

Ecological interactions explaining a dominance shift between Ponto-Caspian bivalves *Dreissena polymorpha* and *Dreissena rostriformis bugensis*



Anouk D'Hont, Dr. Arjan Gittenberger, Prof. Dr. Rob Leuven, Prof. Dr. Jan Hendriks

Introduction

Dreissena polymorpha

(Zebra mussel, Pallas 1771)



Dreissena rostriformis bugensis

(Quagga mussel, Andrusov 1897)



Tested hypotheses comparing both species

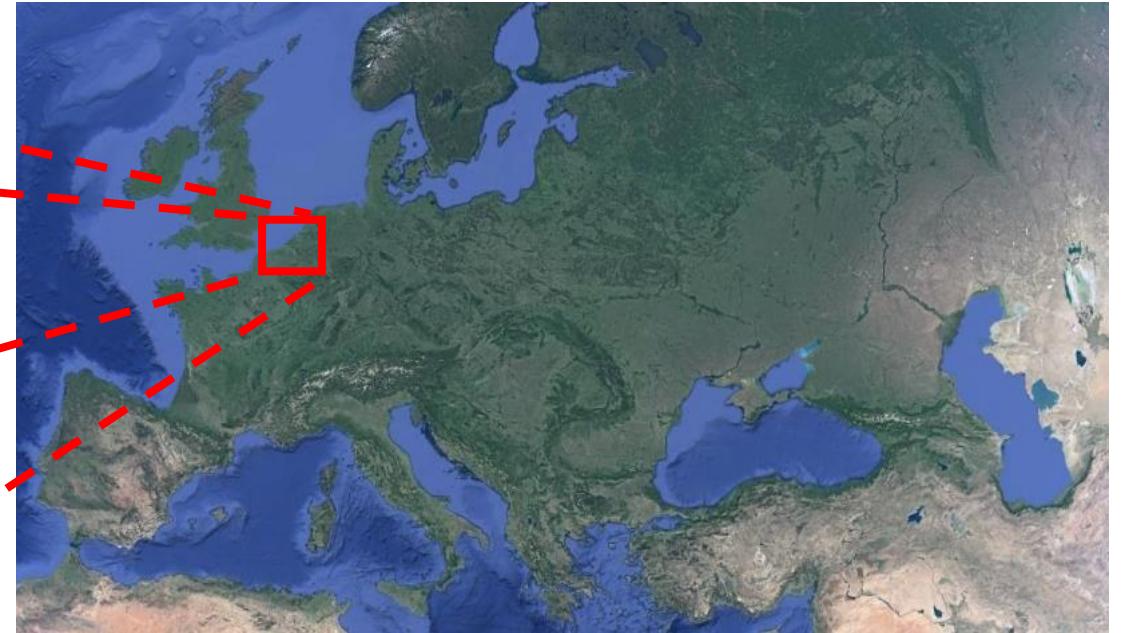
Objective: Assessing mechanisms explaining the dominance shift between *D. polymorpha* and *D. r. bugensis*

- ⇒ Settlement period
- ⇒ Growth rate
- ⇒ External mussel sources
- ⇒ Fouling plate coverage
- ⇒ Attachment strength
- ⇒ Group formation
- ⇒ Presence/absence of other dreissenids
- ⇒ Winter survival
- ⇒ Movement speed
- ⇒ Shade/sunlight
- ⇒ Cluster formation
- ⇒ Salinity
- ⇒ Microhabitat
- ⇒ Presence/absence of other species



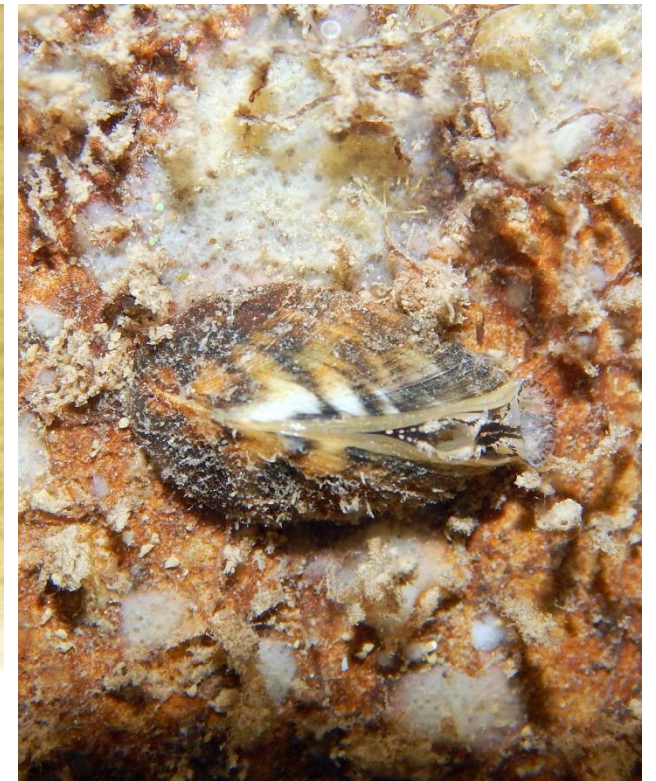
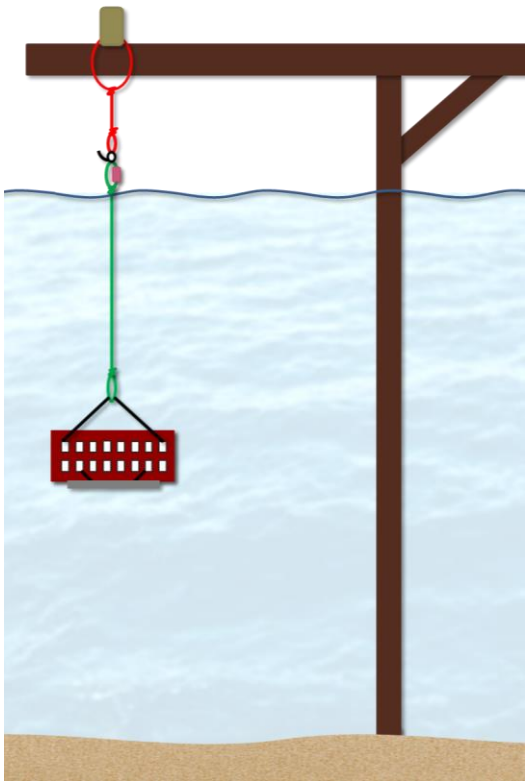
Study area

⇒ Haringvliet, Rhine-Meuse Delta, The Netherlands



Field experiment

- ⇒ Within SETL project
- ⇒ Plates deployed since 2006
- ⇒ Plates checked every 3 months
- ⇒ Plates deployed between 2012 - 2017
- ⇒ 83 settlement plates studied
- ⇒ In total 15.368 dreissenids measured



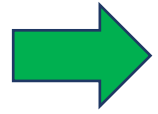
Tested hypotheses comparing both species

Objective: Assessing mechanisms explaining the dominance shift between *D. polymorpha* and *D. r. bugensis*

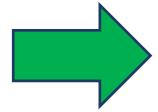
- | | |
|---|-------------------------------------|
| ➡ Settlement period | ➡ Winter survival |
| ➡ Growth rate | ➡ Movement speed |
| ➡ External mussel sources | ➡ Shade/sunlight |
| ⇒ Fouling plate coverage | ⇒ Cluster formation |
| ➡ Attachment strength | ⇒ Salinity |
| ⇒ Group formation | ⇒ Microhabitat |
| ⇒ Presence/absence of other dreissenids | ➡ Presence/absence of other species |



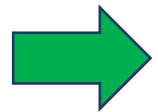
Tested hypotheses comparing both species



Growth rate



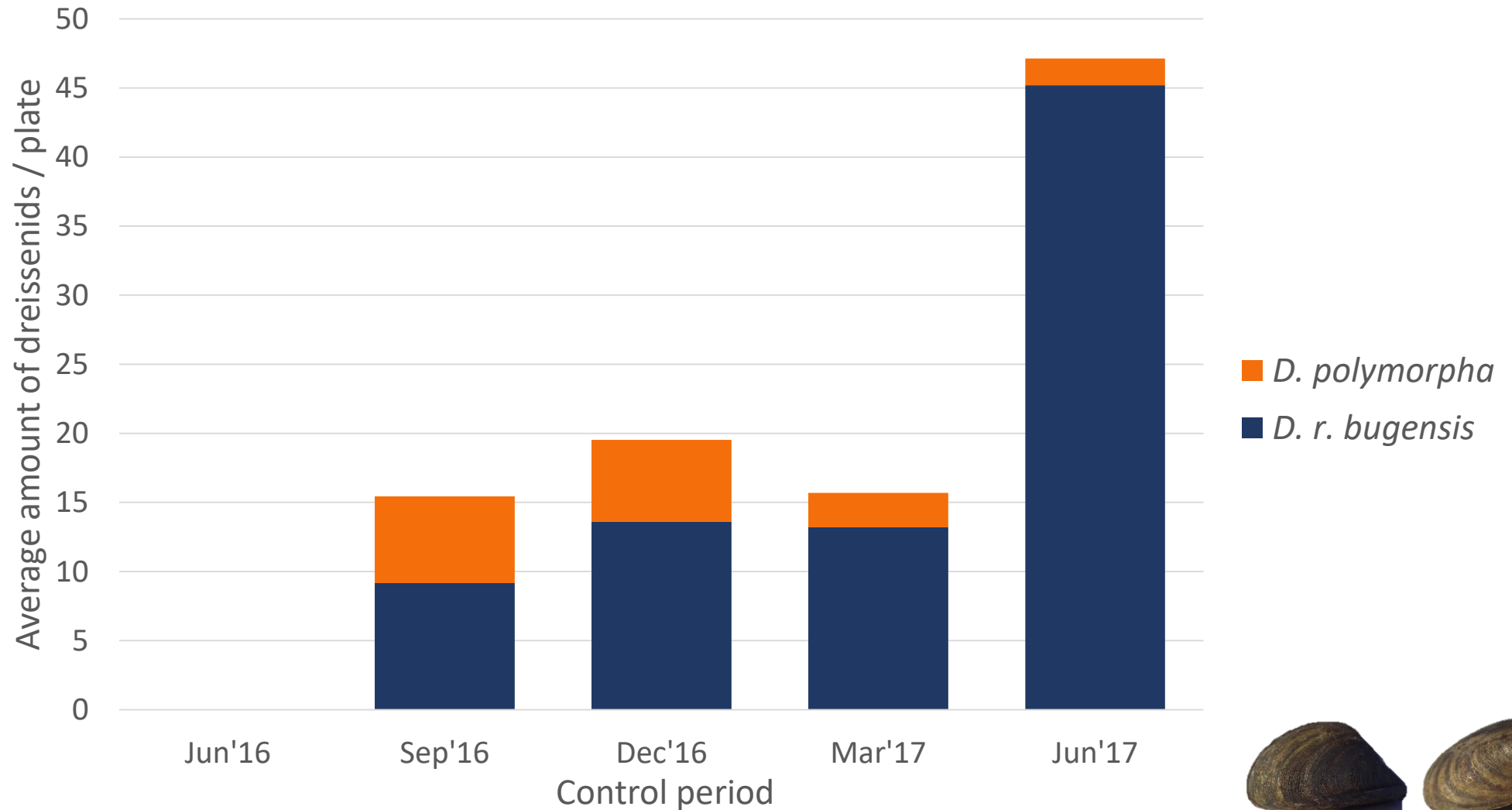
External mussel sources



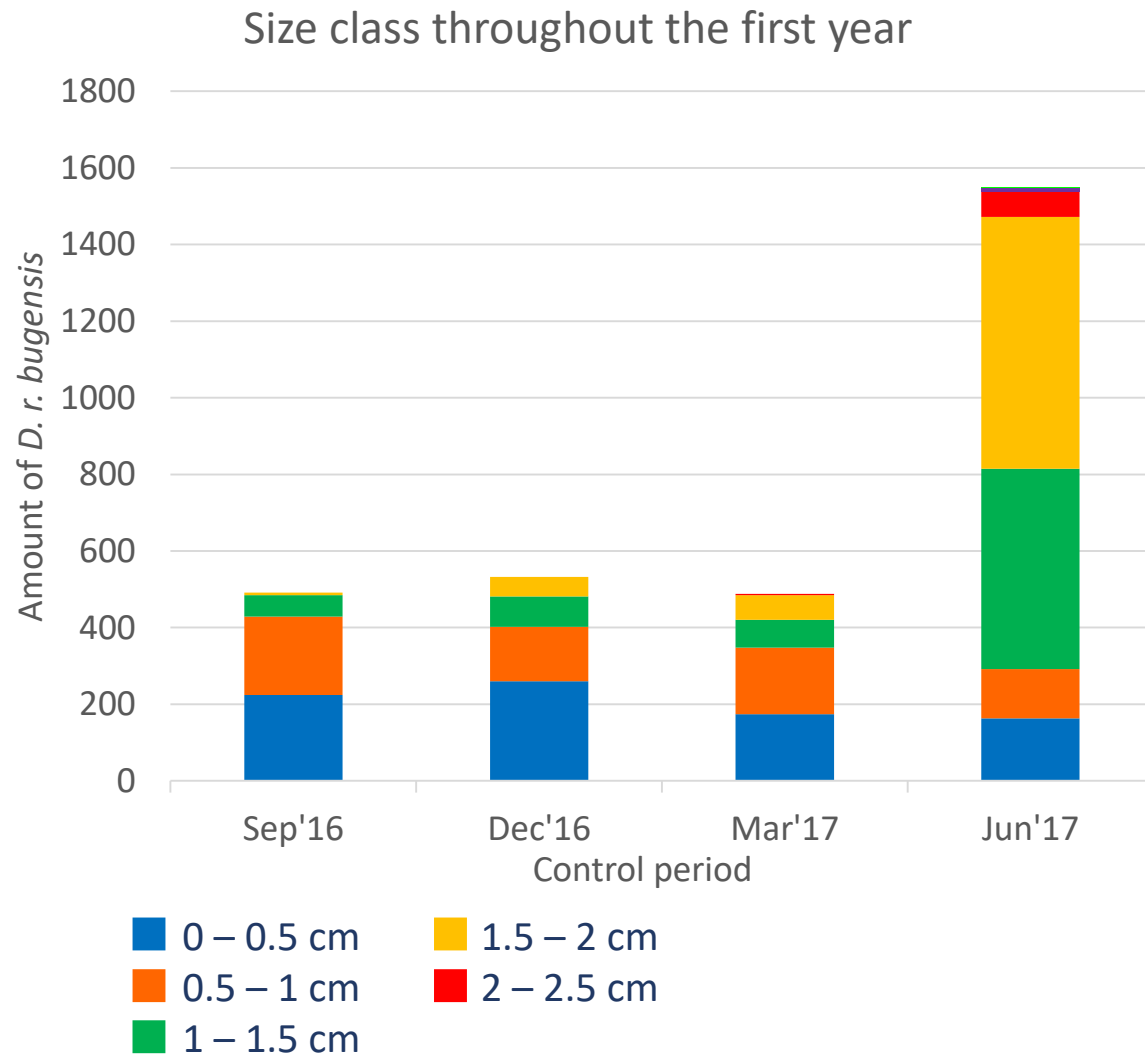
Settlement period



Results: Evolution *Dreissena* ratio through time



Results: Size evolution – Growth rate *D. r. bugensis*



Results: *D. r. bugensis* external mussel sources

D. r. bugensis migration

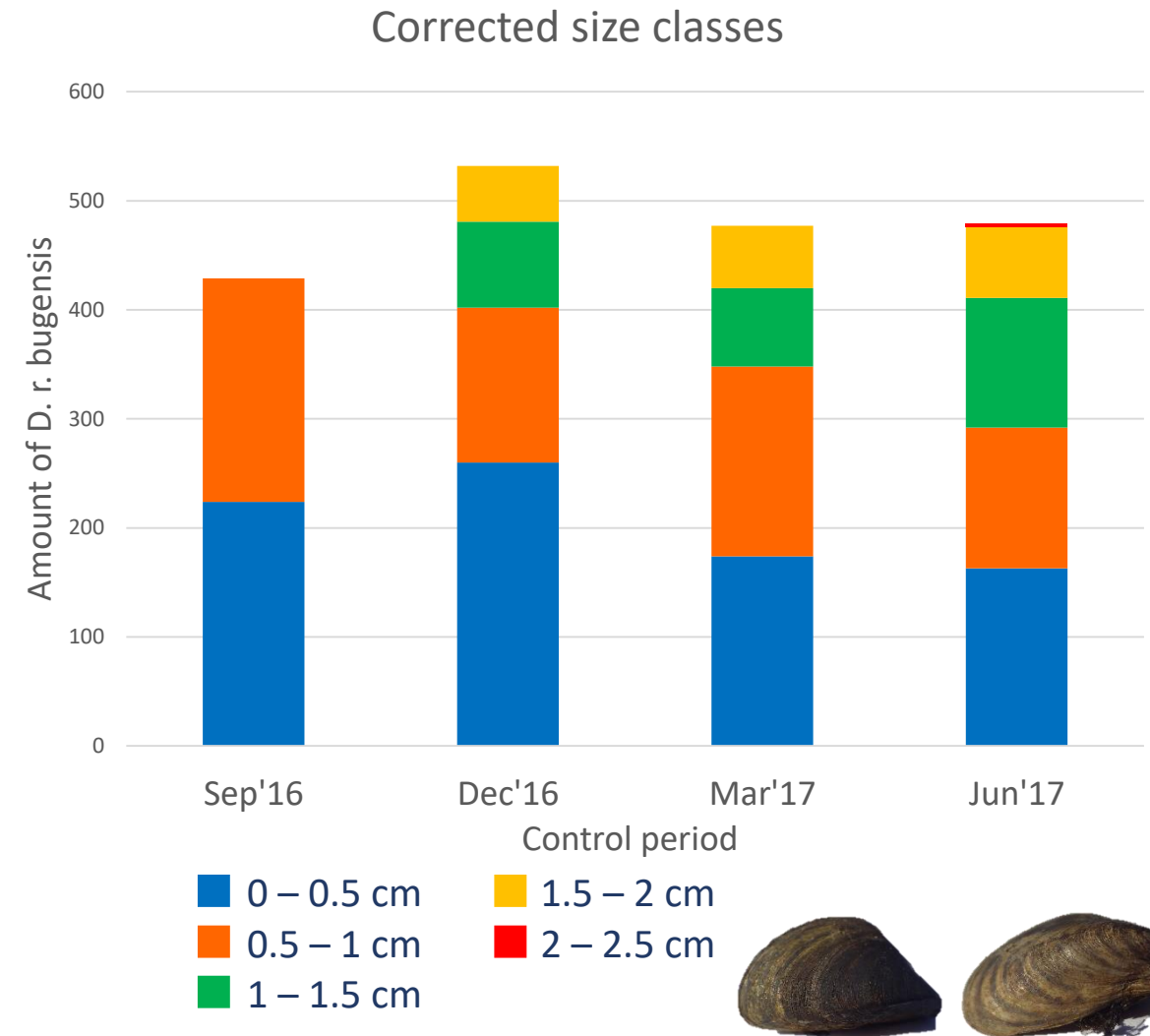
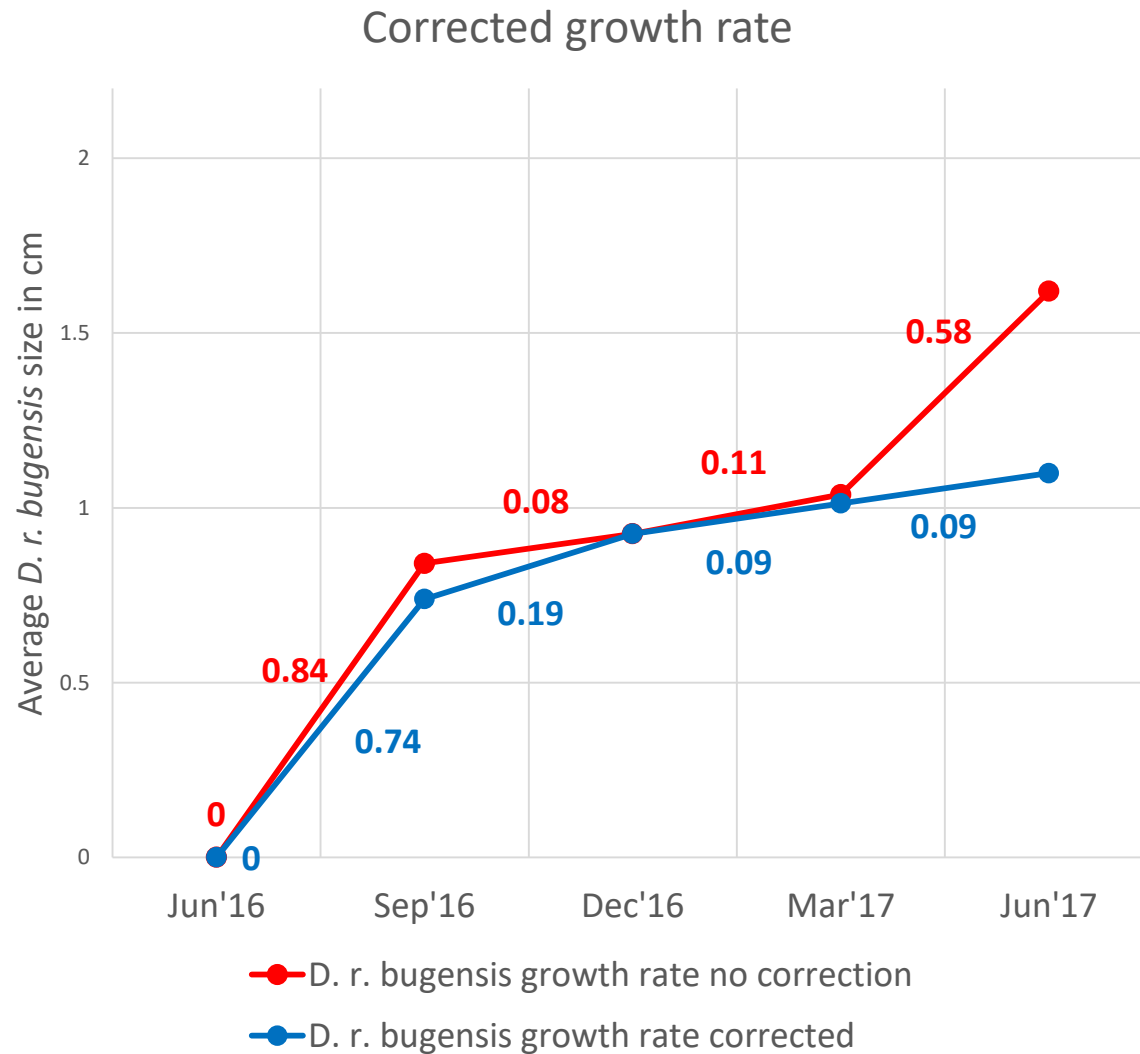
March 2017



June 2017

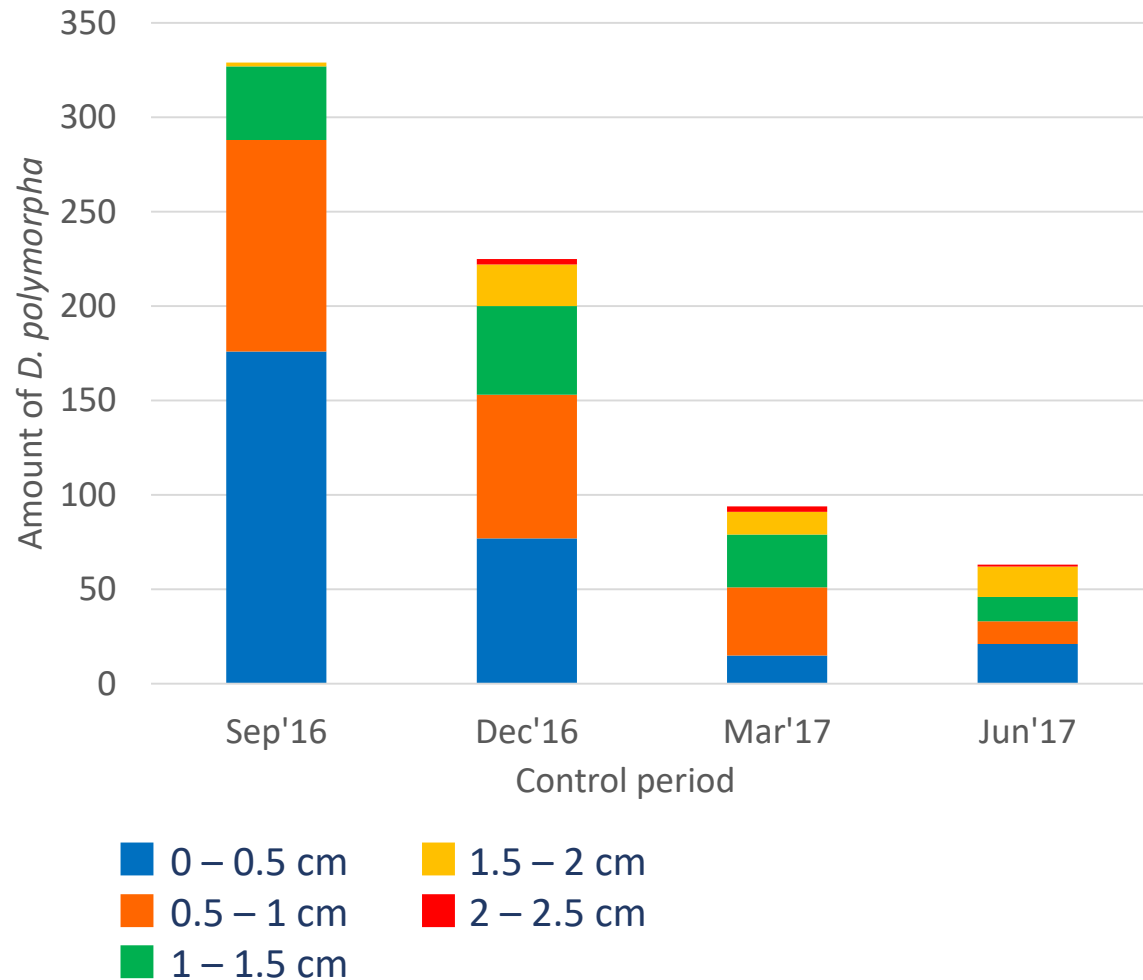


Results: Size evolution – Growth rate *D. r. bugensis*

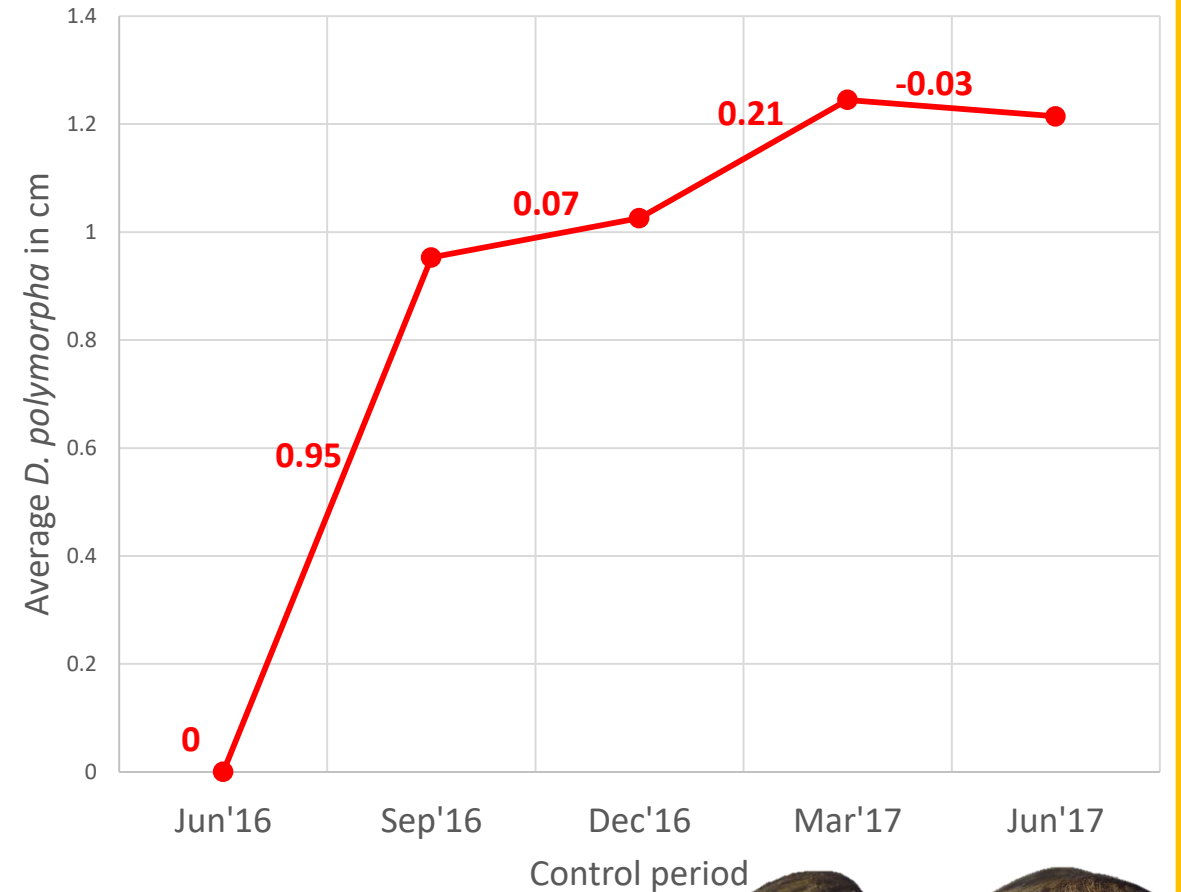


Results: Size evolution – Growth rate *D. polymorpha*

Size class throughout the first year



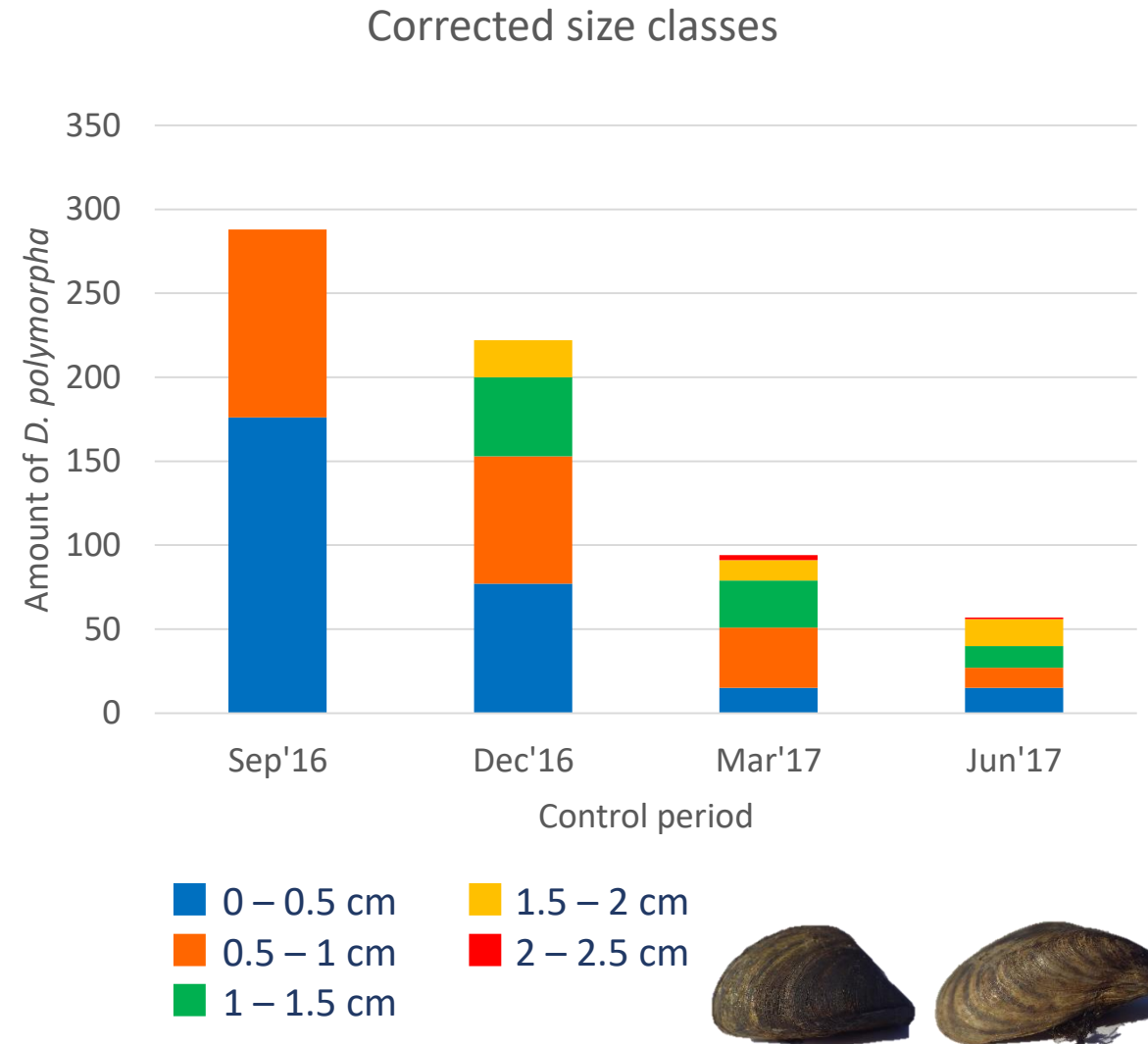
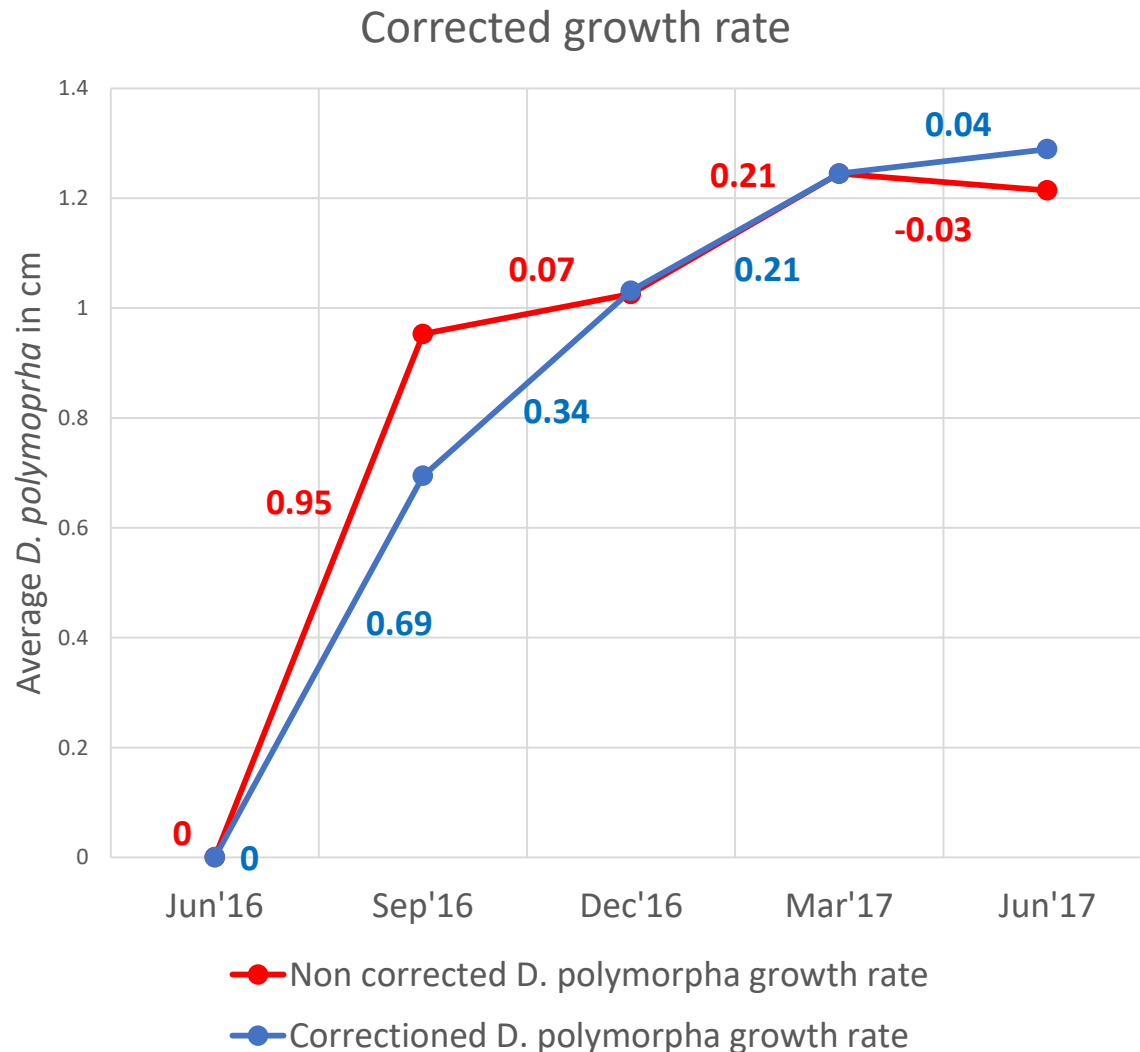
Growth rate



Results: Size Evolution – Growth rate *D. polymorpha*

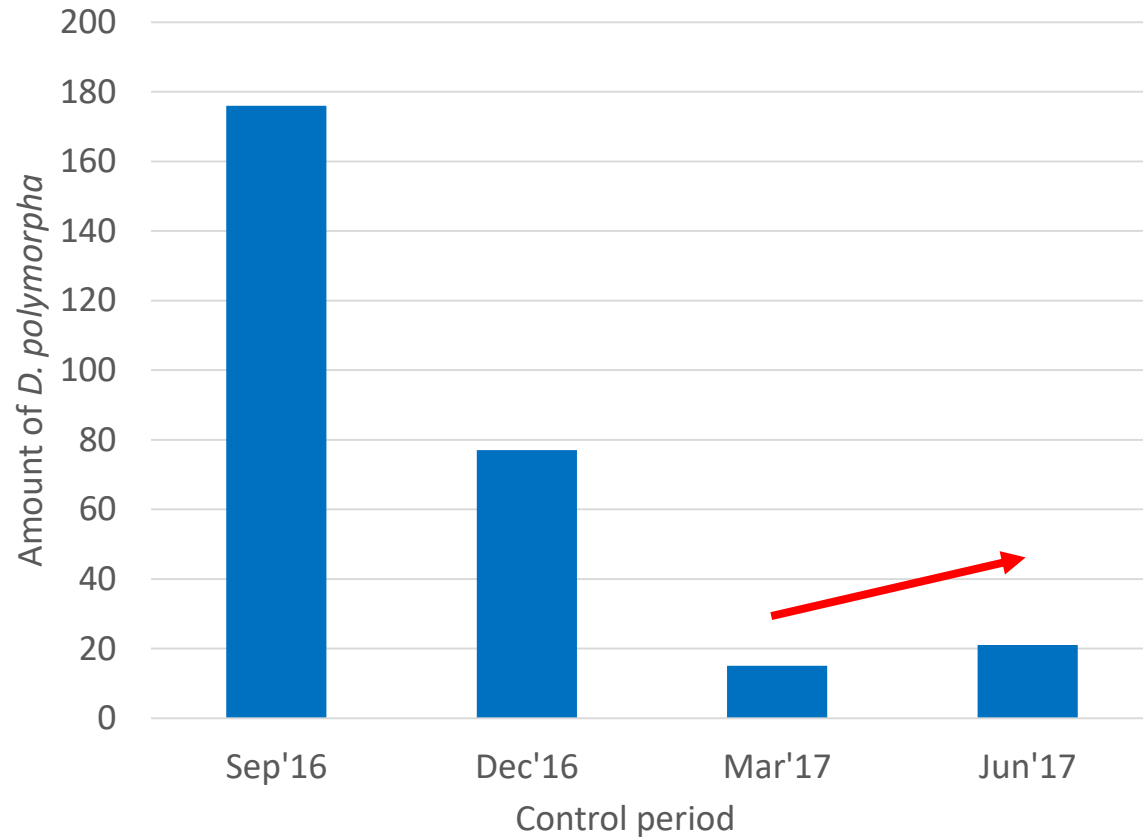


Results: Size evolution – Growth rate *D. polymorpha*

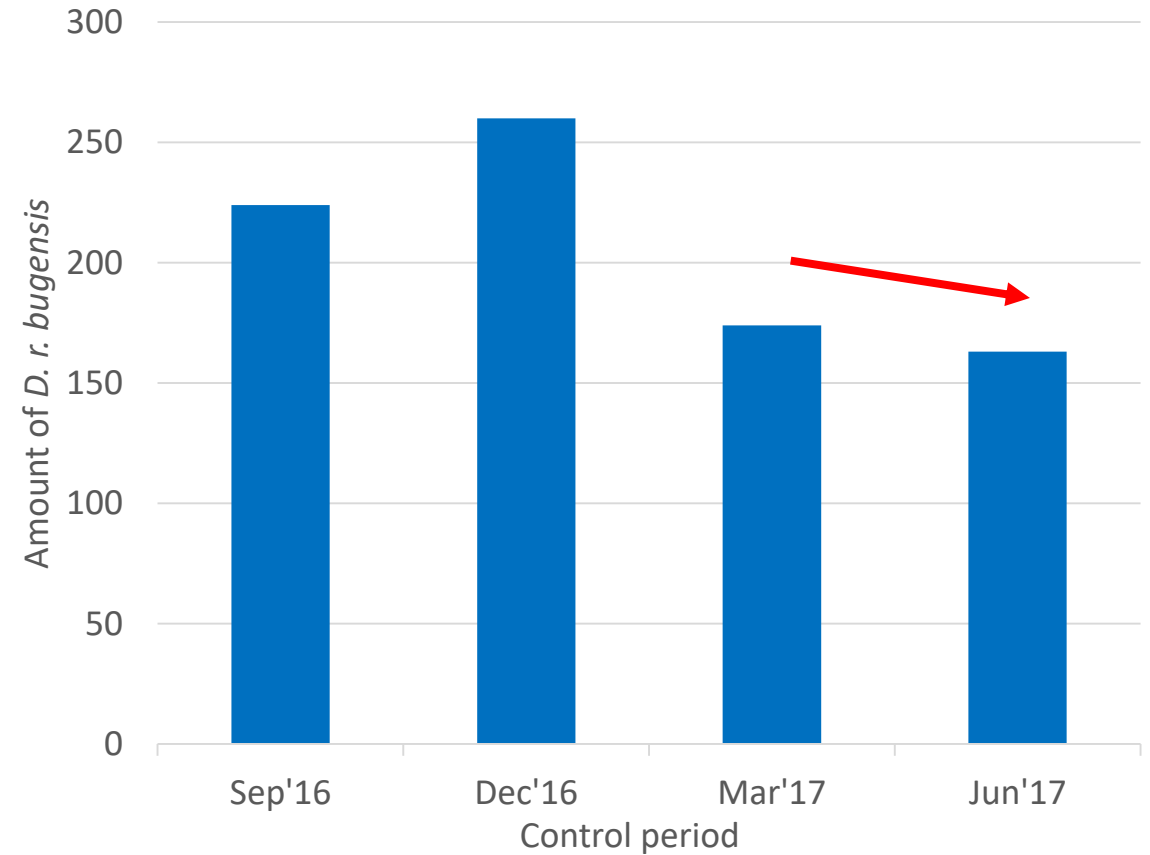


Results: Settlement period

Amount of smallest *D. polymorpha*



Amount of smallest *D. r. bugensis*



Conclusions

Research question:

What mechanisms explain the dominance shift between *D. polymorpha* and *D. r. bugensis*?

- ➔ *D. r. bugensis* becomes dominant species in later phases of settlement
- ➔ Amount of *D. polymorpha* decreases through time, yet doesn't disappear completely

Why?



Conclusions

- ➡ At settlement similar numbers of *D. r. bugensis* and *D. polymorpha*
- ➡ Both species continue growing throughout the year
- ➡ *D. r. bugensis* migration creating external *D. r. bugensis* sources on SETL plates
- ➡ *D. polymorpha* start settling earlier than *D. r. bugensis*



Thank you!



Poster session 6pm – 7:30pm

Invasion success of panmictic populations of the Ponto-Caspian dreissenids *D. polymorpha* and *D. r. bugensis*

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Introduction

This research aims at assessing the anthropogenic impact in the Ponto-Caspian area as a part of the EU funded project PRIDE (Drivers of Pontocaspian Biodiversity Rise and Demise)

Dreissena polymorpha
(Zebra mussel, Pallas 1771)



Dreissena rostriformis bugensis
(Quagga mussel, Andrusov 1897)



Both species:

- Originate in the Ponto-Caspian region
- Became invasive in practically whole northern hemisphere
- D. polymorpha*: +/- 200 years ago
- D. r. bugensis*: +/- 20 years ago
- Have negative ecological and economic impacts

Last decade:

- D. r. bugensis* has started to dominate over *D. polymorpha* in both its native and introduced region

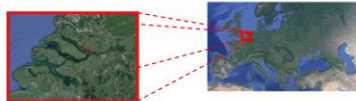
Objective:

- Assessing why there appears to be a dominance shift between *D. polymorpha* and *D. r. bugensis*

Material & Methods

Study area:

- Haringvliet, Rhine-Meuse Delta, The Netherlands



Field experiment:

- 77 settlement plates, oldest deployed since 2012, 15.368 dreissenids measured



Movement over & attachment to substrate:

- 1 week movement, distance and speed tracking
- Attachment strength measurements with a force gauge, relative to the number of byssus threads

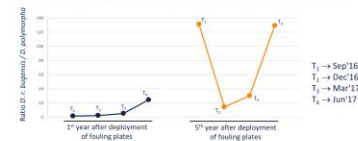


Tested hypotheses comparing *D. polymorpha* & *D. r. bugensis*

- Settlement period
- Growth rate
- External mussel sources
- Fouling plate coverage
- Attachment strength
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- Presence/absence of other Dreissenids
- Winter survival
- Movement speed
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- Cluster formation
- Salinity
- Microhabitat
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Results

- D. r. bugensis* dominates over *D. polymorpha*, but in later succession stages *D. polymorpha* gains terrain in winter



- Although not recorded for *D. polymorpha*, *D. r. bugensis* can form clusters in which they grow on top of each other



- Sponges occupy spaces where dreissenids could grow



- The average strength with which *D. polymorpha* (1,512 Newton) is attached is stronger than that of *D. r. bugensis* (0,645 Newton)

Preliminary conclusions

Although similar numbers of *D. r. bugensis* & *D. polymorpha* settle, *D. r. bugensis* becomes the dominant species later in the succession. This may be explained by aspects like the fact that *D. r. bugensis* forms clusters and appears to move around faster. *D. polymorpha* however, appears to have a competitive advantage in better surviving the winters and in being more strongly attached to the substrate. To what degree sponges have an impact on the interactions between these two dreissenid species remains uncertain.

