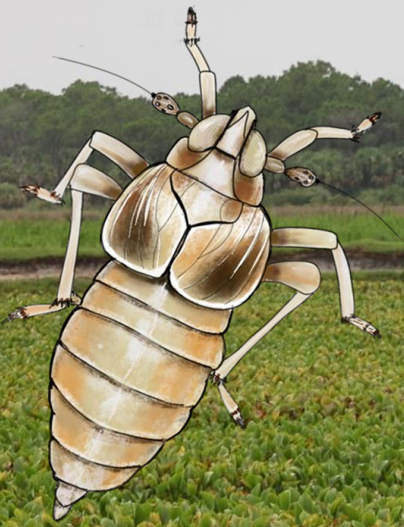


# Inundative Biological Control



# What is bio-control?

- Invasive plants thrive in 'new' locations
- Evolution with their environment is key
- Reuniting 'enemies' to restore ecological balance
- Usually hyper-specialist arthropods
- Filling a niche



Air potato beetle from Asia

# Success stories

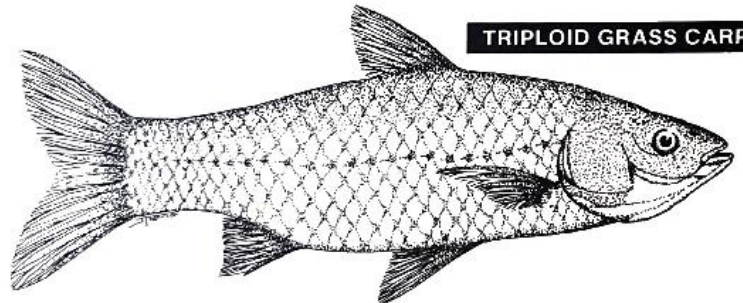
- Alligator weed flea beetle
- Released in 1964
- In the last 25 years, we've treated no more than 40 acres statewide annually
- Asian triploid grass carp



**ATTENTION**

**TRIPLOID GRASS CARP  
HAVE BEEN STOCKED IN  
THESE WATERS TO  
CONTROL EXCESSIVE  
AQUATIC VEGETATION**

**TRIPLOID GRASS CARP**



**IF CAUGHT PLEASE  
RELEASE IMMEDIATELY  
AND UNHARMED**

**THESE FISH ARE ILLEGAL TO  
POSSESS WITHOUT A PERMIT**

 **STATE OF FLORIDA  
GAME & FRESH WATER  
FISH COMMISSION**

WCT-7-008

| Weed                 | Agent                                          | Type    | Origin       | Date <sup>1</sup> | Impact     |
|----------------------|------------------------------------------------|---------|--------------|-------------------|------------|
| Air potato           | <i>Lilioceris cheni</i>                        | Beetle  | China        | 2011              | Widespread |
| Alligatorweed        | <i>Agasicles hygrophila</i>                    | Beetle  | Argentina    | 1964              | Widespread |
|                      | <i>Amynothrips andersoni</i>                   | Thrips  | Argentina    | 1967              | Local      |
|                      | <i>Arcola</i> (= <i>Vogtia</i> ) <i>malloi</i> | Moth    | Argentina    | 1971              | Local      |
| Brazilian peppertree | <i>Megastigmus transvaalensis</i>              | Wasp    | South Africa | Adventive         | Widespread |
|                      | <i>Pseudophilothrips ichini</i>                | Thrips  | Brazil       | 2019              | Local      |
| Hydrilla             | <i>Hydrellia pakistanae</i>                    | Fly     | India        | 1987              | Widespread |
|                      | <i>Cricotopus lebetis</i>                      | Midge   | Louisiana    | Adventive         | Local      |
|                      | <i>Bagous hydrillae</i>                        | Weevil  | Australia    | 1991-1996         | None       |
| Melaleuca            | <i>Oxyops vitiosa</i>                          | Weevil  | Australia    | 1997              | Widespread |
|                      | <i>Boreioglycaspis melaleucae</i>              | Psyllid | Australia    | 2002              | Widespread |
|                      | <i>Lophodiplossis trifida</i>                  | Fly     | Australia    | 2008              | Local      |

|                         |                                   |        |                           |           |            |
|-------------------------|-----------------------------------|--------|---------------------------|-----------|------------|
| Old World climbing fern | <i>Neomusotima conspurcatalis</i> | Moth   | Australia, Southeast Asia | 2008      | Local      |
|                         | <i>Floracarus perrepae</i>        | Mite   | Australia, Southeast Asia | 2008      | Local      |
| Salvinia                | <i>Cyrtobagous salviniae</i>      | Weevil | Brazil                    | Adventive | Widespread |
| Tropical soda apple     | <i>Gratiana boliviana</i>         | Beetle | Argentina                 | 2003      | Widespread |
| Waterhyacinth           | <i>Neochetina bruchi</i>          | Weevil | Argentina                 | 1974      | Widespread |
|                         | <i>Neochetina eichhorniae</i>     | Weevil | Argentina                 | 1972      | Widespread |
|                         | <i>Niphograpta albiguttalis</i>   | Moth   | Argentina                 | 1977      | Local      |
|                         | <i>Orthogalumna terebrantis</i>   | Mite   | --                        | Native    | Local      |
|                         | <i>Megamalus scutellaris</i>      | Bug    | South America             | 2010      | Local      |
|                         |                                   |        |                           |           |            |
| Waterlettuce            | <i>Neohydronomus affinis</i>      | Weevil | Brazil                    | 1987      | Local      |

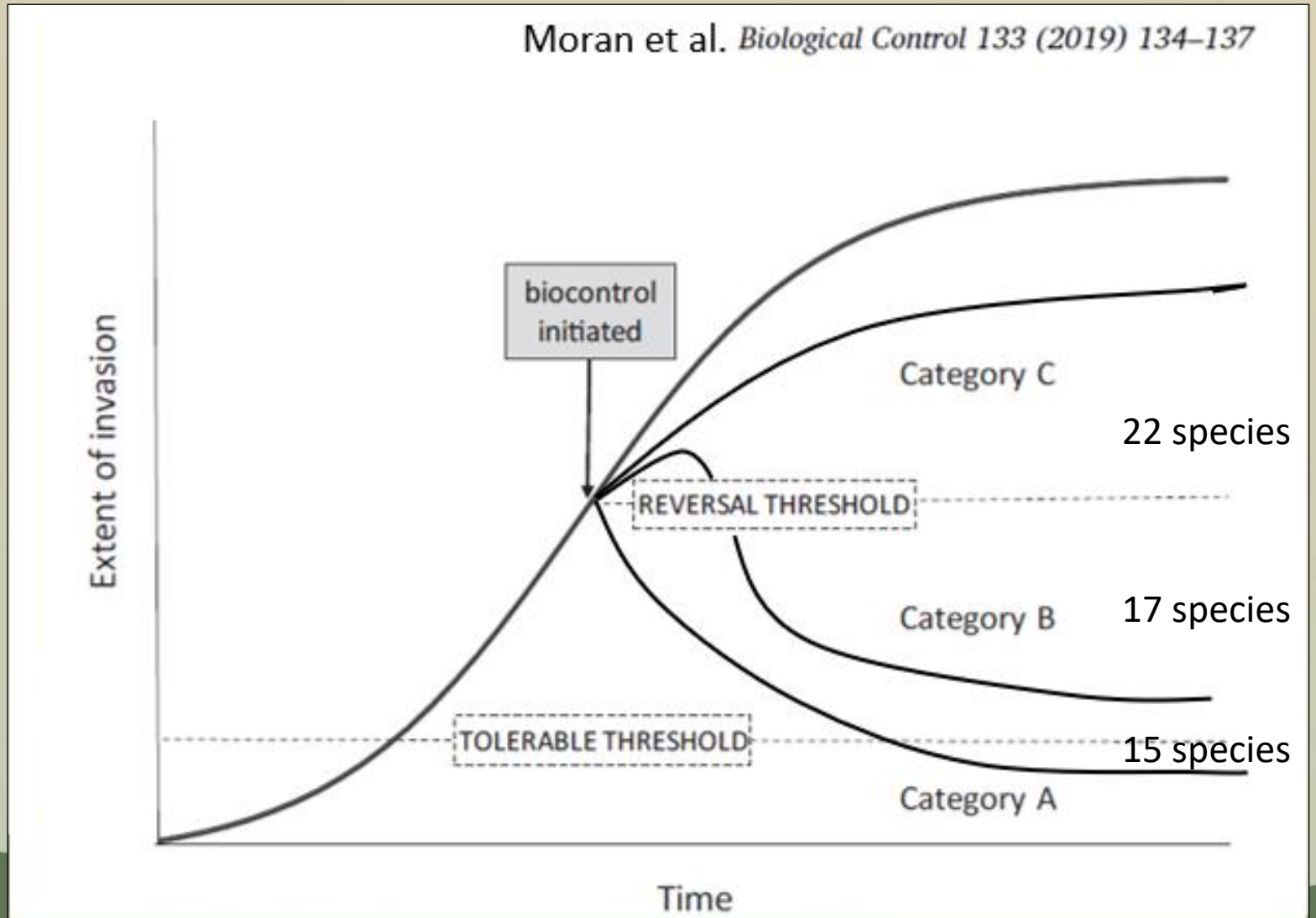
# Benefits & Downsides

- Can be a part of IPM
- Can reduce herbicide use
- Target specific
- Ideally, self sustaining
- Very labor and cost intensive
- Not always a perfect solution
- Can *require* IPM
- Establishment can take time
- Public trust



# Measuring Success

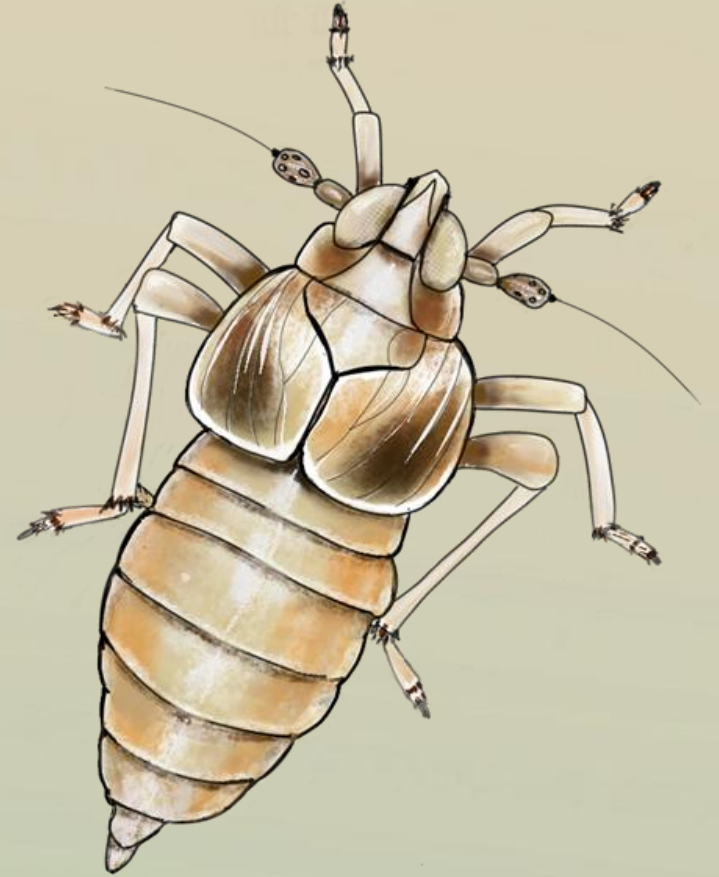
- 54 weeds assessed
- Density, Biomass, Area, Rate of spread
- Extent of the invasion has been reduced in all cases
- 15 species are no longer a problem



# *Megamelus scutellaris*

- Released in 2010; native to S. America where water hyacinth is its host plant
- Plant hopper that reproduces rapidly
- Rearing is fairly easy
- Nymphs feed on plant tissue causing chlorosis and eventual death

Chosen as ideal candidate for inundative release



# New Approach – Inundative Release

Classic vs. inundative

Research in South Africa – Dr. Coetzee

- Used in a 4502-acre closed system
- Reduced hyacinth from 37% to 6% over two years with no herbicide



*Megamelus scutellaris*

Reduce  
two ye

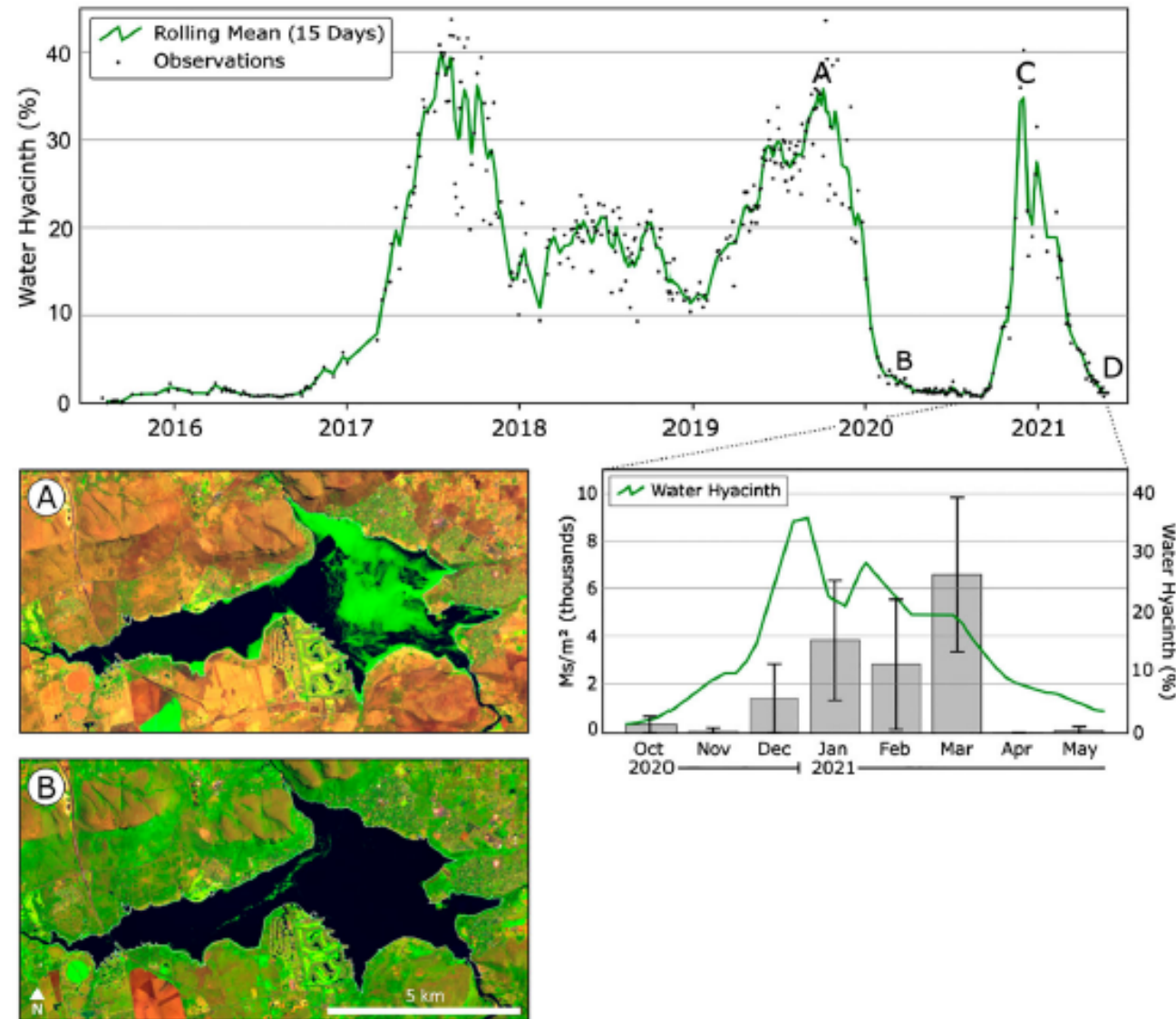


**Figure 2.** In the absence of herbicide applications (from January 2017), the first significant decline in water hyacinth occurred between October 2019 (A) and February 2020 (B), falling from 37% ( $\pm 4.66$ ) to 3% ( $\pm 0.53$ ), respectively. Water hyacinth appears bright green against the black water in the satellite images. After recovering over the 2020 winter period, water hyacinth cover declined from a peak coverage of 36% ( $\pm 5.1$ ) in December 2020 (C) down to 6% ( $\pm 0.2$ ) in April 2021 (D) as a result of damage from high densities of *Megamelus scutellaris* (Images: Sentinel-2).



# Inundative Release

- Releasing **6-10k individuals every two weeks** throughout the year
- Over a two-year period more than 197k were released
- Utilized mass rearing facility but also volunteer rearing stations



*Megamelus scutellaris* nymphs

# Current IPM Research Projects

- UF / USDA mass rearing / inundative release and biotype research in south Florida
  - S. Africa used bugs from Argentina while those released in Florida came from Uruguay
- FAMU mass rearing / inundative release in north Florida





# Other Potential Opportunities



Salvinia weevil from Brazil



# Questions?

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