

# RESTORING BURBOT IN THE KOOTENAI RIVER: MONITORING AND EVALUATION



# OVERVIEW

- ❑ Objectives and agency roles
- ❑ Field efforts
- ❑ Population updates
- ❑ Looking ahead
- ❑ Summary



# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)





# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)



# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)



# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)



# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)



# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)





# OBJECTIVES AND AGENCY ROLES

- Overarching objective
  - ▣ Restore a naturally reproducing and harvestable Burbot population in the Kootenai River
- IDFG roles
  - ▣ Population characterization
  - ▣ Spatiotemporal characteristics of spawning
  - ▣ Movement and habitat use
  - ▣ Success of various stocking strategies
  - ▣ Academic research
  - ▣ Setting angling regulations (ultimately)



# FIELD EFFORTS

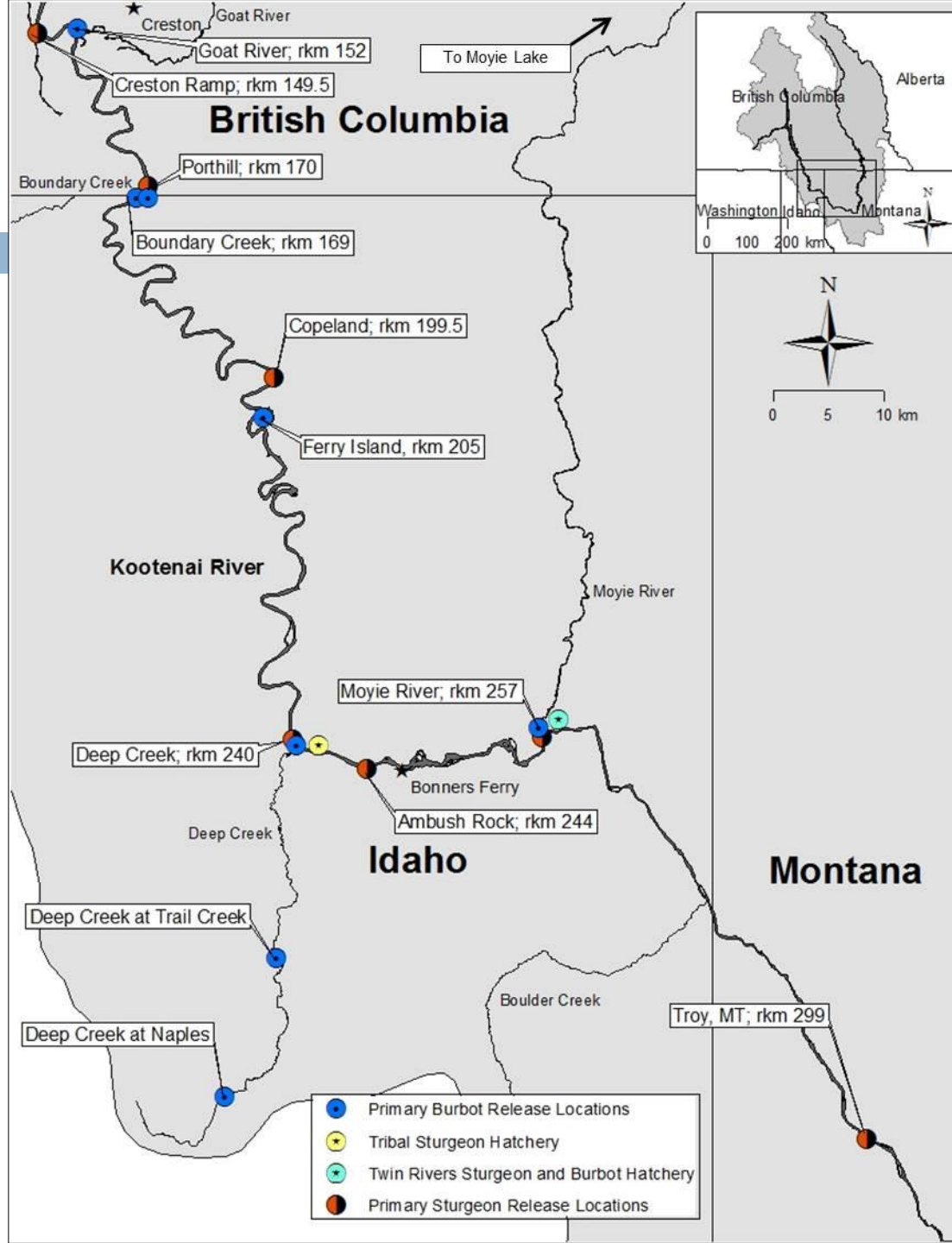
- Key points:
  - ▣ Hatchery fish and genetics
  - ▣ PIT tagging
    - Six stocking locations
    - Released at different life stages



# FIELD EFFORTS

- Key points:
  - ▣ Hatchery fish and genetics
  - ▣ PIT tagging
    - Six stocking locations
    - Released at different life stages







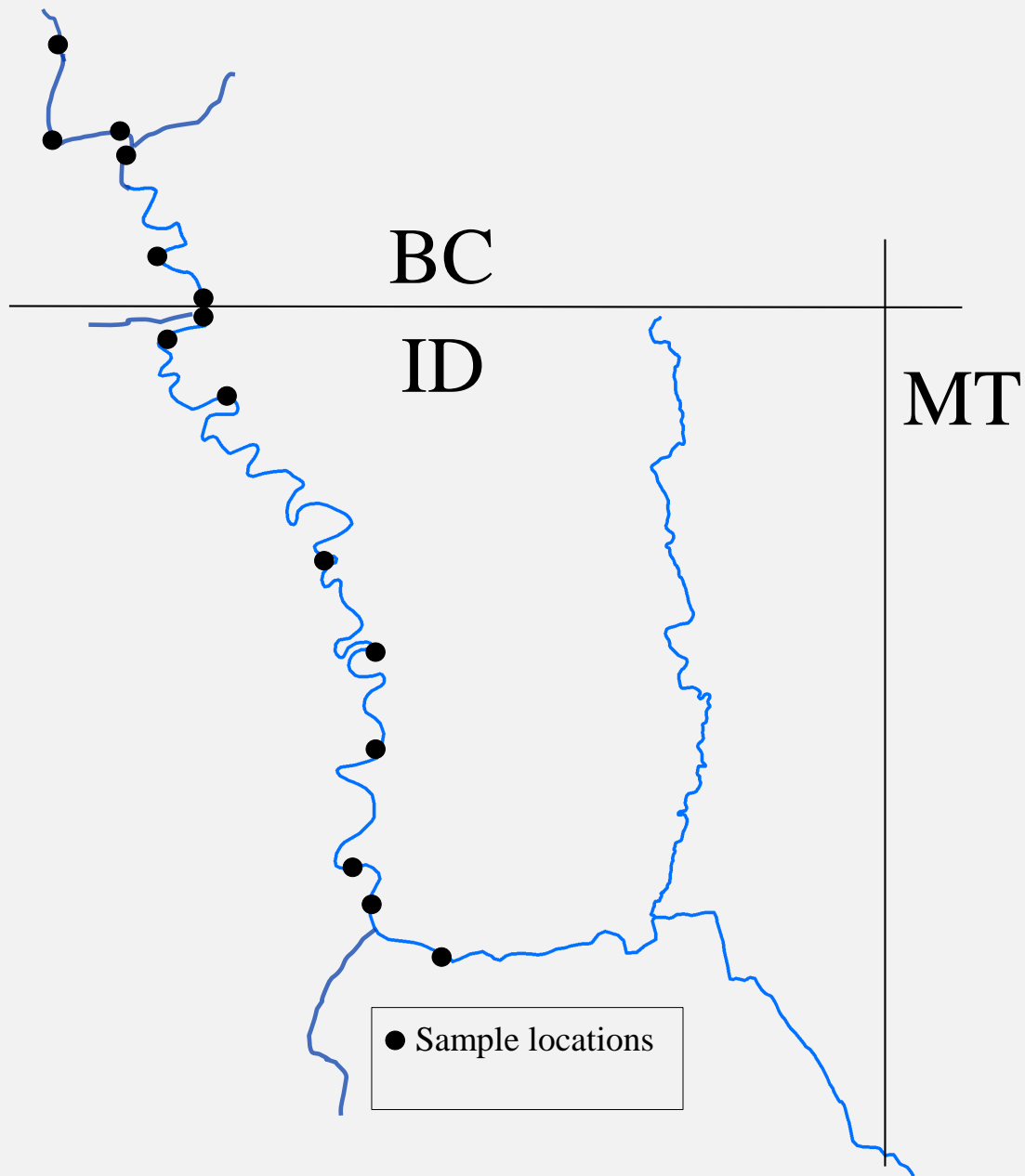
# FIELD EFFORTS

**Baited hoop-nets  
(December 1-March 31)**

VEMCO sonic tags and  
passive arrays

University studies

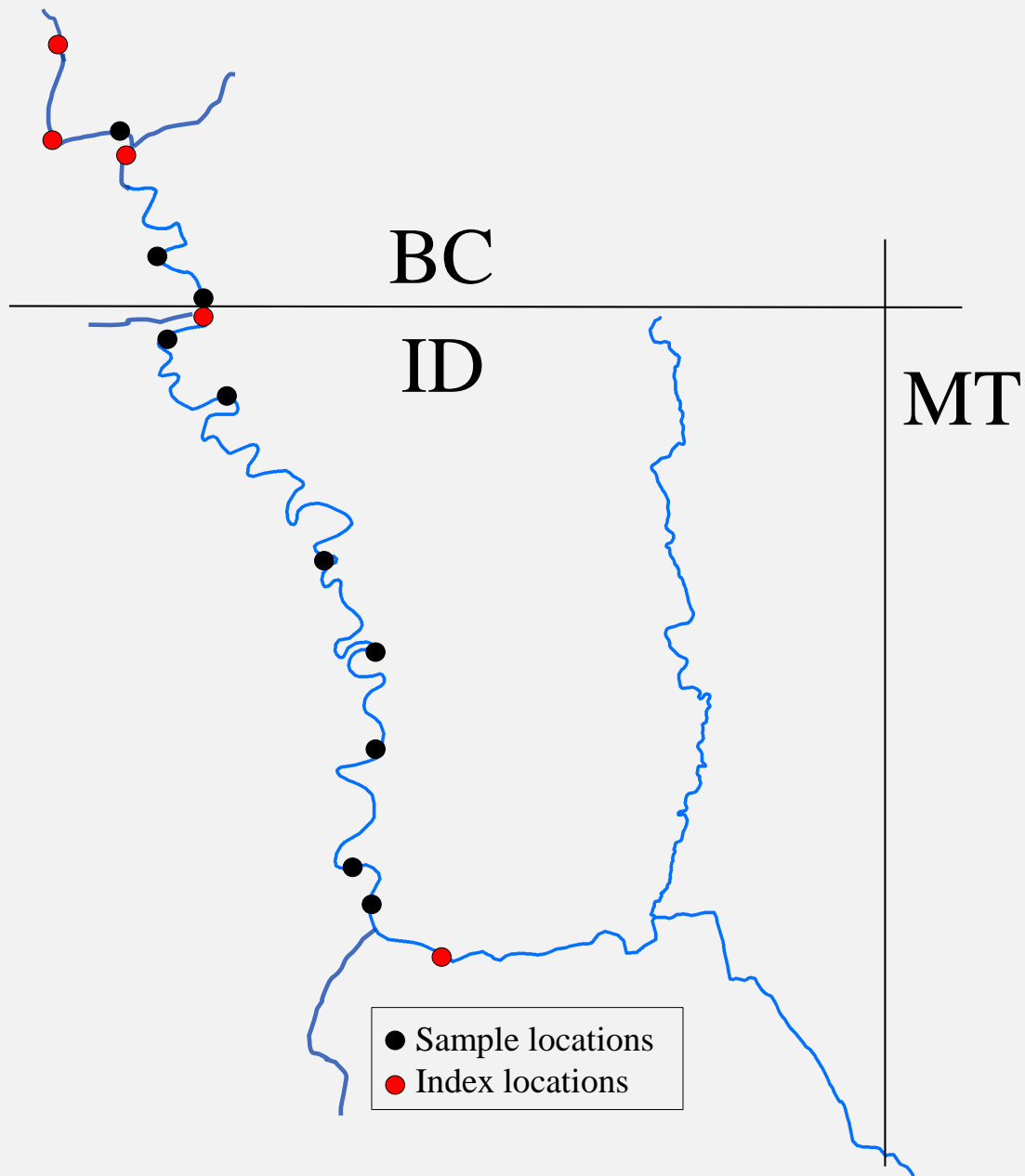




### WINTER SAMPLING

- Hoop nets: 60cm x 2m
- 15 sites, 36 total hoop nets
- 6.4 and 19.1mm mesh size (paired sets at each site)
- Three sites to evaluate catch difference in shallow and deep sets





### WINTER SAMPLING

- Hoop nets: 60cm x 2m
- 15 sites, 36 total hoop nets
- 6.4 and 19.1mm mesh size (paired sets at each site)
- Three sites to evaluate catch difference in shallow and deep sets

### INDEX LOCATIONS

- Five sites since 1996
- Monitor trend CPUE





# FIELD EFFORTS

Baited hoop-nets  
(December 1-March 31)

**VEMCO** sonic tags and  
passive arrays

University studies





# FIELD EFFORTS

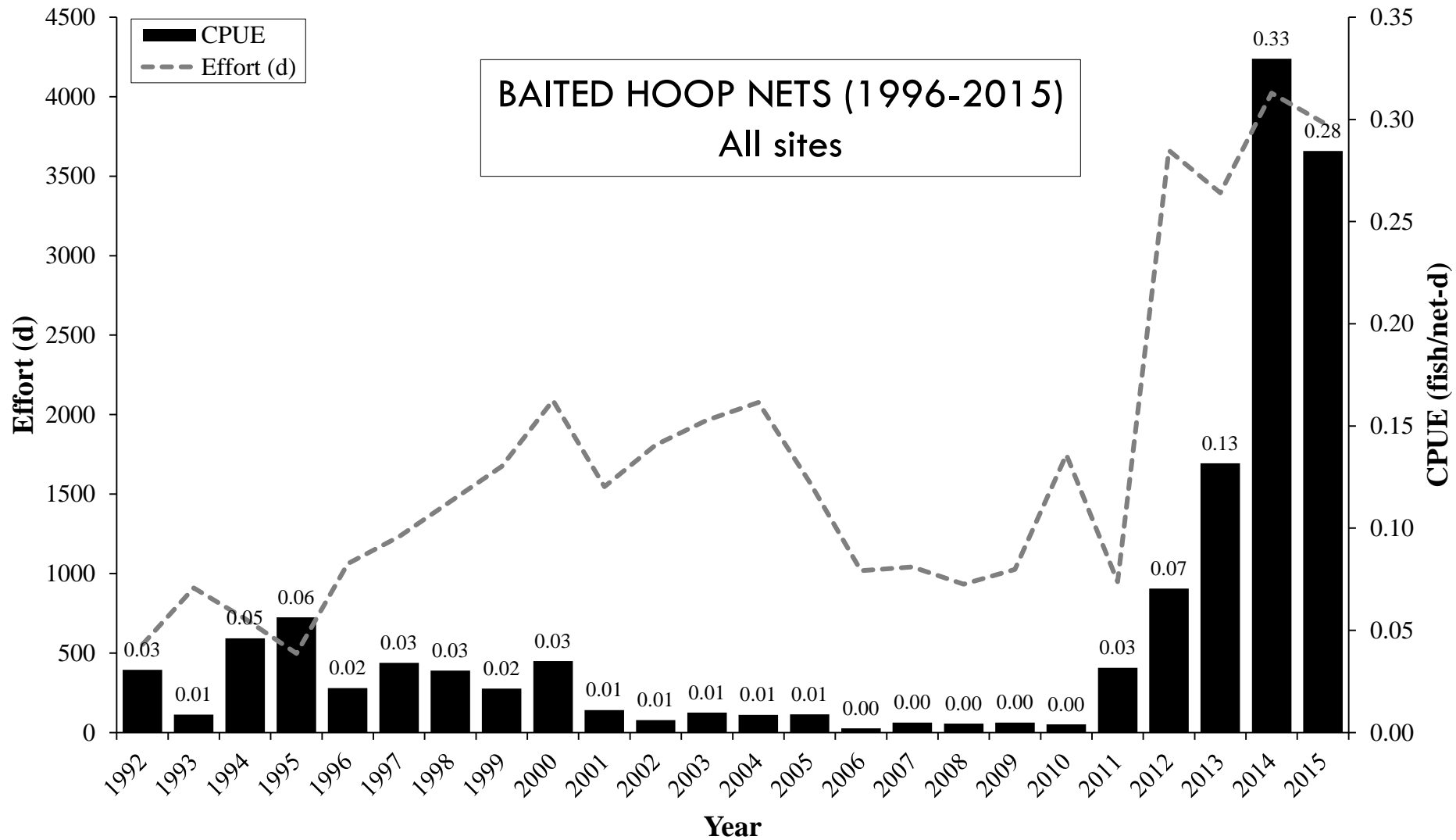
Baited hoop-nets  
(December 1-March 31)

VEMCO sonic tags and  
passive arrays

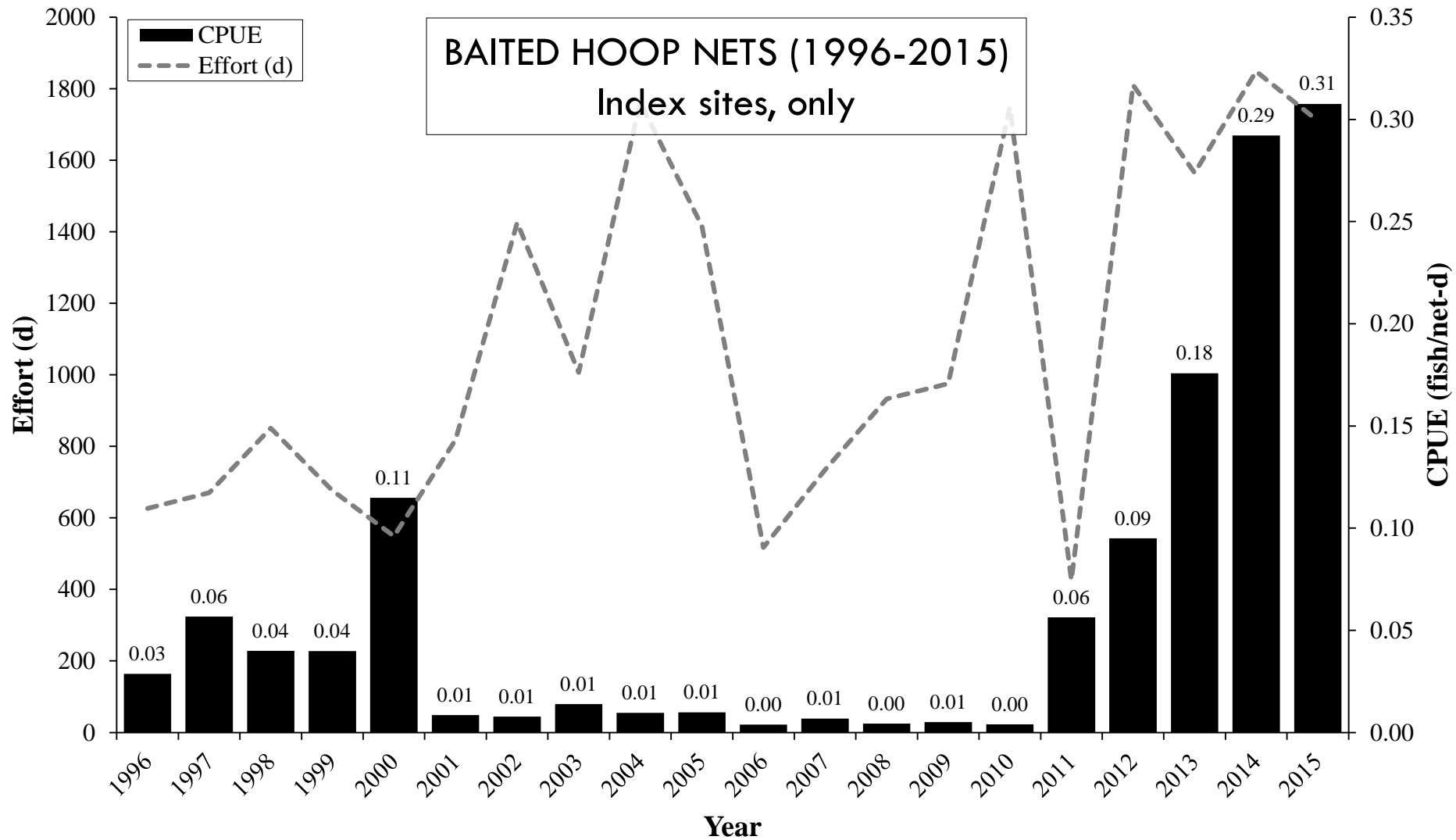
**University studies**



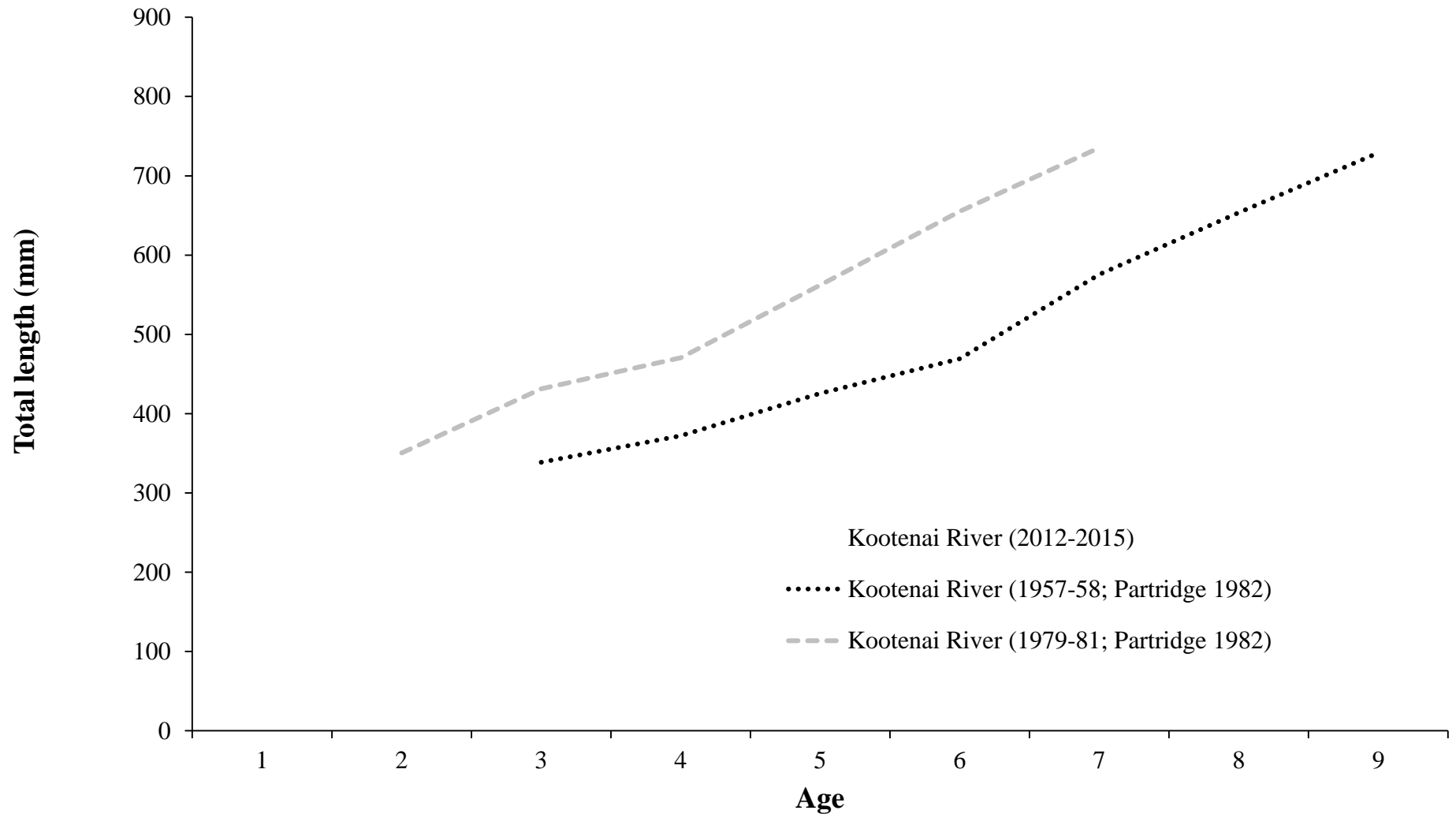
# POPULATION UPDATES: CATCH RATES



# POPULATION UPDATES: CATCH RATES

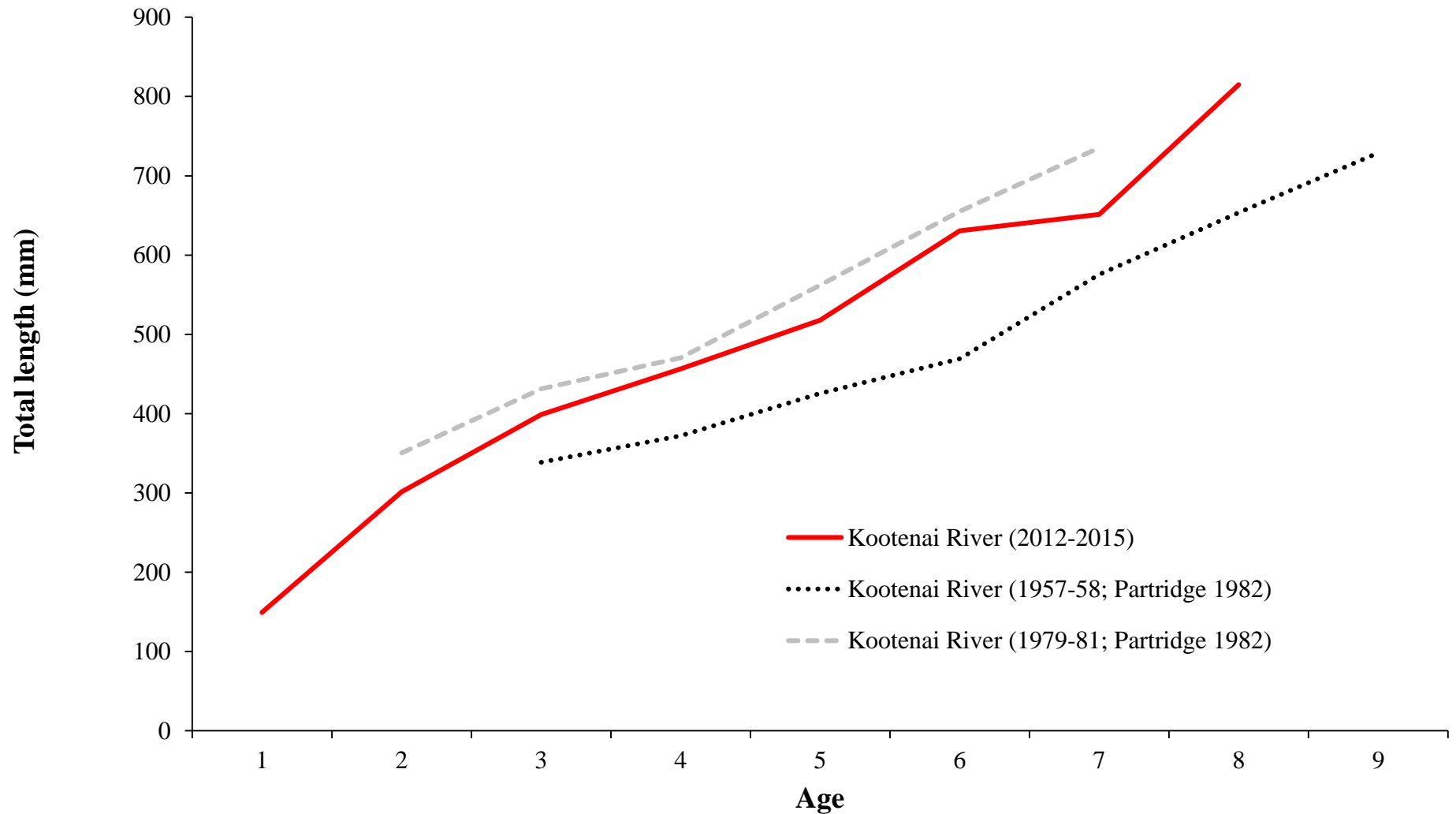


# POPULATION UPDATES: GROWTH

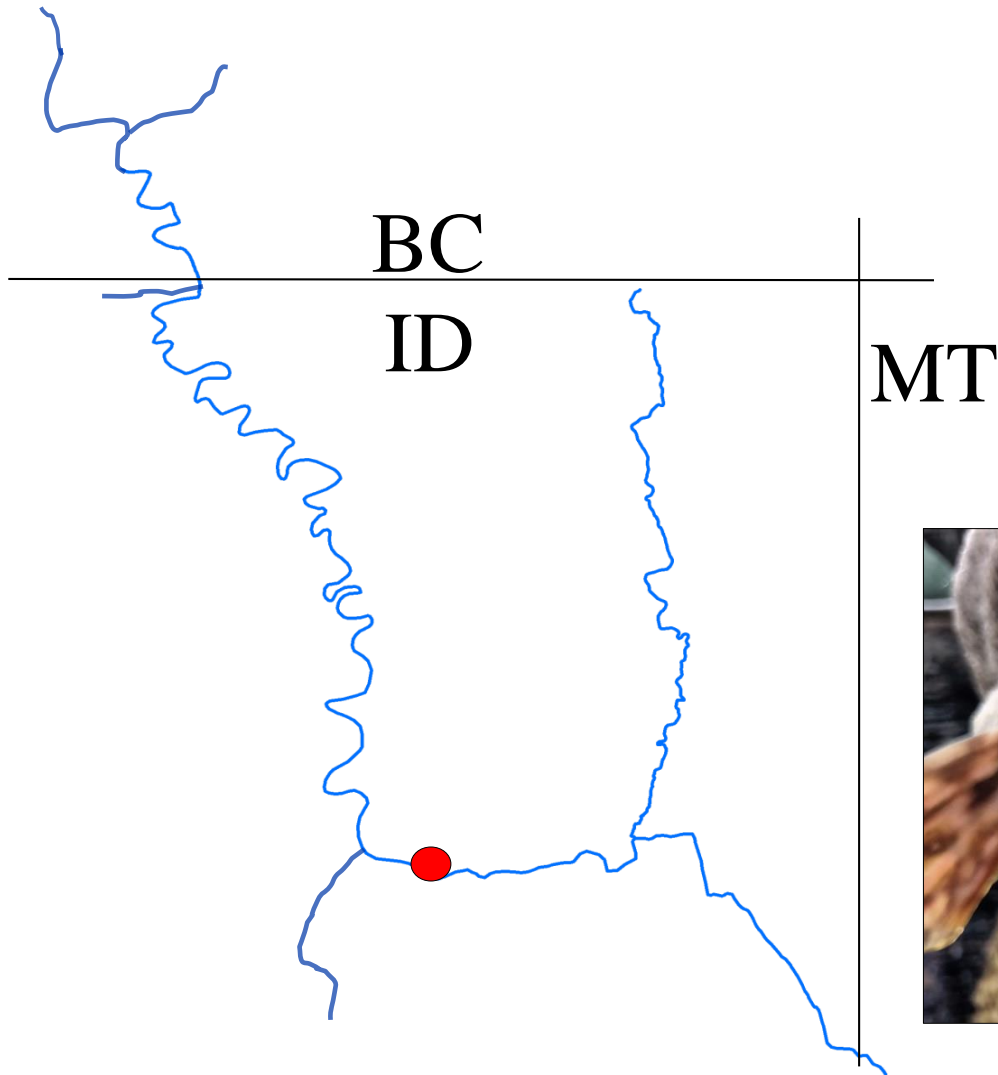




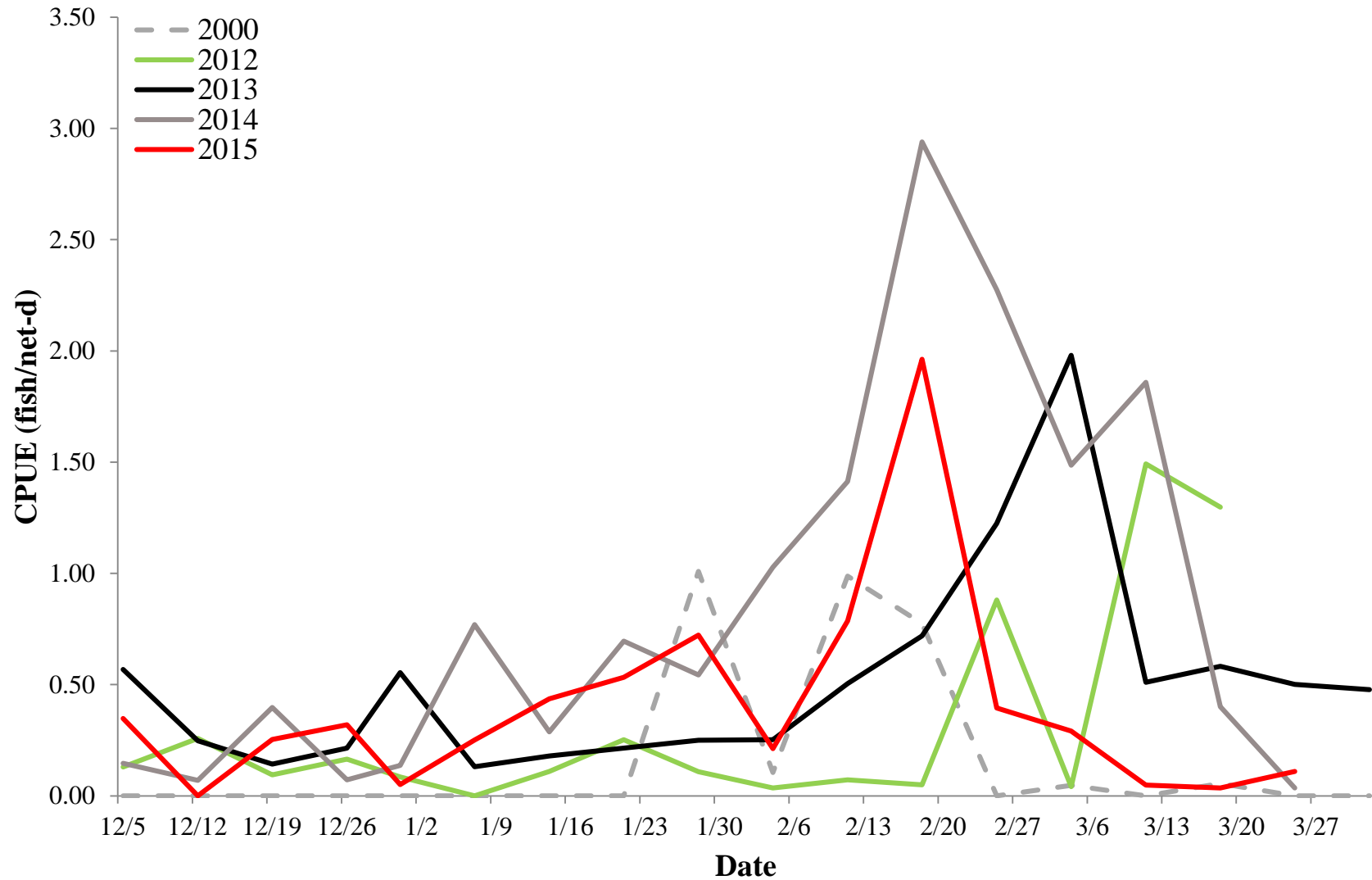
# POPULATION UPDATES: GROWTH



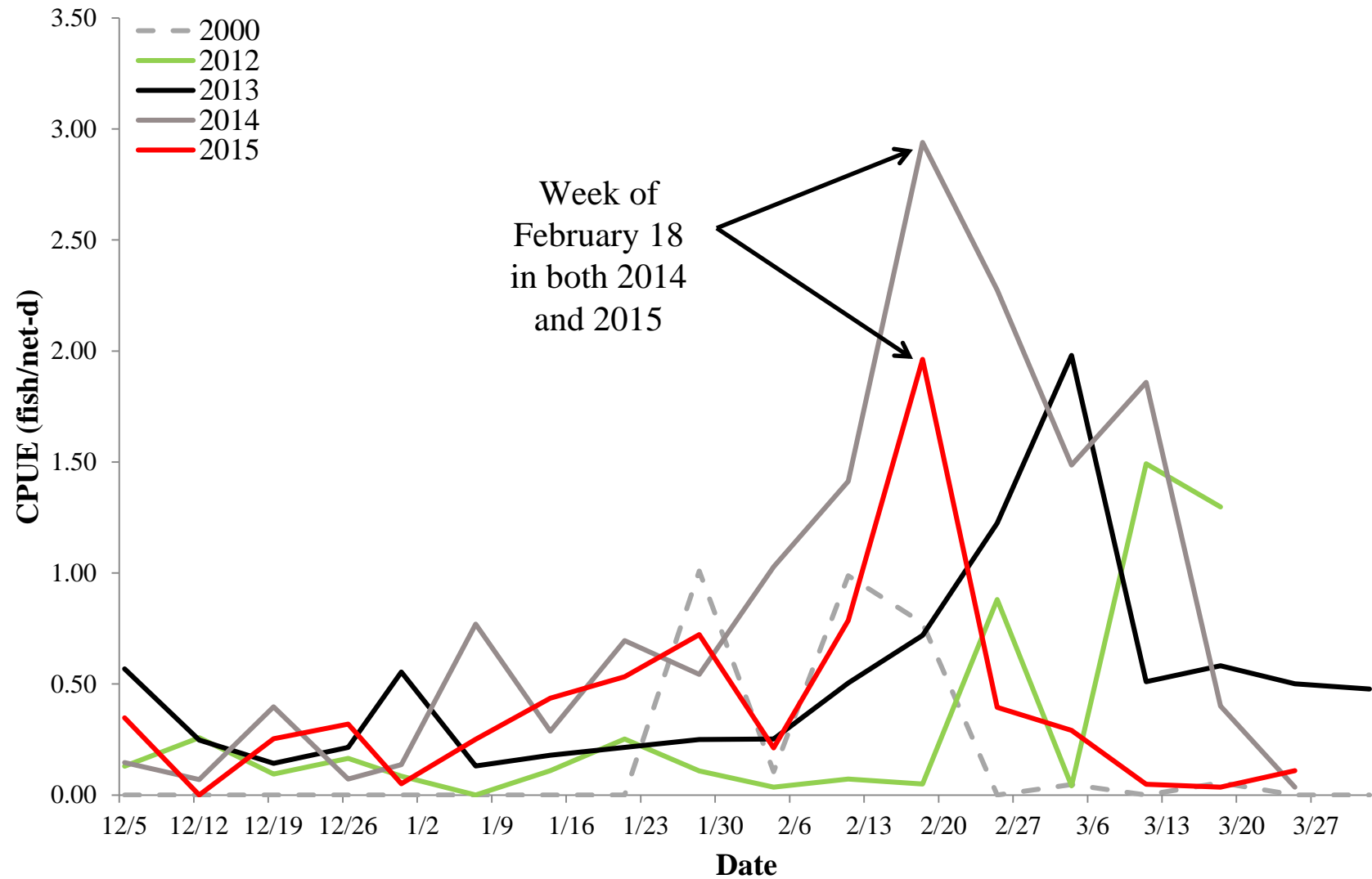
# POPULATION UPDATES: SPAWN TIMING



# POPULATION UPDATES: SPAWN TIMING

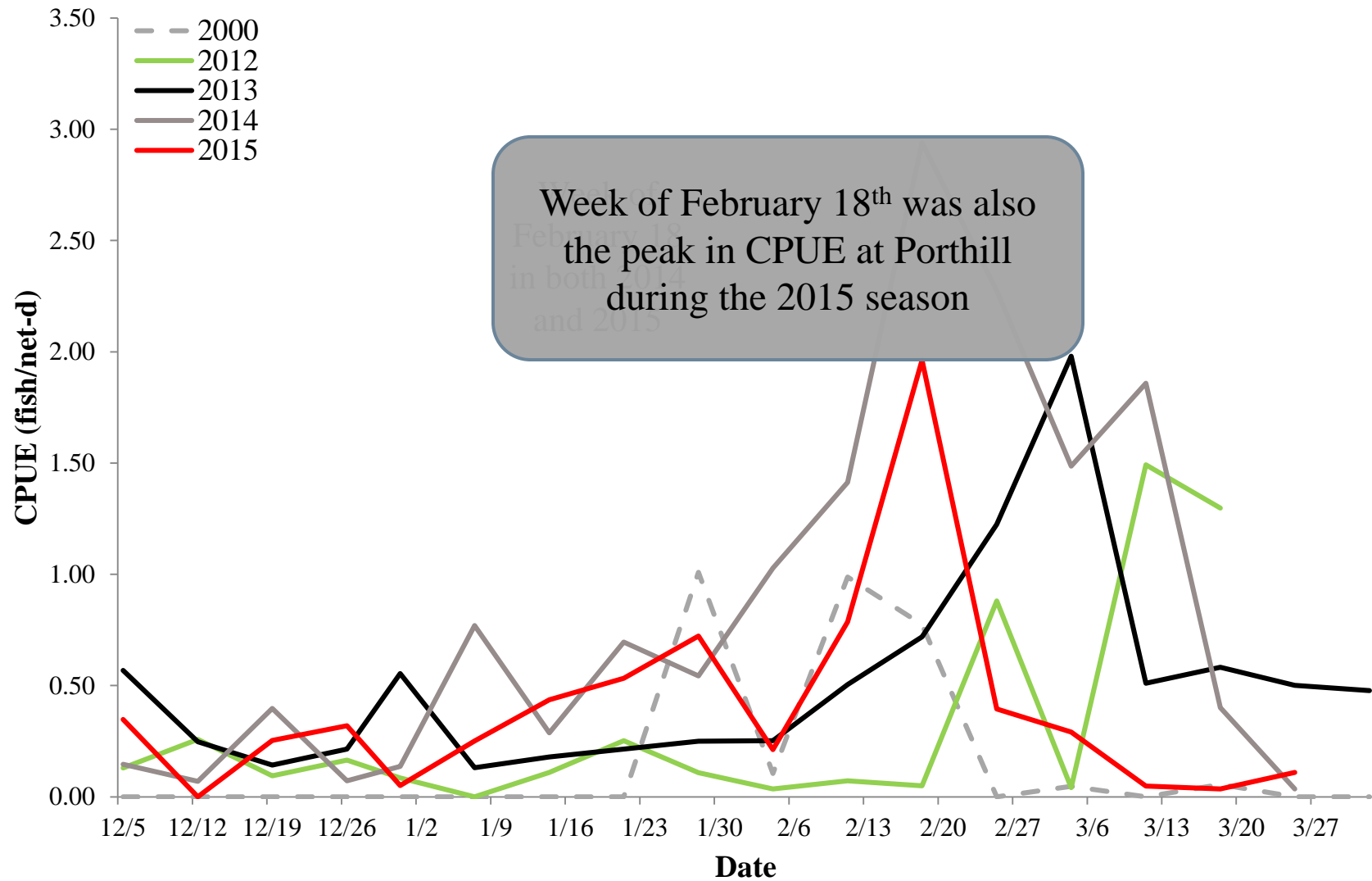


# POPULATION UPDATES: SPAWN TIMING

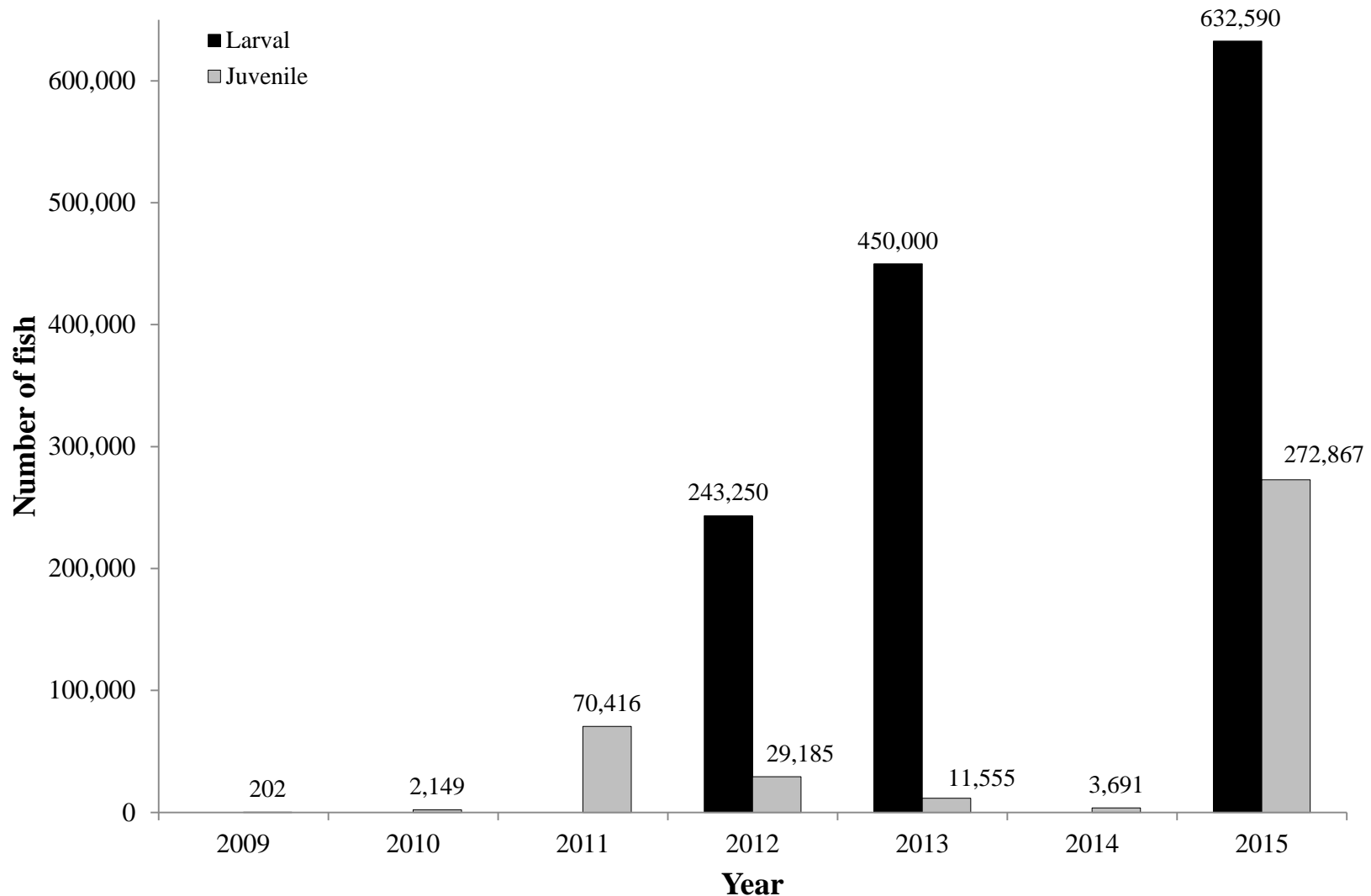




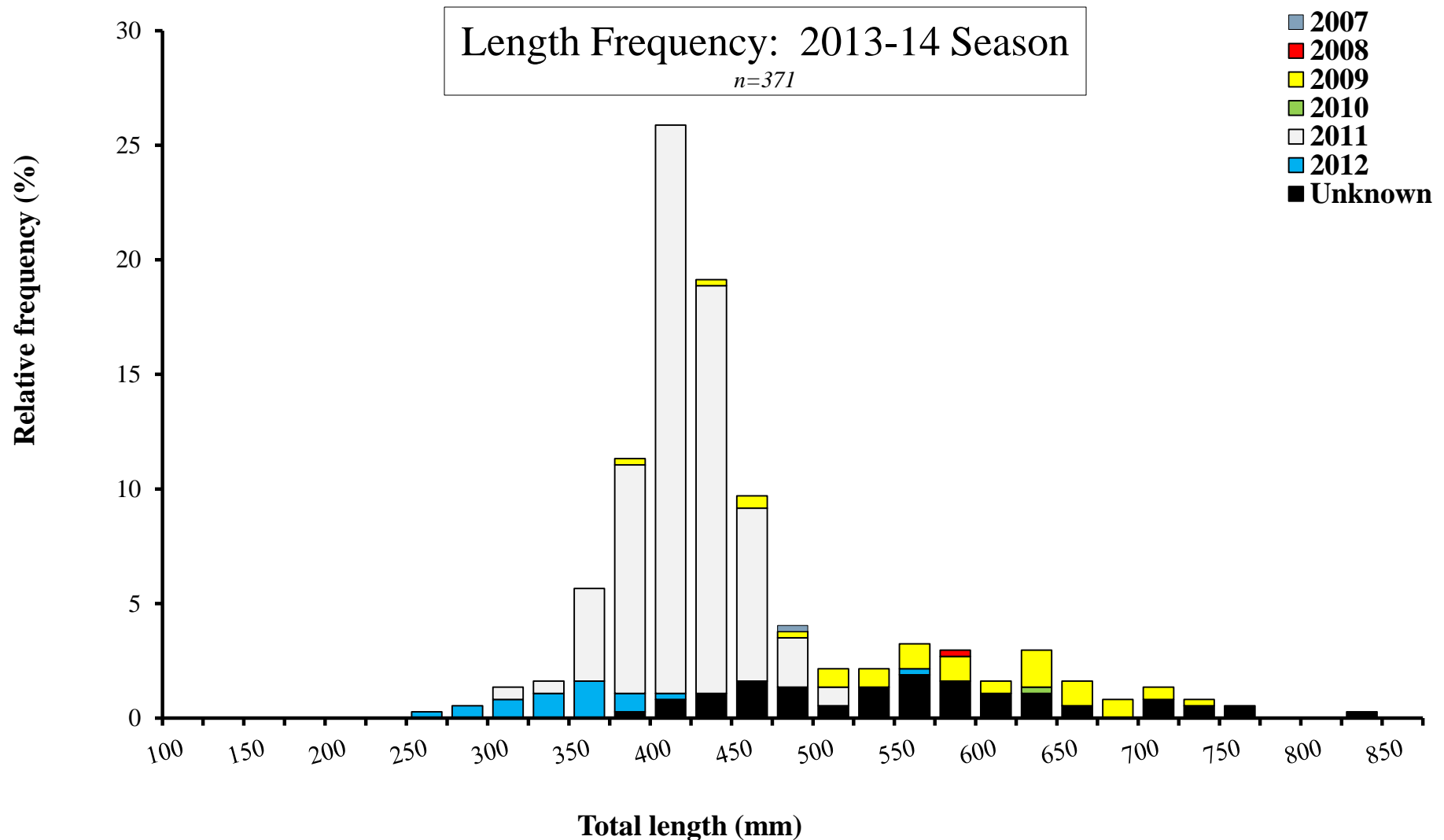
# POPULATION UPDATES: SPAWN TIMING



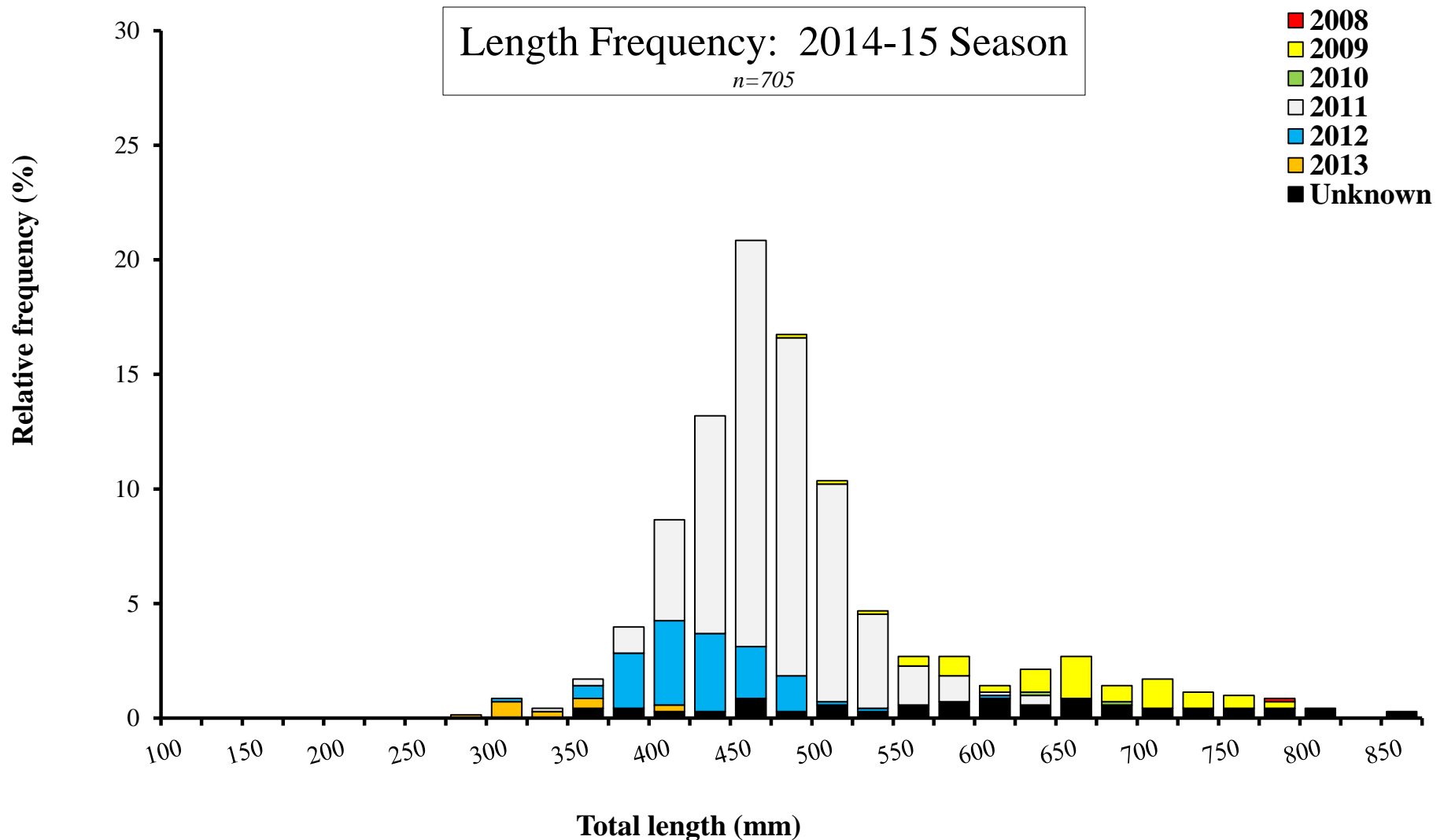
# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES



# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES



# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES



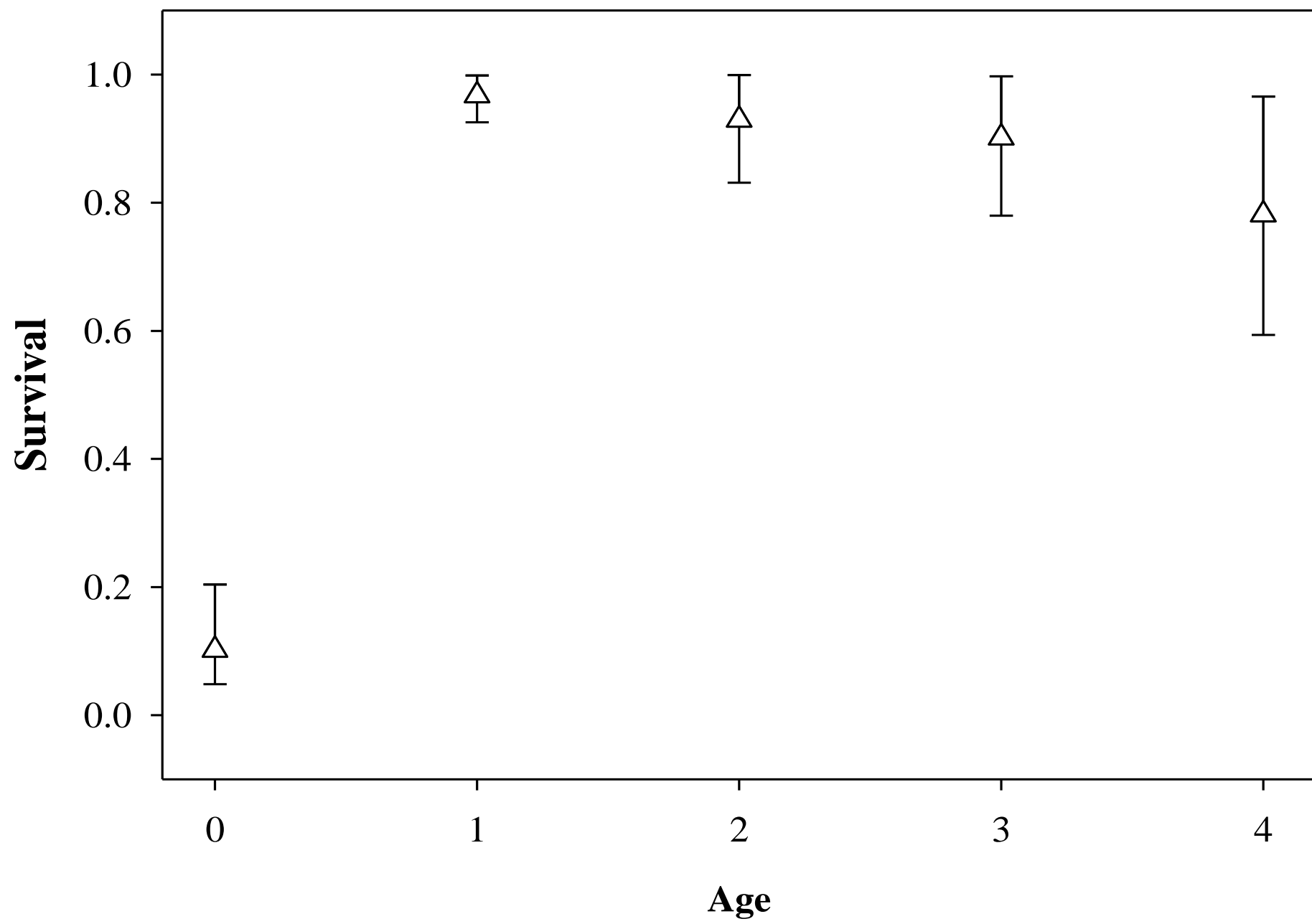




Age	Release Location	Survival	SD	- 95% CI	+ 95% CI

# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659



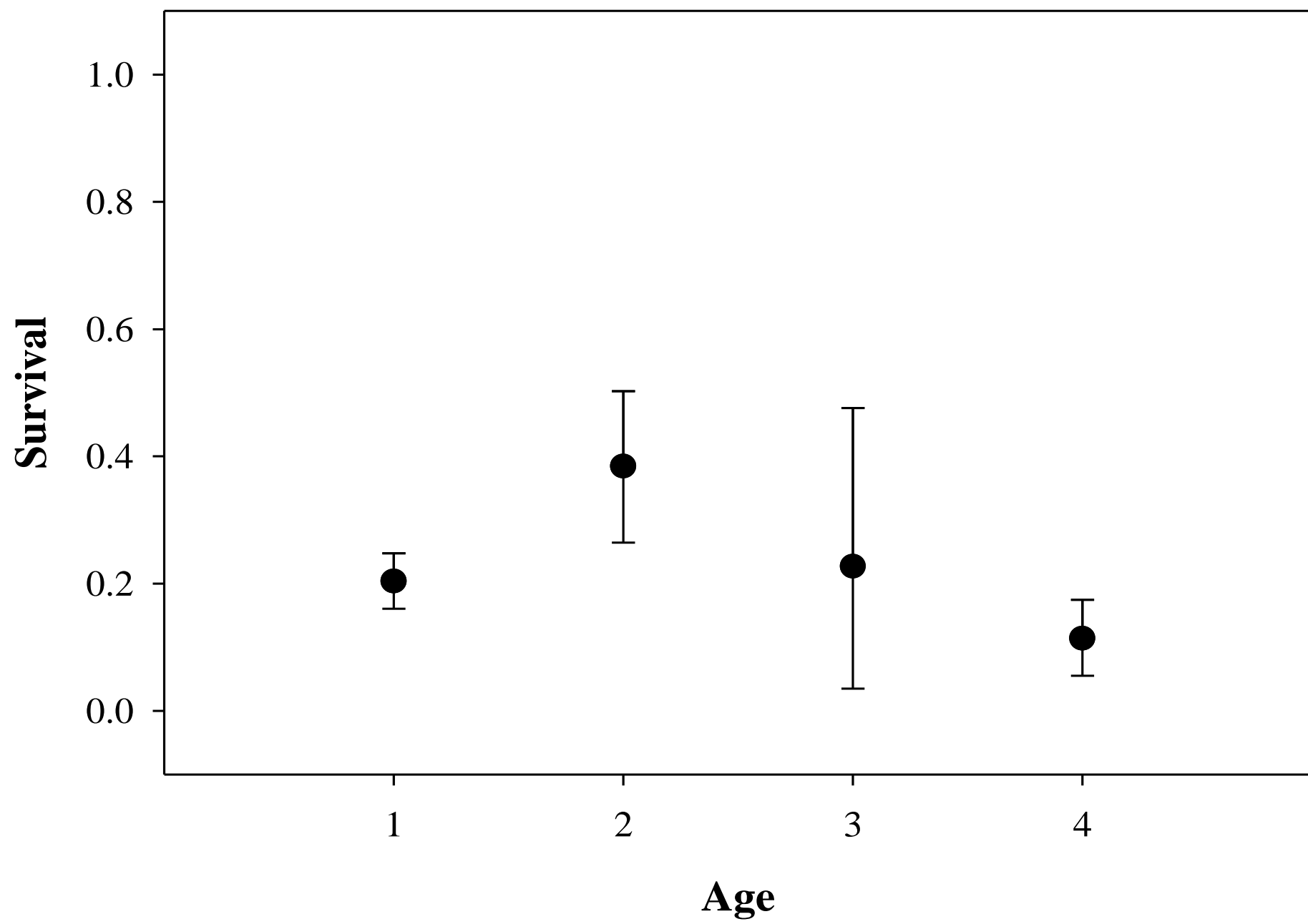
# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

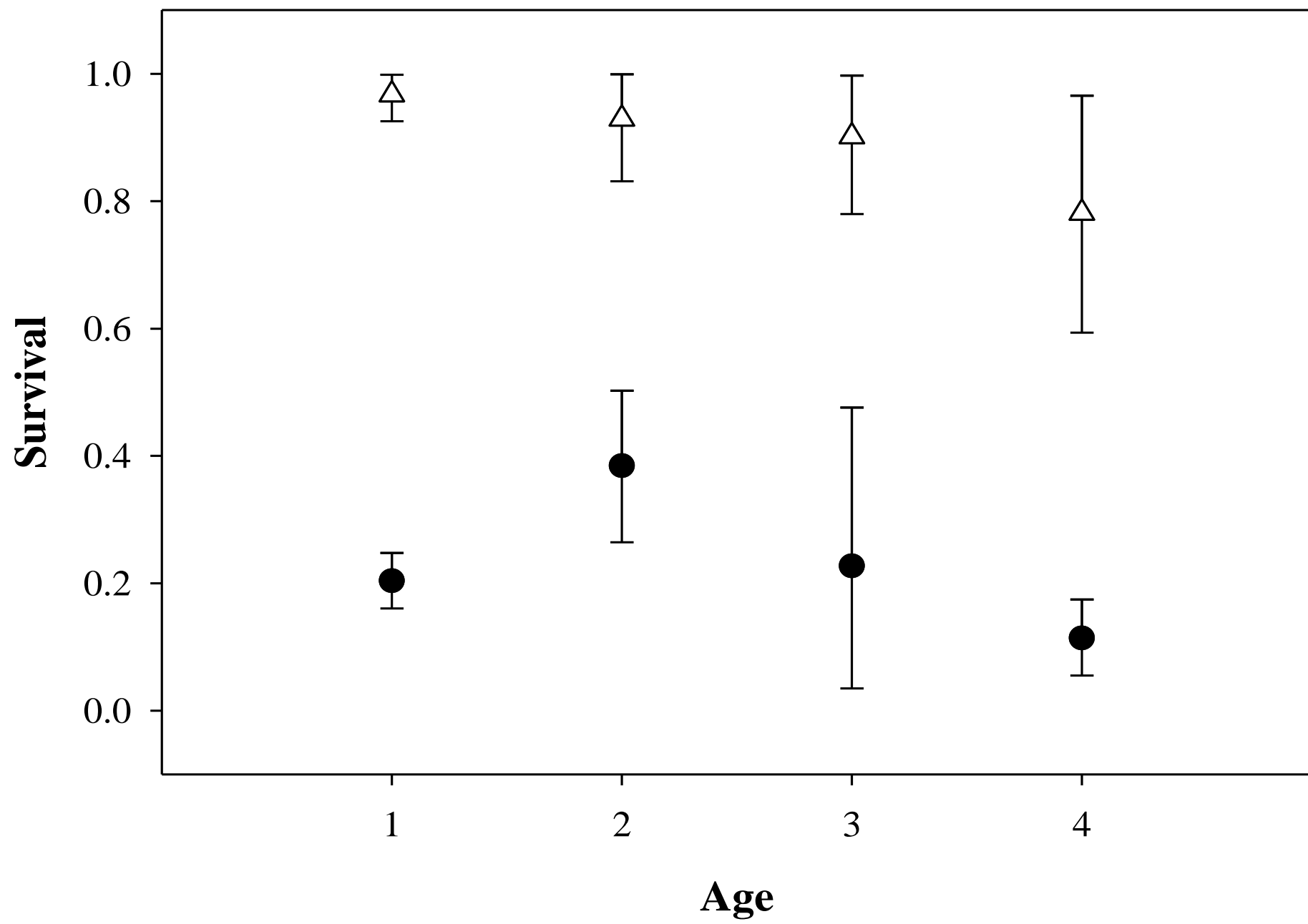
Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659



# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659
Age-1	N/A	0.2036	0.0222	0.1604	0.2476
Age-2	N/A	0.3841	0.0611	0.2642	0.5025
Age-3	N/A	0.2271	0.1232	0.0348	0.4762
Age-4	N/A	0.1137	0.0338	0.0552	0.1743





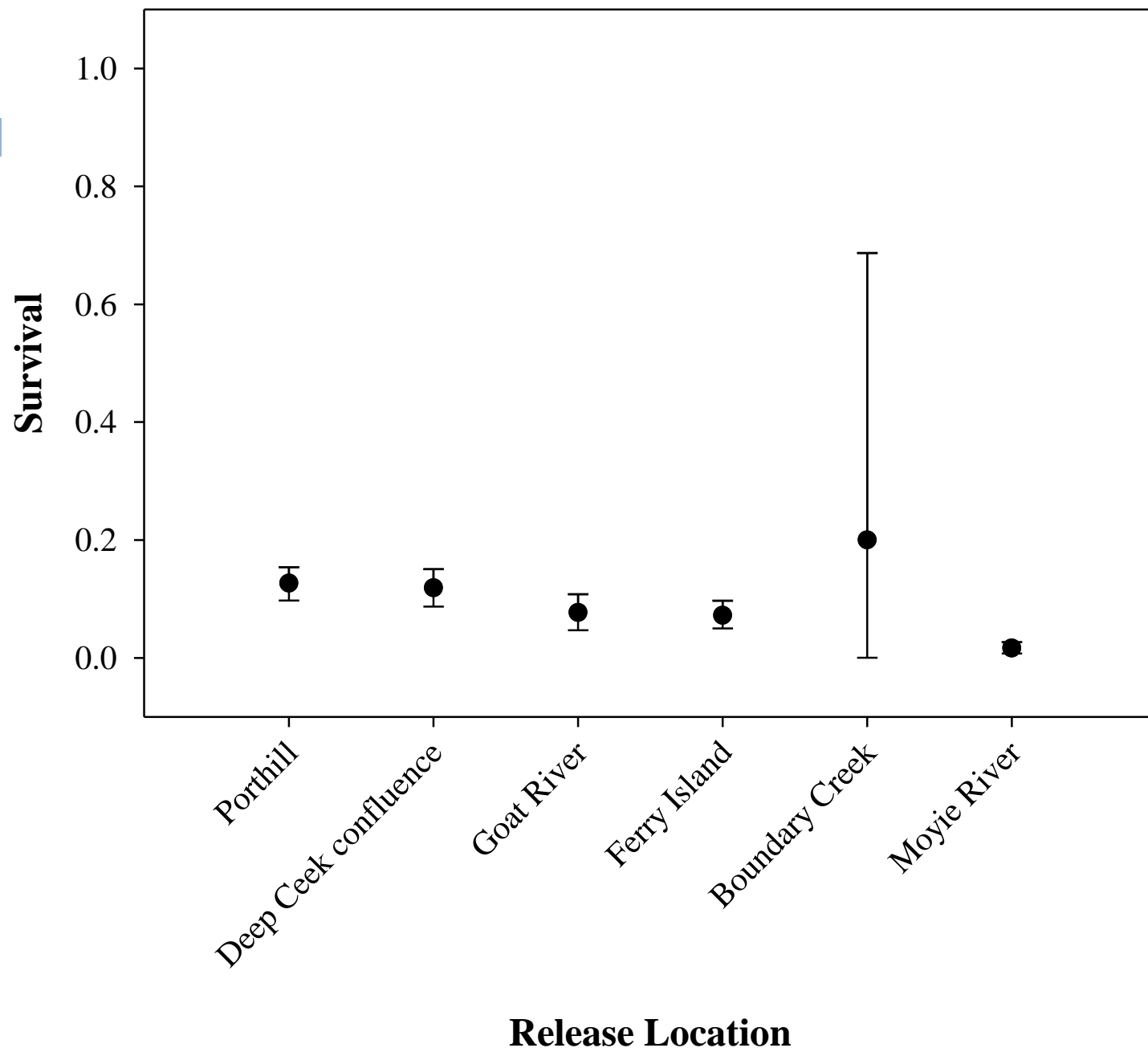
# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

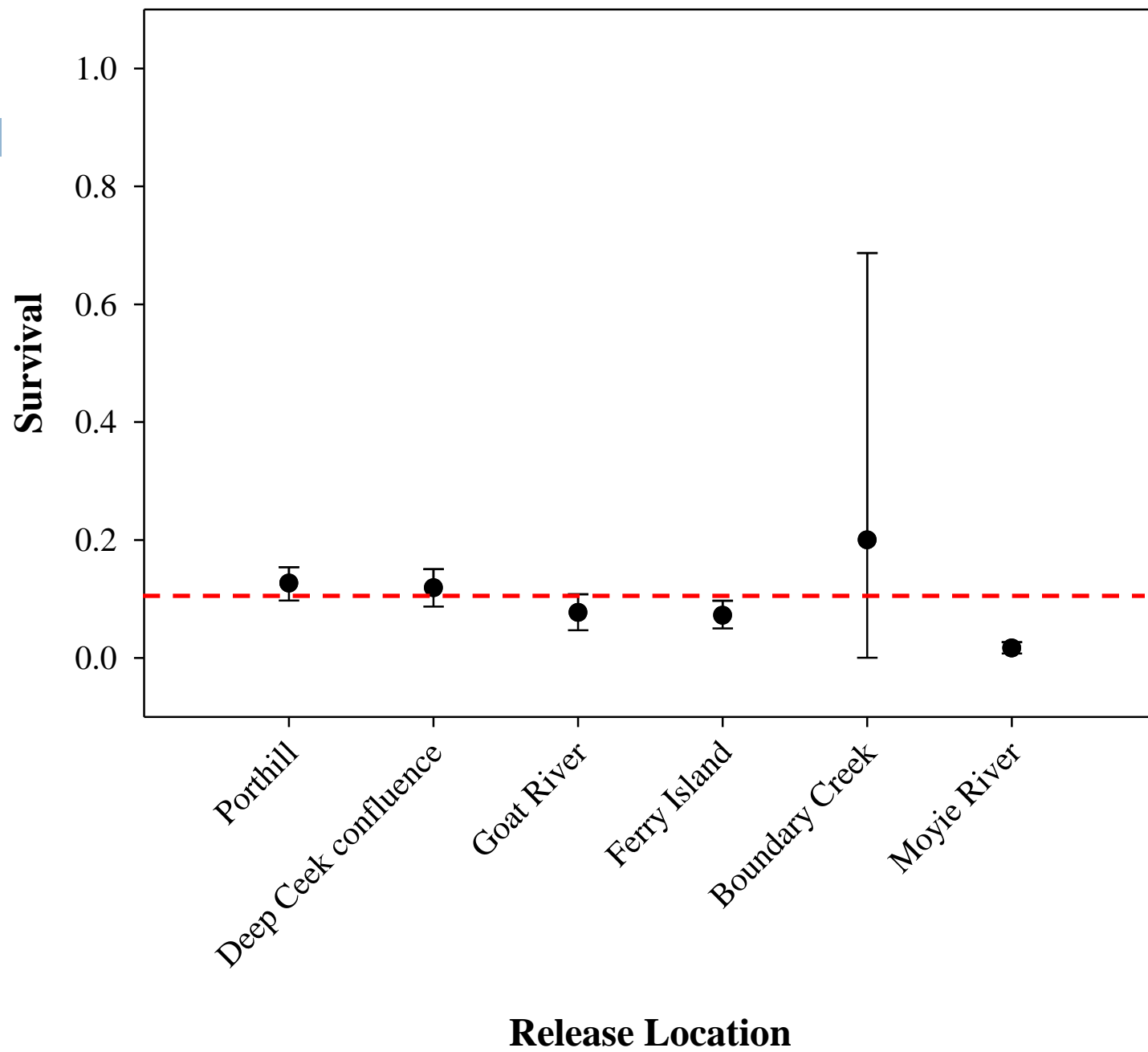
Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659
Age-1	N/A	0.2036	0.0222	0.1604	0.2476
Age-2	N/A	0.3841	0.0611	0.2642	0.5025
Age-3	N/A	0.2271	0.1232	0.0348	0.4762
Age-4	N/A	0.1137	0.0338	0.0552	0.1743

# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	Boundary Creek	0.1997	0.2166	0.0003	0.6871
Age-0	Deep Creek confluence	0.1187	0.0166	0.0869	0.1503
Age-0	Ferry Island	0.0720	0.0122	0.0500	0.0969
Age-0	Goat River	0.0766	0.0158	0.0469	0.1079
Age-0	Moyie River	0.0166	0.0051	0.0075	0.0266
Age-0	Porthill	0.1263	0.0147	0.0975	0.1540
Age-0	Unknown	0.0228	0.0222	0.1604	0.2476
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659
Age-1	N/A	0.2036	0.0222	0.1604	0.2476
Age-2	N/A	0.3841	0.0611	0.2642	0.5025
Age-3	N/A	0.2271	0.1232	0.0348	0.4762
Age-4	N/A	0.1137	0.0338	0.0552	0.1743



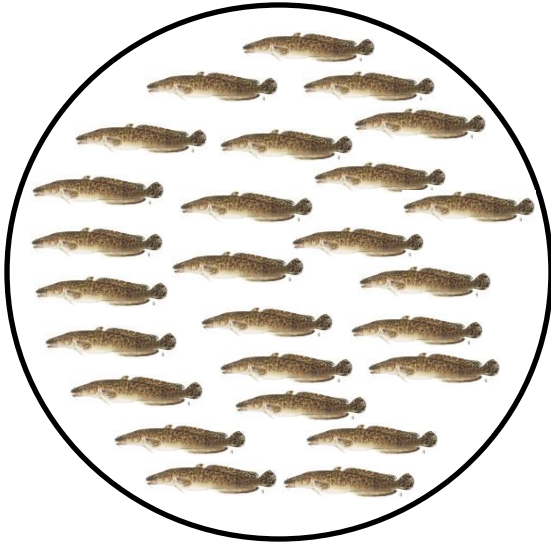




# POPULATION UPDATES: SUCCESS OF VARIOUS STOCKING STRATEGIES

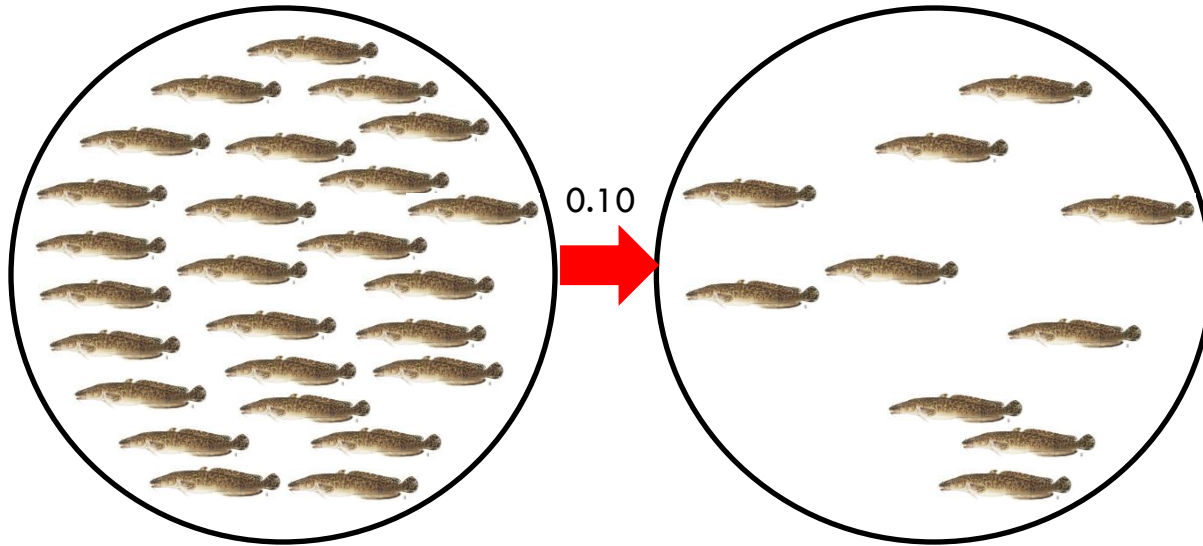
Age	Release Location	Survival	SD	- 95% CI	+ 95% CI
Age-0	Boundary Creek	0.1997	0.2166	0.0003	0.6871
Age-0	Deep Creek confluence	0.1187	0.0166	0.0869	0.1503
Age-0	Ferry Island	0.0720	0.0122	0.0500	0.0969
Age-0	Goat River	0.0766	0.0158	0.0469	0.1079
Age-0	Moyie River	0.0166	0.0051	0.0075	0.0266
Age-0	Porthill	0.1263	0.0147	0.0975	0.1540
Age-0	Unknown	0.0228	0.0222	0.1604	0.2476
Age-0	N/A	0.1016	0.0468	0.0482	0.2038
Age-1	N/A	0.9675	0.0212	0.9257	0.9987
Age-2	N/A	0.9293	0.0494	0.8313	0.9994
Age-3	N/A	0.9015	0.063	0.7800	0.9972
Age-4+	N/A	0.7816	0.102	0.5937	0.9659
Age-1	N/A	0.2036	0.0222	0.1604	0.2476
Age-2	N/A	0.3841	0.0611	0.2642	0.5025
Age-3	N/A	0.2271	0.1232	0.0348	0.4762
Age-4	N/A	0.1137	0.0338	0.0552	0.1743

## Juvenile release group



Juvenile release group

Age-1 survivors

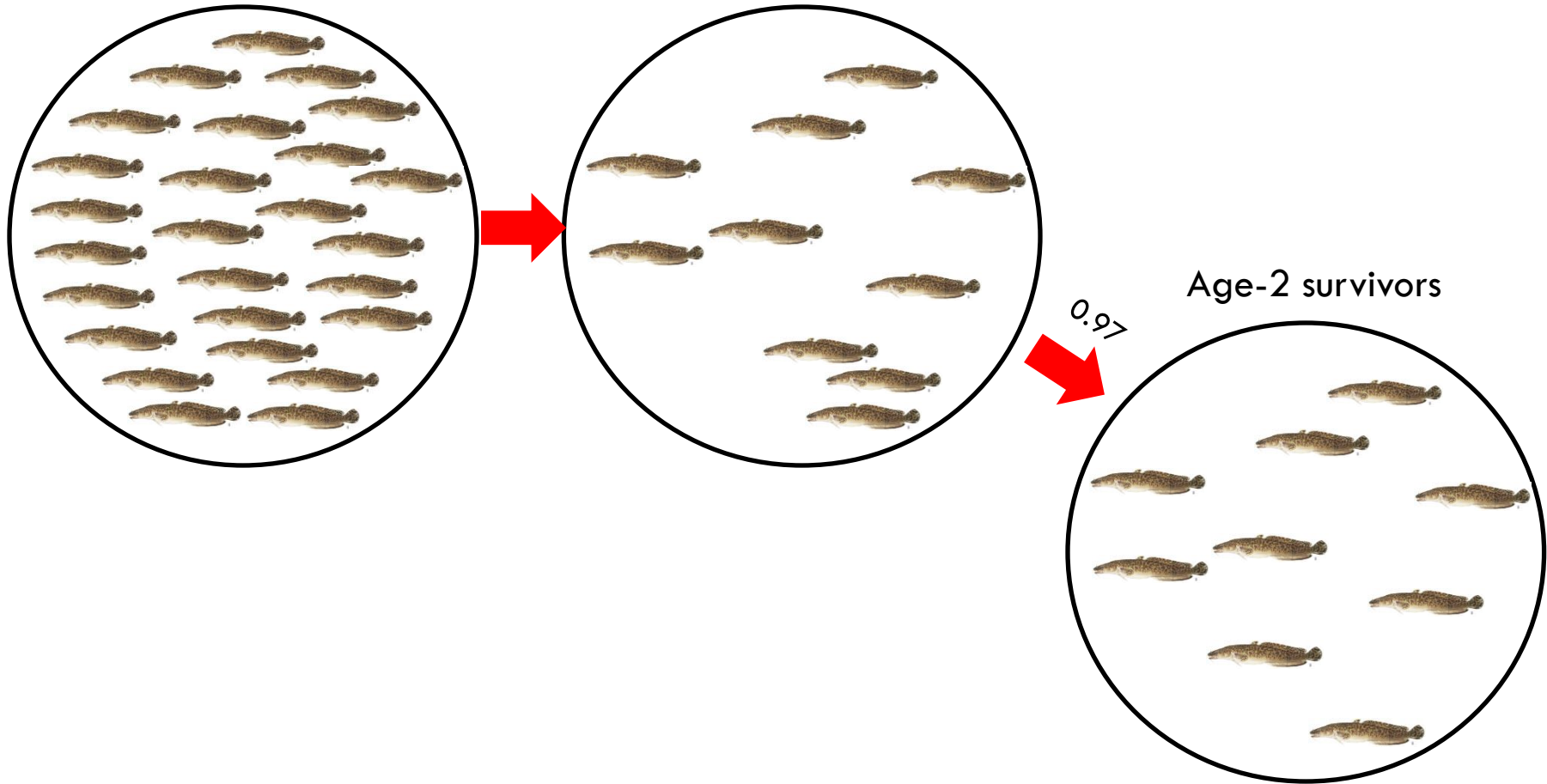




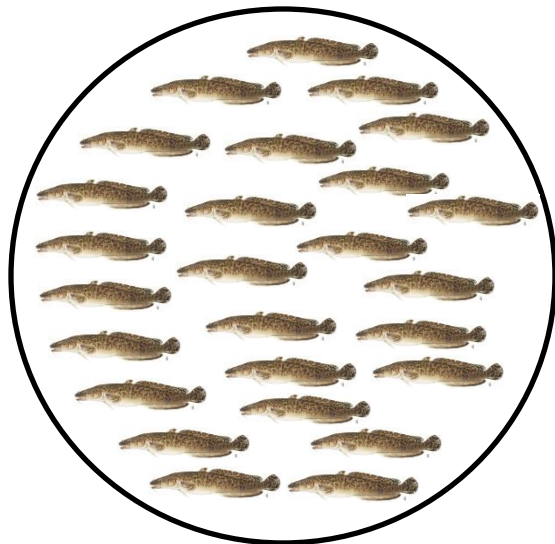
Juvenile release group

Age-1 survivors

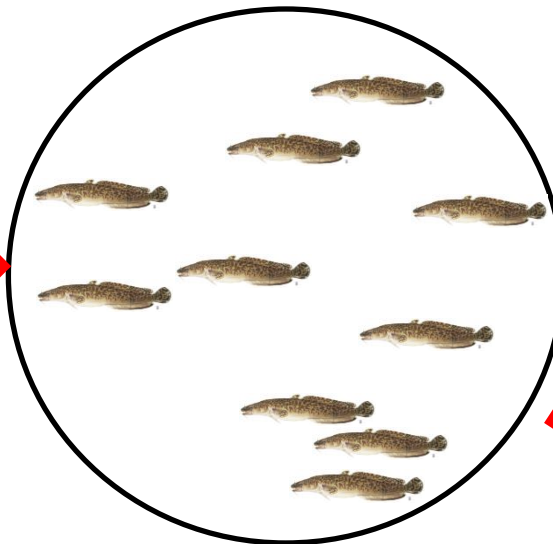
Age-2 survivors



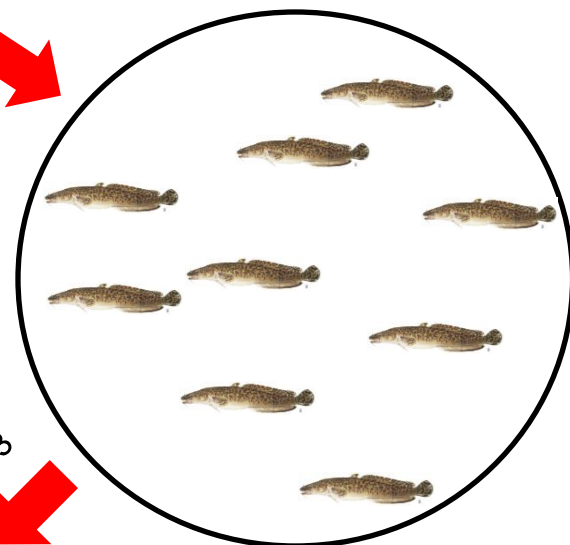
Juvenile release group



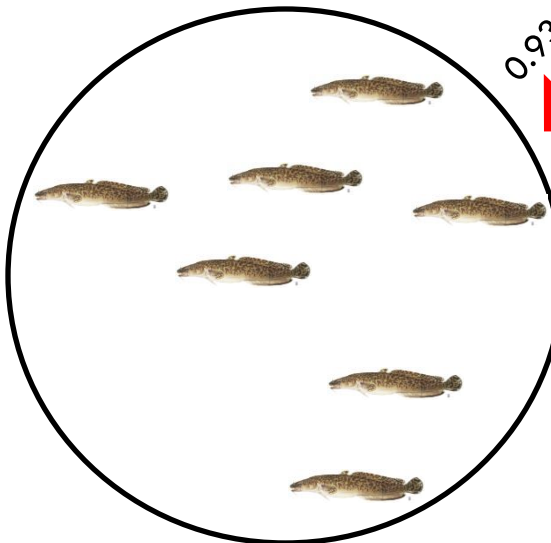
Age-1 survivors



Age-2 survivors



Age-3 survivors



0.93

Juvenile release group

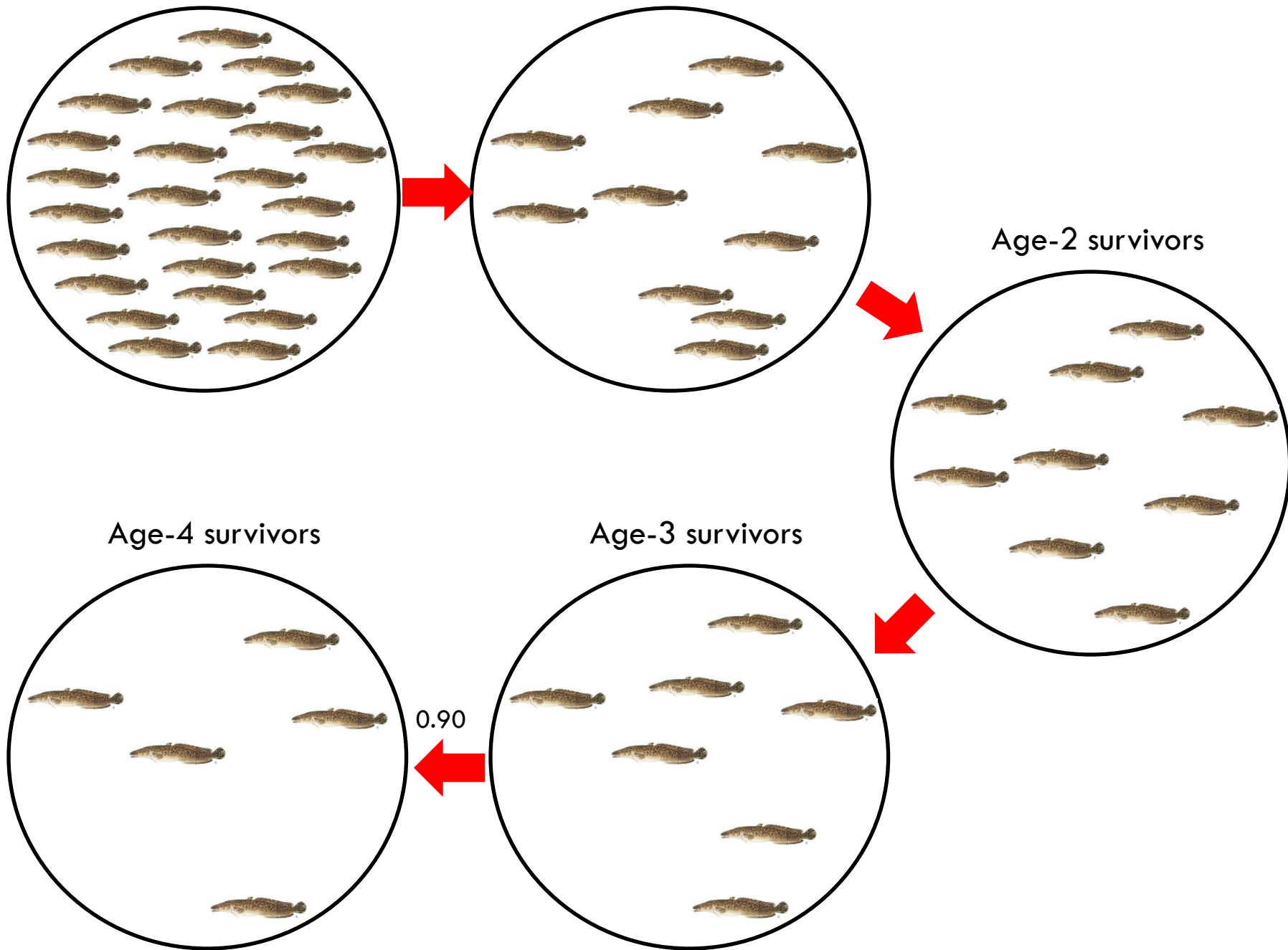
Age-1 survivors

Age-2 survivors

Age-3 survivors

Age-4 survivors

0.90



# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Deep, Boundary, and Smith creeks
  - ▣ Anecdotal information
- IDFG PIT tag array
- “Final” interpretations available from Deep Creek study





# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Deep, Boundary, and Smith creeks
  - ▣ Anecdotal information
- IDFG PIT tag array
- “Final” interpretations available from Deep Creek study





# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Deep, Boundary, and Smith creeks
  - ▣ Anecdotal information
- IDFG PIT tag array
- “Final” interpretations available from Deep Creek study



# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Smith and Boundary creeks → sampled February-March
  - ▣ Zero fish captured in Smith Creek, will try again in 2016/17
  - ▣ 29 fish captured in Boundary Creek
    - All from 2/17/16 – 2/24/16
    - Included ripe and spent males and females
- Deep Creek sampled December 1-March 31
  - ▣ Five fish captured
    - All stocked in Deep Creek in 2014 or 2015

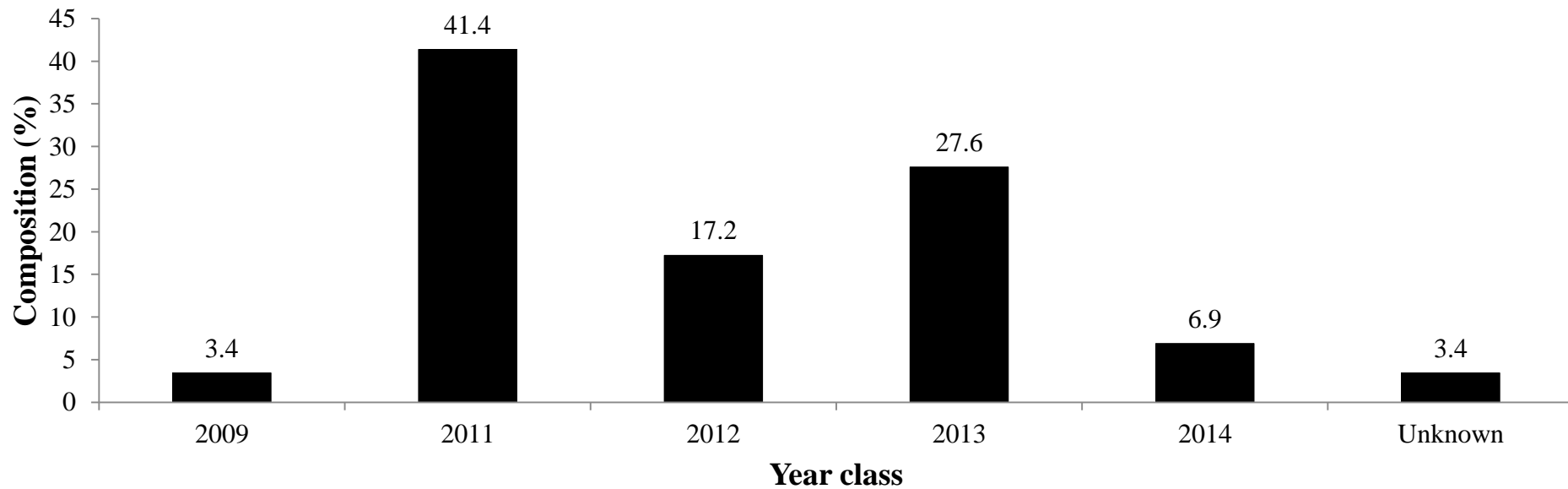
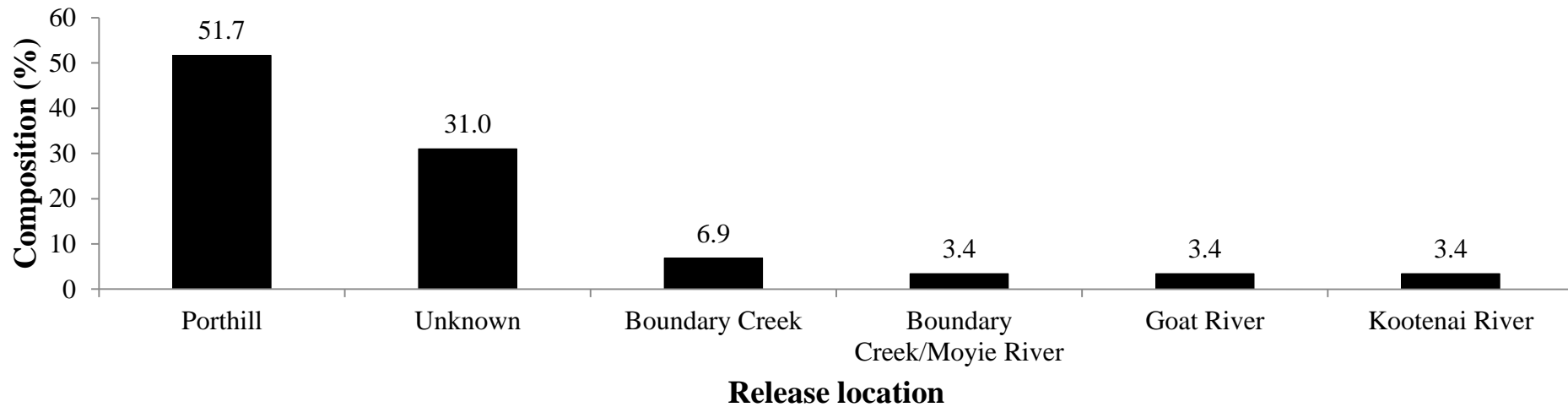
# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Smith and Boundary creeks → sampled February-March
  - ▣ Zero fish captured in Smith Creek, will try again in 2016/17
  - ▣ 29 fish captured in Boundary Creek
    - All from 2/17/16 – 2/24/16
    - Included ripe and spent males and females
- Deep Creek sampled December 1-March 31
  - ▣ Five fish captured
    - All stocked in Deep Creek in 2014 or 2015

# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Smith and Boundary creeks → sampled February-March
  - ▣ Zero fish captured in Smith Creek, will try again in 2016/17
  - ▣ 29 fish captured in Boundary Creek
    - All from 2/17/16 – 2/24/16
    - Included ripe and spent males and females
- Deep Creek sampled December 1-March 31
  - ▣ Five fish captured
    - All stocked in Deep Creek in 2014 or 2015

# POPULATION UPDATES: TRIBUTARY ASSESSMENTS



# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

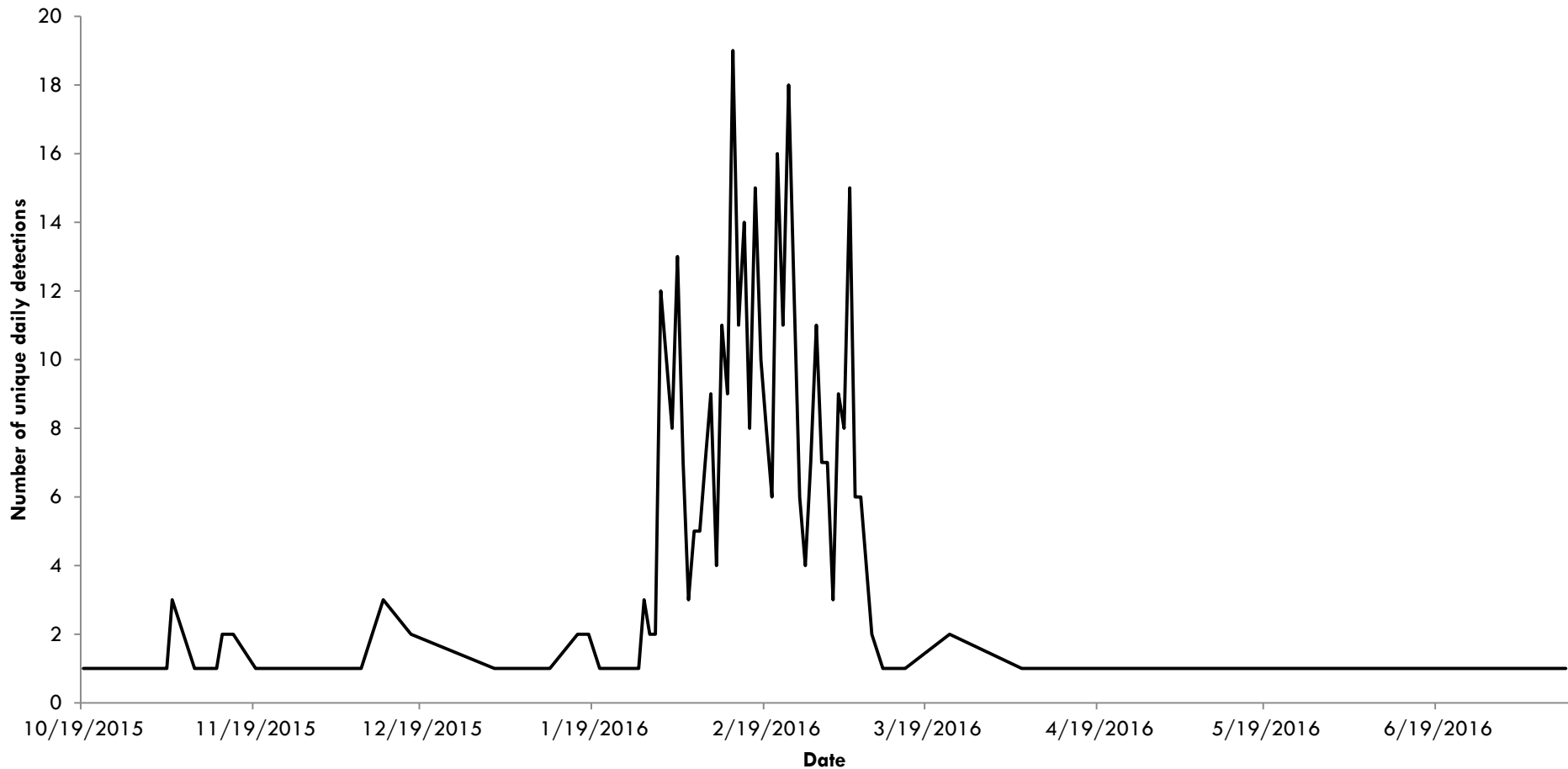
- Smith and Boundary creeks → sampled February-March
  - ▣ Zero fish captured in Smith Creek, will try again in 2016/17
  - ▣ 29 fish captured in Boundary Creek
    - All from 2/17/16 – 2/24/16
    - Included ripe and spent males and females
- Deep Creek sampled December 1-March 31
  - ▣ Five fish captured
    - All stocked in Deep Creek in 2014 or 2015

# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Smith and Boundary creeks → sampled February-March
  - ▣ Zero fish captured in Smith Creek, will try again in 2016/17
  - ▣ 29 fish captured in Boundary Creek
    - All from 2/17/16 – 2/24/16
    - Included ripe and spent males and females
- Deep Creek sampled December 1-March 31
  - ▣ Five fish captured
    - All stocked in Deep Creek in 2014 or 2015

# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

## Deep Creek Array Detections 2015-16 Season

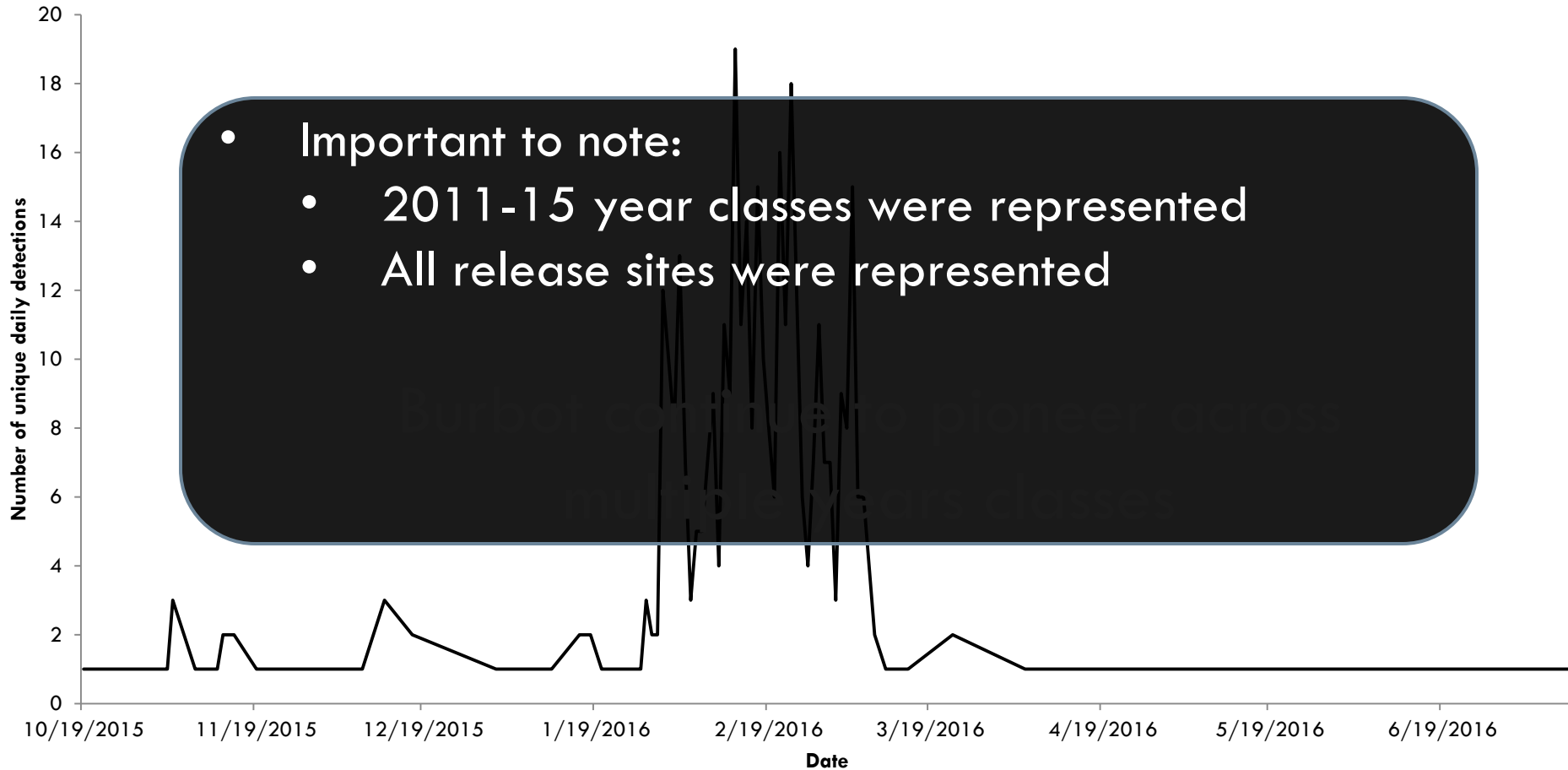




# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

## Deep Creek Array Detections 2015-16 Season

- Important to note:
  - 2011-15 year classes were represented
  - All release sites were represented

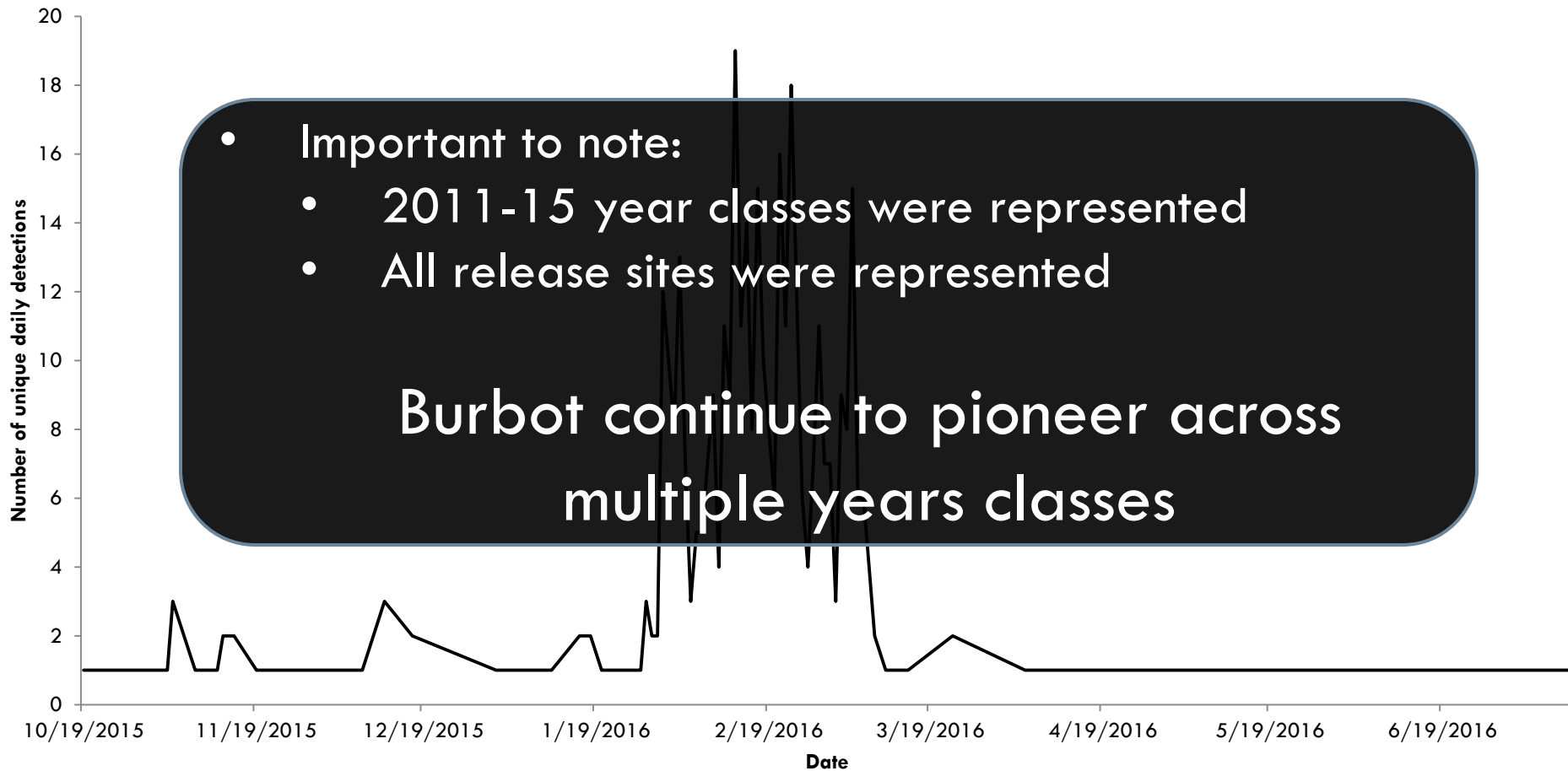


# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

## Deep Creek Array Detections 2015-16 Season

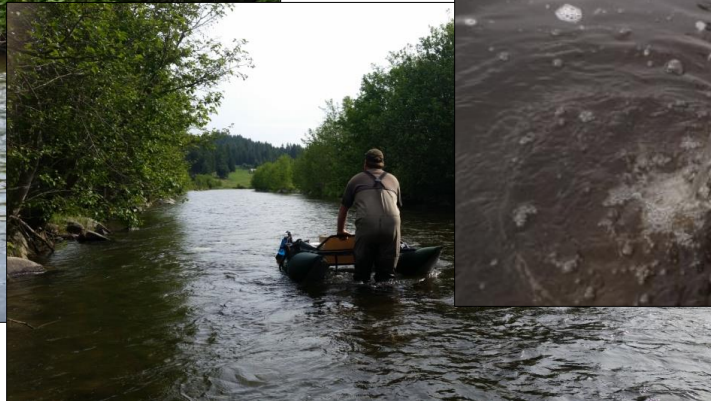
- Important to note:
  - 2011-15 year classes were represented
  - All release sites were represented

**Burbot continue to pioneer across  
multiple years classes**



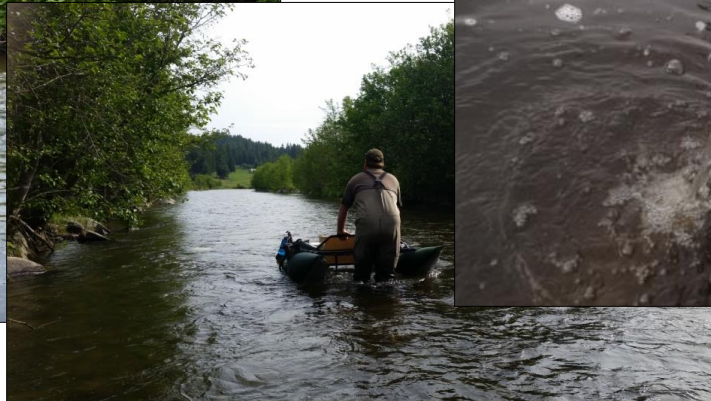
# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Graduate Study on Deep Creek
  - ▣ 88% of fish stayed within 1 km of release location
  - ▣ Survival of juveniles in 2014 and 2015 was 0.19
  - ▣ Additional questions need to be answered



# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

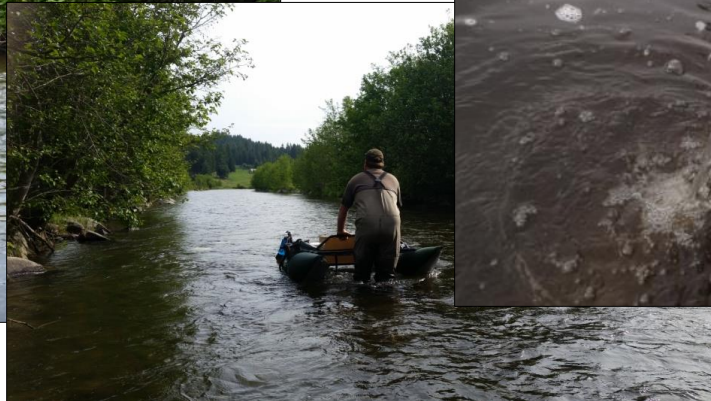
- Graduate Study on Deep Creek
  - ▣ 88% of fish stayed within 1 km of release location
  - ▣ Survival of juveniles in 2014 and 2015 was 0.19
  - ▣ Additional questions need to be answered





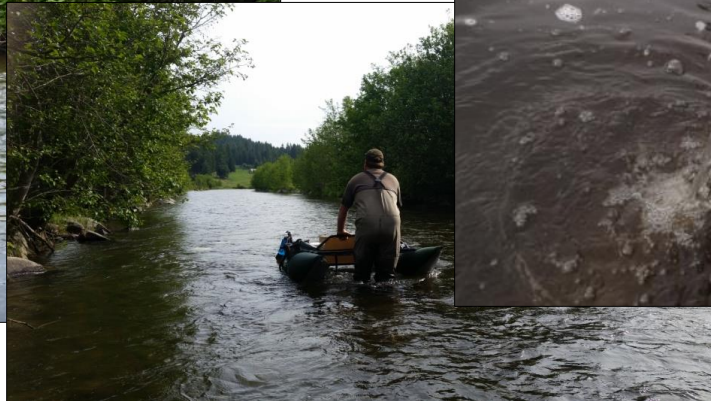
# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Graduate Study on Deep Creek
  - ▣ 88% of fish stayed within 1 km of release location
  - ▣ Survival of juveniles in 2014 and 2015 was 0.19
  - ▣ Additional questions need to be answered



# POPULATION UPDATES: TRIBUTARY ASSESSMENTS

- Graduate Study on Deep Creek
  - ▣ 88% of fish stayed within 1 km of release location
  - ▣ Survival of juveniles in 2014 and 2015 was 0.19
  - ▣ Additional questions need to be answered





# LOOKING AHEAD: LARVAL LIGHT TRAPS

- First year of running larval light traps in spring 2016
  - ▣ Timing
  - ▣ Sampling design
  - ▣ Zero larval Burbot captured
  - ▣ More robust approach in Spring 2017





# LOOKING AHEAD: LARVAL LIGHT TRAPS

- First year of running larval light traps in spring 2016
  - ▣ Timing
  - ▣ Sampling design
  - ▣ Zero larval Burbot captured
  - ▣ More robust approach in Spring 2017



# LOOKING AHEAD: LARVAL LIGHT TRAPS

- First year of running larval light traps in spring 2016
  - ▣ Timing
  - ▣ Sampling design
  - ▣ Zero larval Burbot captured
  - ▣ More robust approach in Spring 2017



# LOOKING AHEAD: LARVAL LIGHT TRAPS

- First year of running larval light traps in spring 2016
  - ▣ Timing
  - ▣ Sampling design
  - ▣ **Zero** larval Burbot captured
- ▣ More robust approach in Spring 2017





# LOOKING AHEAD: LARVAL LIGHT TRAPS

- First year of running larval light traps in spring 2016
  - ▣ Timing
  - ▣ Sampling design
  - ▣ **Zero** larval Burbot captured
  - ▣ More robust approach in Spring 2017



# LOOKING AHEAD: HOOPNETTING IN THE CANYON

- Moyie River releases
- Burbot in the canyon
  - ▣ 2016 captures
- Should:
  - ▣ Refine Moyie River survival estimate
  - ▣ Inform Burbot use of the canyon
  - ▣ Benefit KRHRP projects above town



# LOOKING AHEAD: HOOPNETTING IN THE CANYON

- Moyie River releases
- Burbot in the canyon
  - ▣ 2016 captures
- Should:
  - ▣ Refine Moyie River survival estimate
  - ▣ Inform Burbot use of the canyon
  - ▣ Benefit KRHRP projects above town





# LOOKING AHEAD: HOOPNETTING IN THE CANYON

- Moyie River releases
- Burbot in the canyon
  - ▣ 2016 captures
- Should:
  - ▣ Refine Moyie River survival estimate
  - ▣ Inform Burbot use of the canyon
  - ▣ Benefit KRHRP projects above town





# LOOKING AHEAD: TRIBUTARY ASSESSMENTS

- Relocating all Deep Creek HDX arrays except McArthur outlet
  - ▣ Boundary Creek
  - ▣ Smith Creek
  - ▣ Myrtle Creek
  - ▣ Ball Creek



# LOOKING AHEAD: HARVEST SCENARIOS

- Age-structured population models
  - ▣ Zach Klein's (Quist student) work on the Green River, Wyoming
  - ▣ Primary model inputs include (among others):
    - Population size
    - Reproduction/fecundity
    - Age-specific survival
    - Harvest scenarios
    - Plan to have this completed by August 2017

# LOOKING AHEAD: HARVEST SCENARIOS

- Age-structured population models
  - ▣ Zach Klein's (Quist student) work on the Green River, Wyoming
  - ▣ Primary model inputs include (among others):
    - Population size
    - Reproduction/fecundity
    - Age-specific survival
    - Harvest scenarios
    - Plan to have this completed by August 2017

# SUMMARY

- ❑ Catch rates climbing
- ❑ Survival estimates
  - ▣ On-target with restoration goals
- ❑ Year class representation
- ❑ Burbot pioneering
- ❑ New projects
- ❑ Discussions about future fishery important



# SUMMARY

- ❑ Catch rates climbing
- ❑ Survival estimates
  - ▣ On-target with restoration goals
- ❑ Year class representation
- ❑ Burbot pioneering
- ❑ New projects
- ❑ Discussions about future fishery important





# SUMMARY

- Catch rates climbing
- Survival estimates
  - ▣ On-target with restoration goals
- Year class representation
- Burbot pioneering
- New projects
- Discussions about future fishery important



# SUMMARY

- ❑ Catch rates climbing
- ❑ Survival estimates
  - ❑ On-target with restoration goals
- ❑ Year class representation
- ❑ Burbot pioneering
- ❑ New projects
- ❑ Discussions about future fishery important





# SUMMARY

- ❑ Catch rates climbing
- ❑ Survival estimates
  - ❑ On-target with restoration goals
- ❑ Year class representation
- ❑ Burbot pioneering
- ❑ New projects
- ❑ Discussions about future fishery important



# SUMMARY

- ❑ Catch rates climbing
- ❑ Survival estimates
  - ❑ On-target with restoration goals
- ❑ Year class representation
- ❑ Burbot pioneering
- ❑ New projects
- ❑ Discussions about future fishery important



# ACKNOWLEDGEMENTS

- **ARI**
  - Patrick Blaufuss
  - Joe Evavold
  - Ken Cain
  - Neil Ashton
  - Hatchery staff
- **KTOI**
  - Sue Ireland
  - Shawn Young
  - Nate Jensen
  - Chris Lewandowski
  - Hatchery staff
- **UI**
  - Mike Quist
  - Zach beard
- **IDFG**
  - Diane Wakkinen
  - Cathy Gidley
  - Ryan Hardy
  - Andrew Ransom
  - Dylan Gollen
  - IDFG field crews
- **BC**
  - Matt Neufeld
  - Sarah Stephenson
  - Val Evans
- **MFWP**
  - Jim Dunnigan
  - Ryan Sylvester



University of Idaho  
Aquaculture Research Institute

