Review of seagrass revegetation projects worldwide

Keys to enhanced success of planting

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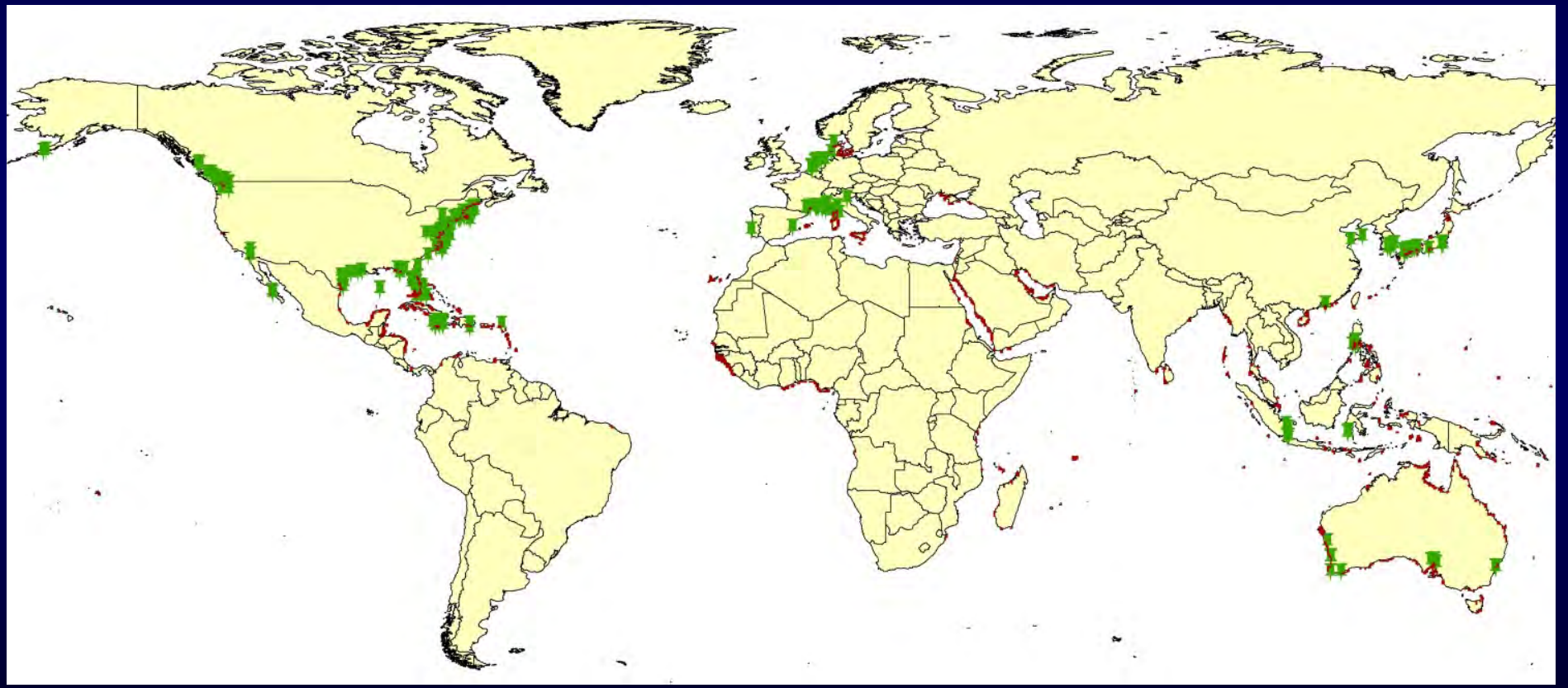
Revegetations worldwide

-Manual – mechanical
-Rhizome fragments, seeds, sods
-Anchoring
-Habitat treatments
…

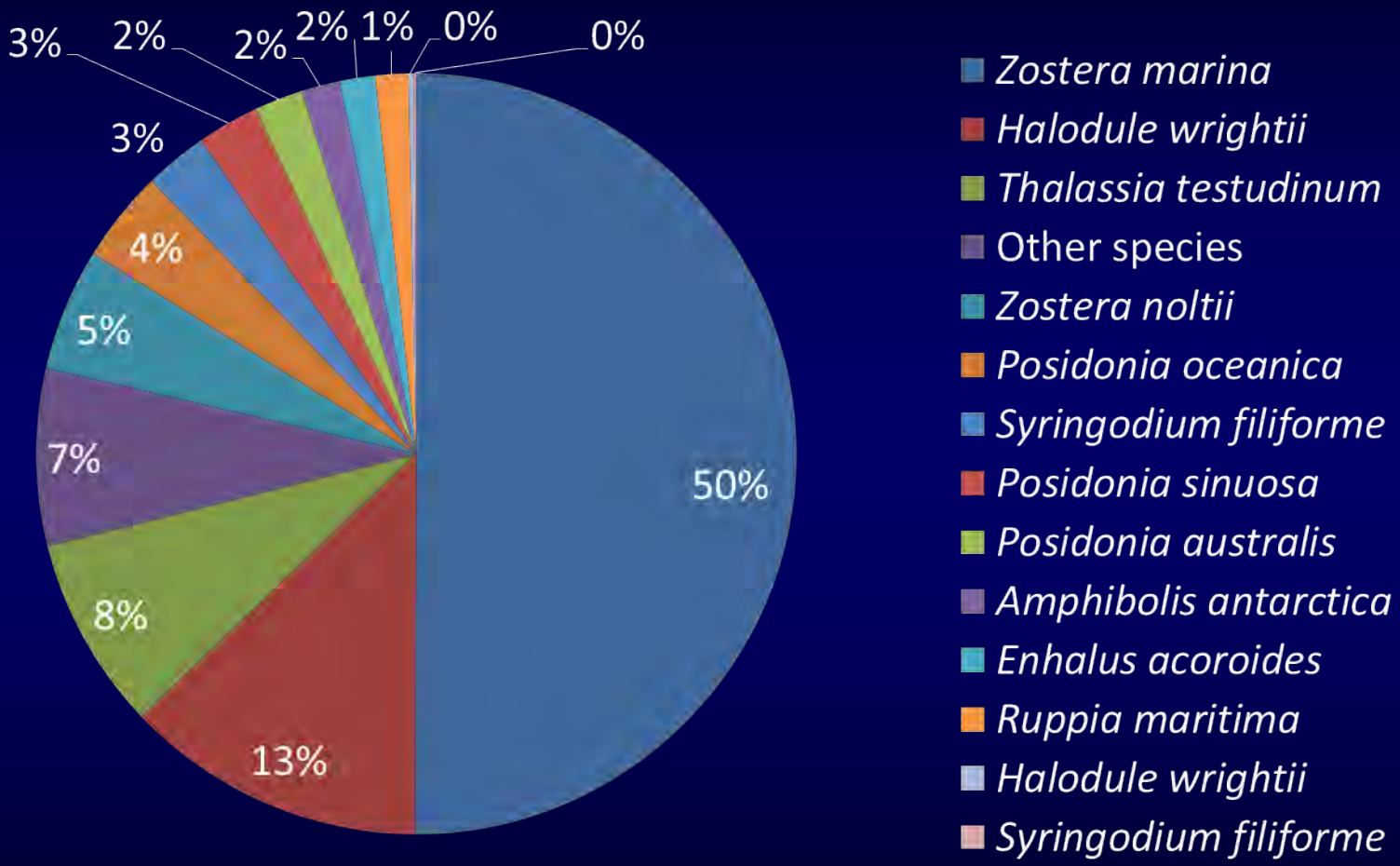
Inventory of “all” revegetations

1786 Plantings in 17 countries

213 sources (Web of Science 105, Grey literature 102, unpub.data 6)

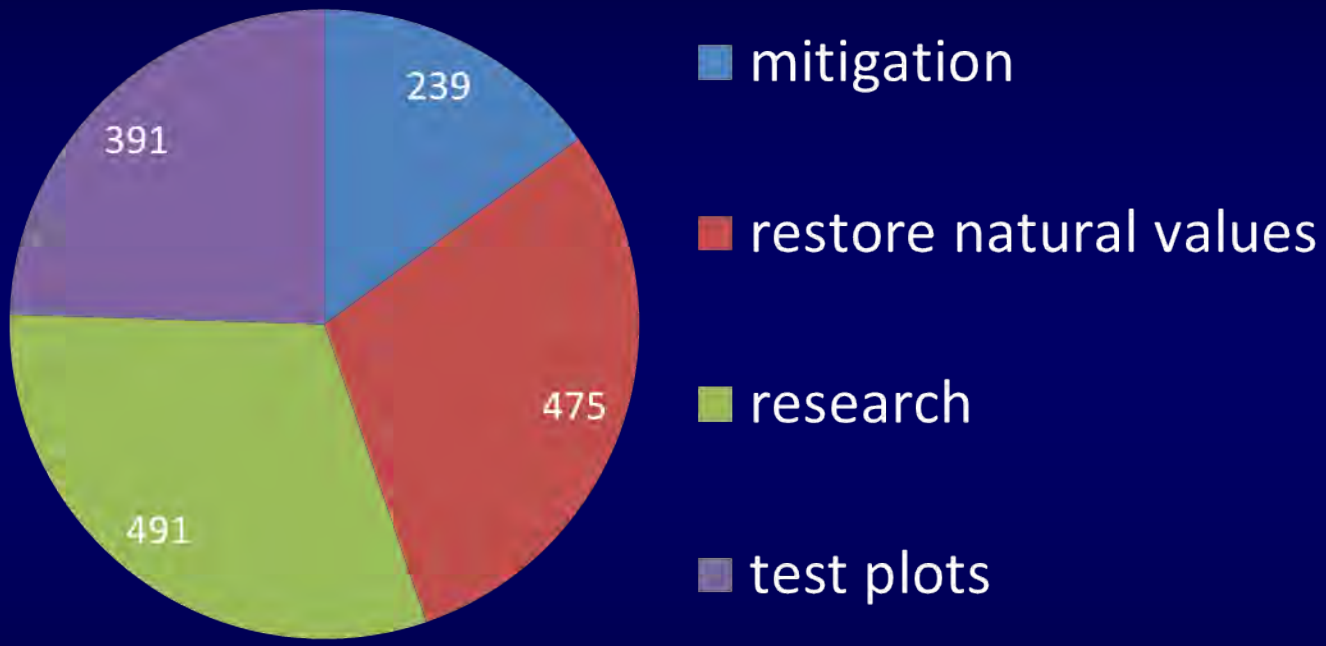


Species



1786 plantings

Reasons for revegetation



1786 plantings

Facts & figures
(1786 plantings)

Dataset:
Many omissions
Planting densities /spacing PU's vary
Monitoring period and frequency vary

At t=zero, per planting

	median	N
Number of shoots	409 shoots	1109

Facts & figures
(1786 plantings)

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Area glued together (area of PU x no of PU)	4 m^2	1342

(PU=Planting Unit)

Facts & figures
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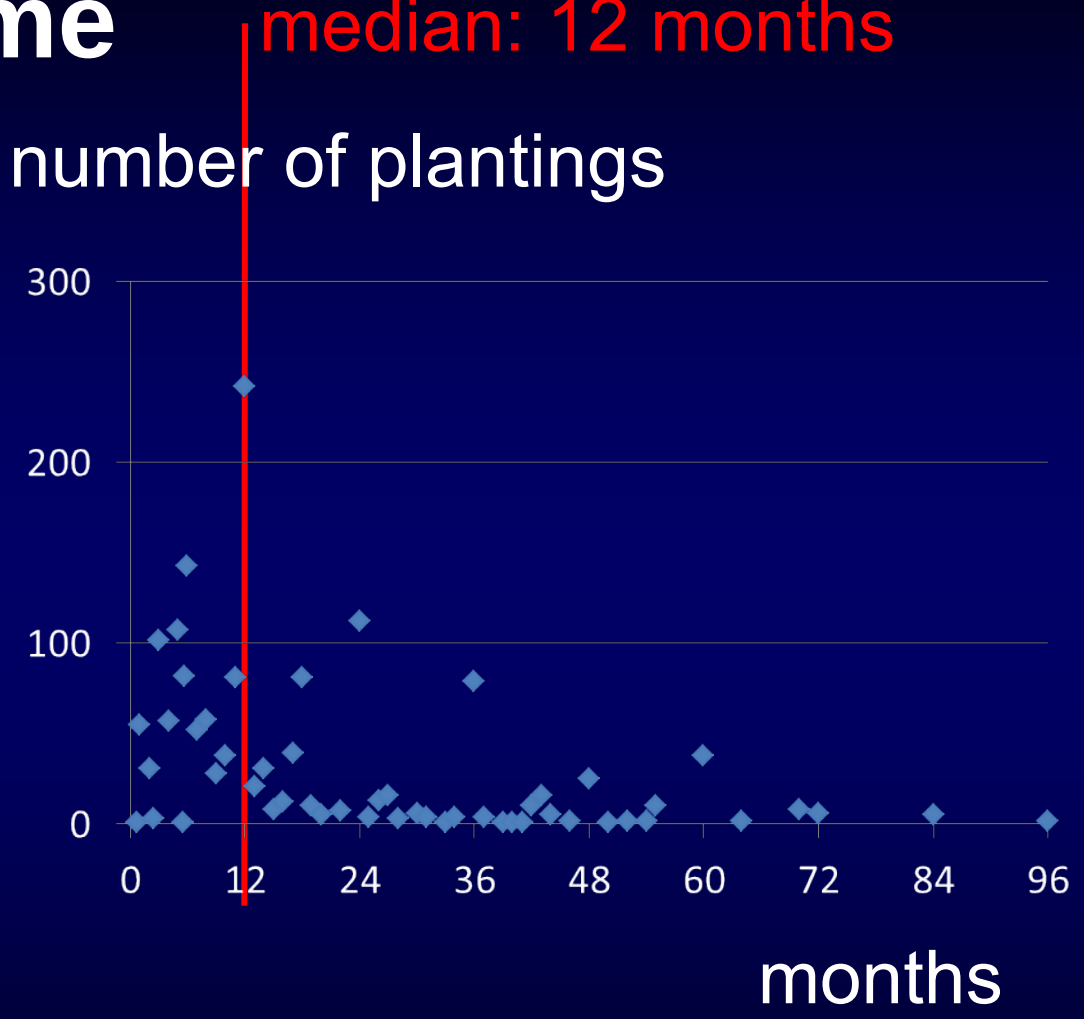
Area glued together, standardized density	0.9 m^2	1108

(PU=Planting Unit)

Monitoring time

if survival:

median: 22 mo



Achievements: survival

		Monitoring	N
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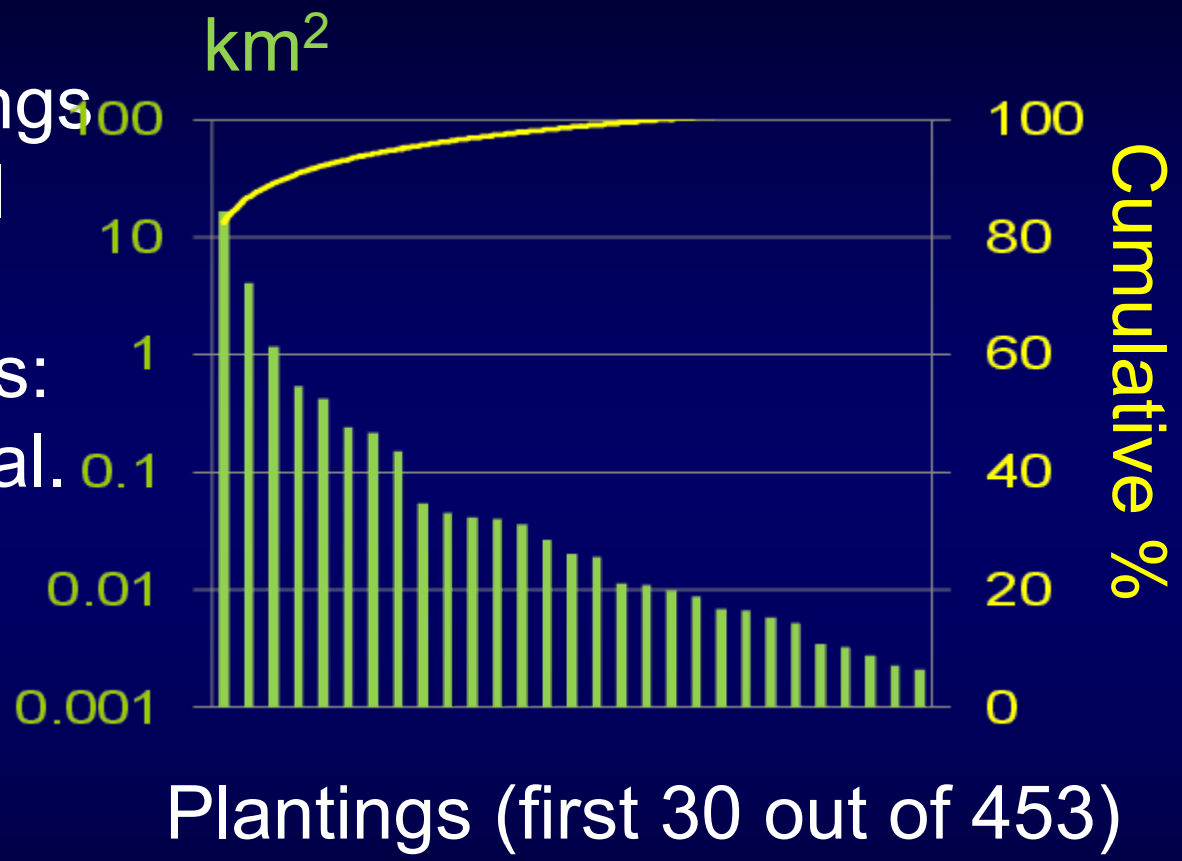
Full recovery projects mitigation	16%	43 months (median)	35
Full recovery projects restore natural values	3%	84 months (median)	14

NOTE: Full recovery is a subjective measure

Achievements: area

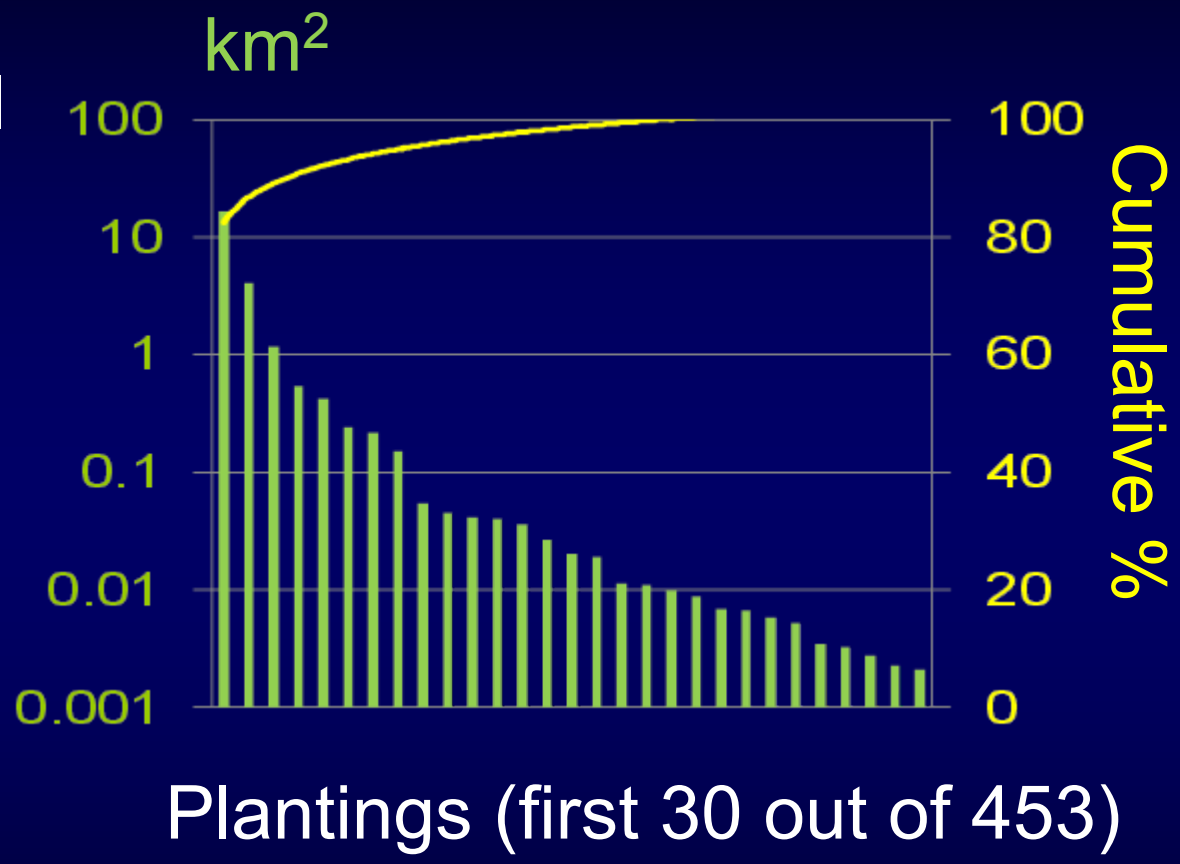
- 99% by 12 plantings
- 5 decades: virtual 24.1 km^2
- Four Virginia Bays: 22.5 km^2(Orth et al. 2012)
- Underestimation



(area was standardised per species)

Compare to annual losses

- 5 decades: virtual 24.1 km^2
- Annual loss: 110 km^2 (Waycott ea 2009)



(area was standardised per species)

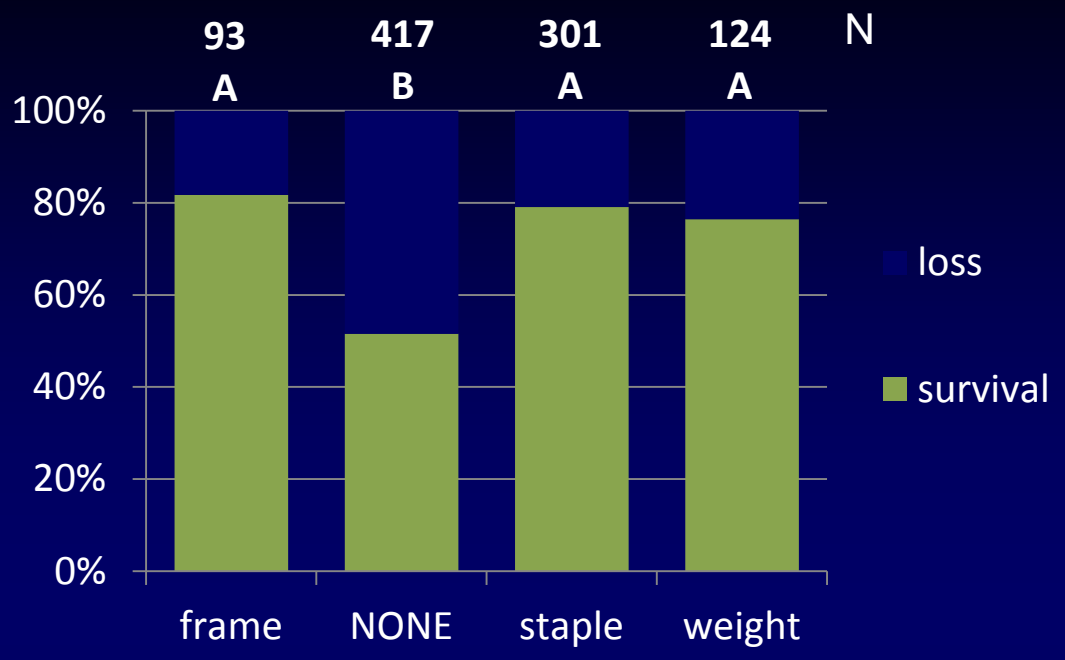
Success evaluation

- Initial survival (<10 months)
- Long-term success (> 22 months)
  - 0 = Loss
  - 1 = Decline
  - 2 = Equal presence
  - 3 = Increase
- ~Full recovery

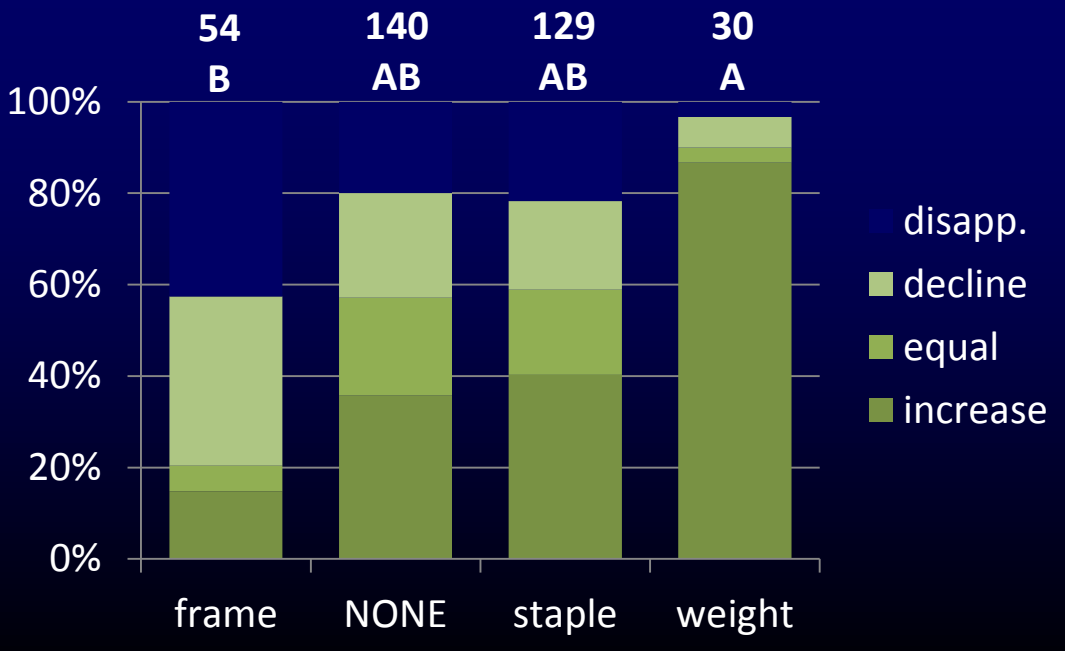
Keys to success: 50 variables tested

Anchoring

Initial survival
(< 10 months)



Long-term success
(> 22 months)



Keys to success **preliminary results**

Site:

- Close to donor (< 1km)
- Threats: no threats ≥ substrate ≥ local direct impact ≥ construction, water quality

Seagrass plants:

- Seedlings << rhizome fragments, sods or seeds (*Z. marina*)
- Small 'pioneers' ≤ large climax species

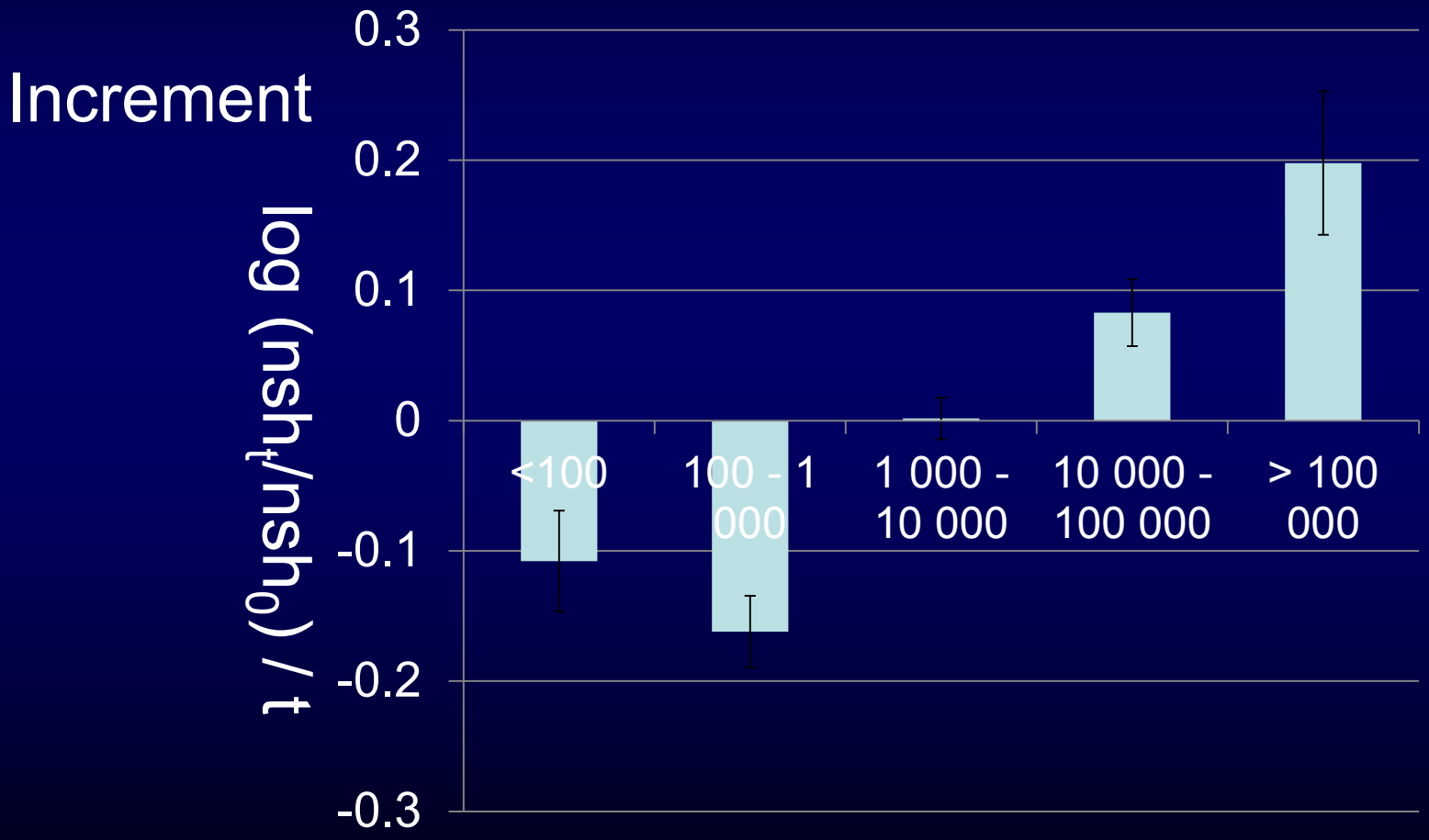
Techniques:

- Anchoring: weights!
- Larger scale > small scale

In total ca 50 variables tested

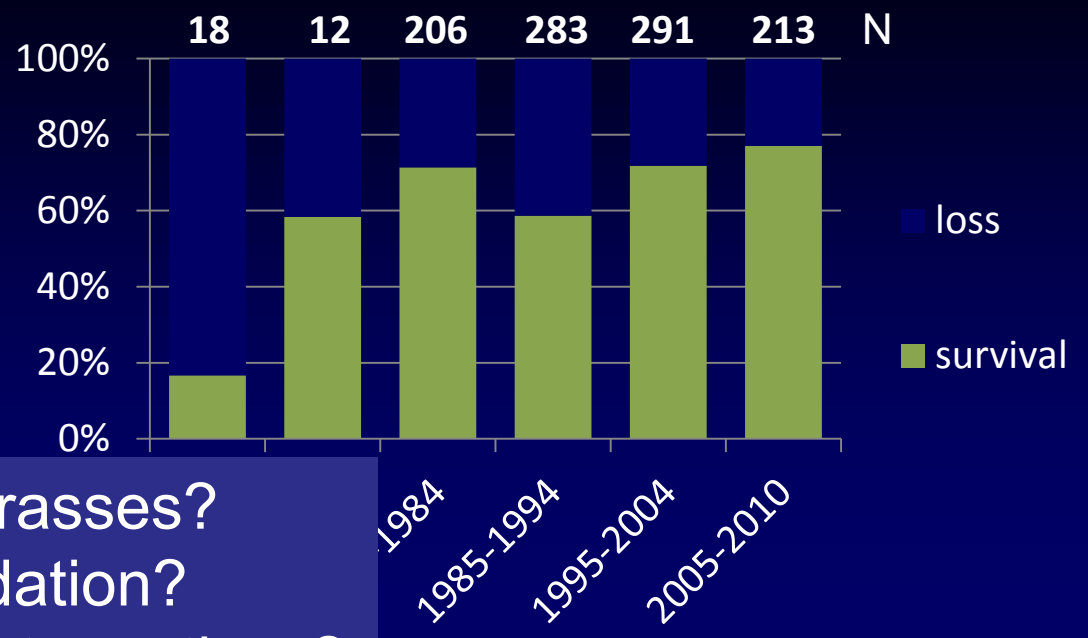
Planting scale

Suitable for comparison: number of shoots planted



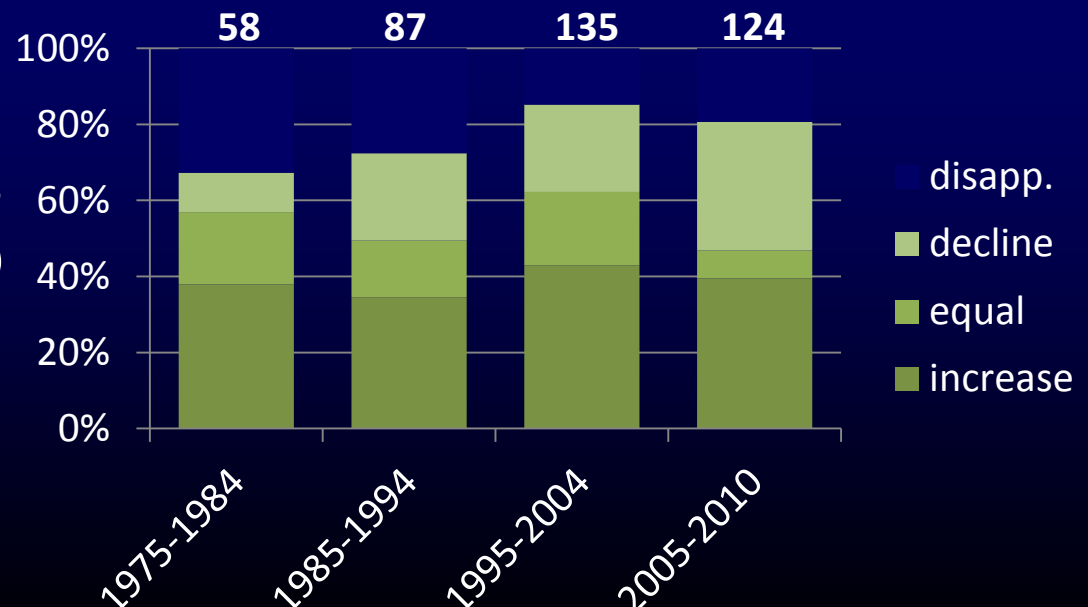
‘Learning Curve’

Initial survival
(< 10 months)



- difficulty of planting seagrasses?
- increasing habitat degradation?
- Insufficient sharing of best practices?

Long-term success
(> 22 months)



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Conclusions

- Revegetation can be very succesful
- Low survival: efficiency can be improved
- Our review: sharing best practices
- Sustaining seagrass needs conservation & restoration

Questions?










Tentative cost-benefit

Per hectare:

Cost: (*preliminary estimate!!*) 125,000 $ at shoot density 1%

Benefit:

Nutrient cycling: 19,000 $ (Costanza e.a. 1997)
Carbon sequestration: 33,000 $? (emission rights carbon)

So costs can be earnt back within 3 year after full recovery…

What is full recovery

- Full recovery is a subjective measure, e.g. 70% cover, ‘coalescence of patches’
- Relate to what area? What is total suitable area of the water body (‘carrying capacity’)? Neighbouring beds?
- Over-claim: invasion from neighboring bed?
- Under-claim: lag phase: monitoring stopped too soon
- Return of ecosystem services? (habitat, stabilisation, C-sequestration, ..)

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