species-specific distribution potential decision tree





# Develop of a species-specific distribution potential decision tree

Fishes		Aquatic plants	
Scientific name	Common name	Scientific name	Common name
<i>Channa argus</i>	Northern Snakehead	<i>Alternanthera philoxeroides</i>	Alligatorweed
<i>Channa marulius</i>	Bullseye Snakehead	<i>Hydrilla verticillata</i>	Hydrilla
<i>Herichthys cyanoguttatus</i>	Rio Grande Cichlid	<i>Myriophyllum aquaticum</i>	Parrot Feather
<i>Hypophthalmichthys molitrix</i>	Silver Carp	<i>Myriophyllum spicatum</i>	Eurasian Milfoil
<i>Hypophthalmichthys nobilis</i>	Bighead Carp	<i>Nymphoides peltata</i>	Floating-heart
<i>Monopterus albus</i>	Asian Swamp Eel	<i>Pistia stratiotes</i>	Water Lettuce
<i>Mylopharyngodon piceus</i>	Black Carp	<i>Salvinia molesta</i>	Giant Salvinia
<i>Oreochromis niloticus</i>	Nile Tilapia	<b>Mussels</b>	
<b>Crayfishes</b>		<i>Corbicula fluminea</i>	Asian Clam
<i>Orconectes rusticus</i>	Rusty Crayfish	<i>Dreissena bugensis</i>	Quagga Mussel
<i>Procambarus clarkii</i>	Red Swamp Crayfish	<i>Dreissena polymorpha</i>	Zebra Mussel

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- **Create and integrate a national public boat ramp database to account for the risk of boat vectored spread.**
- Automate the map making process of NAS ARM to improve effectiveness and speed of dissemination of information.

# National public boat ramp database

- Boat ramps represent a potential distribution vector for both nonindigenous plants and animals
- NAS ARM could account for the risk of boat vectored spread between drainages.



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# Thanks



## USFWS Region 4



## GSARP



# Questions?

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