Density dependence in fish stocks

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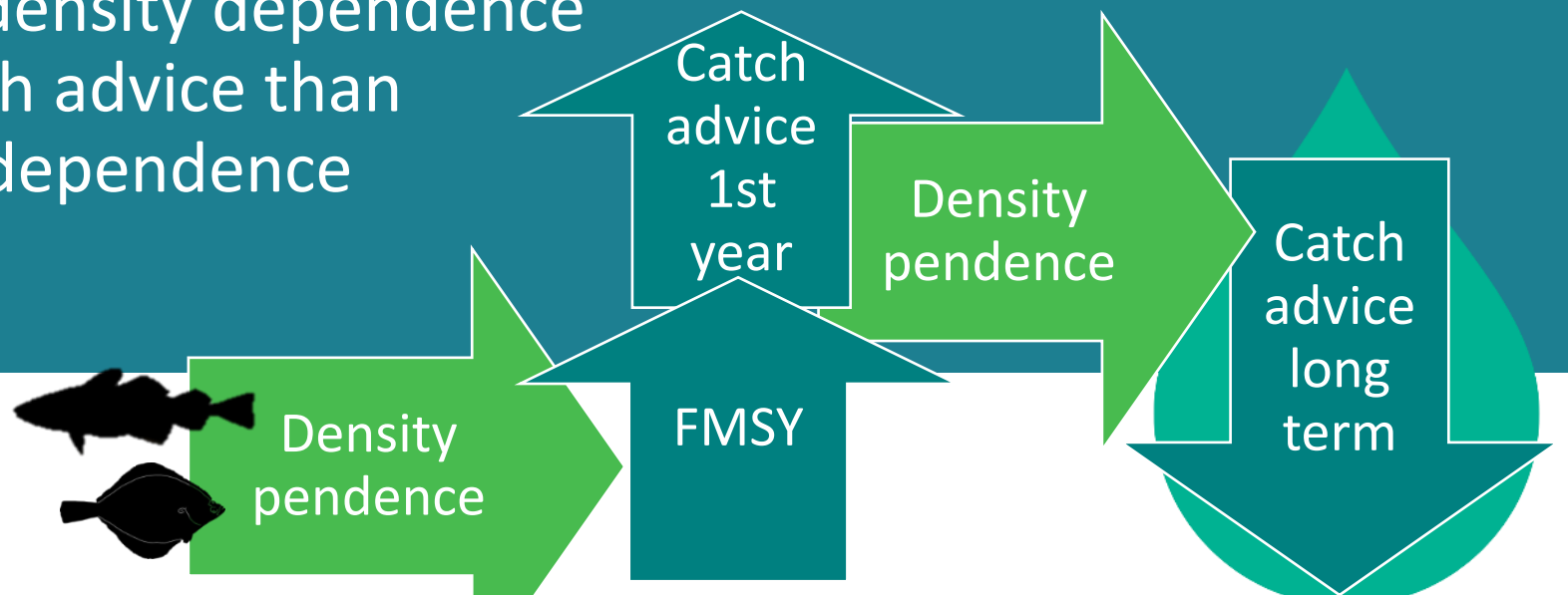
SEAwise has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000318

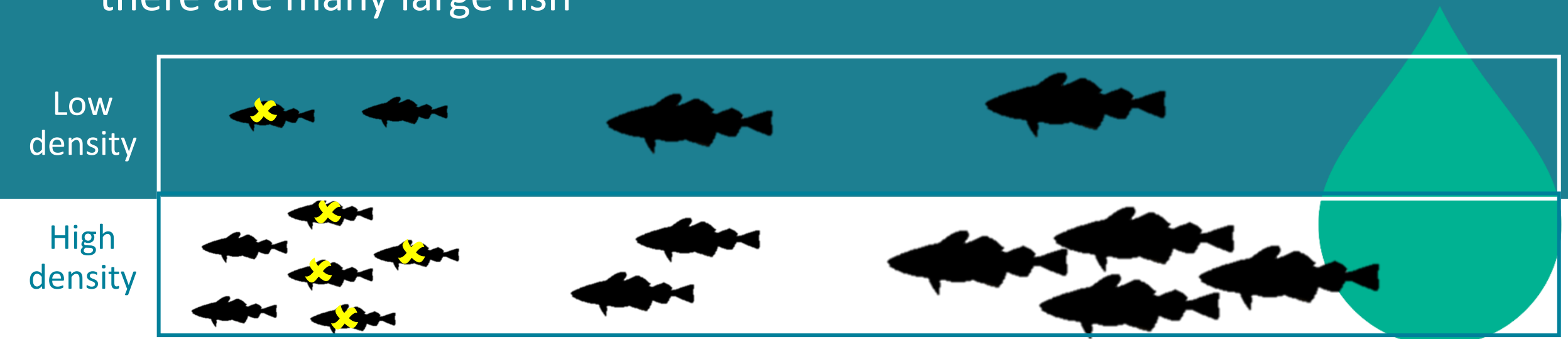
Sounds like a topic for some very detail oriented scientists?

- Productivity at high density matters to the fishing pressure producing maximum yield, F_{MSY}
- Decreasing productivity at high density typically leads to higher F_{MSY} for cod fishes and flatfishes but lower F_{MSY} of pelagic fishes
- In the first year, larger F_{MSY} means larger catch advice
- In the subsequent years, density dependence means lower average catch advice than when there is no density dependence



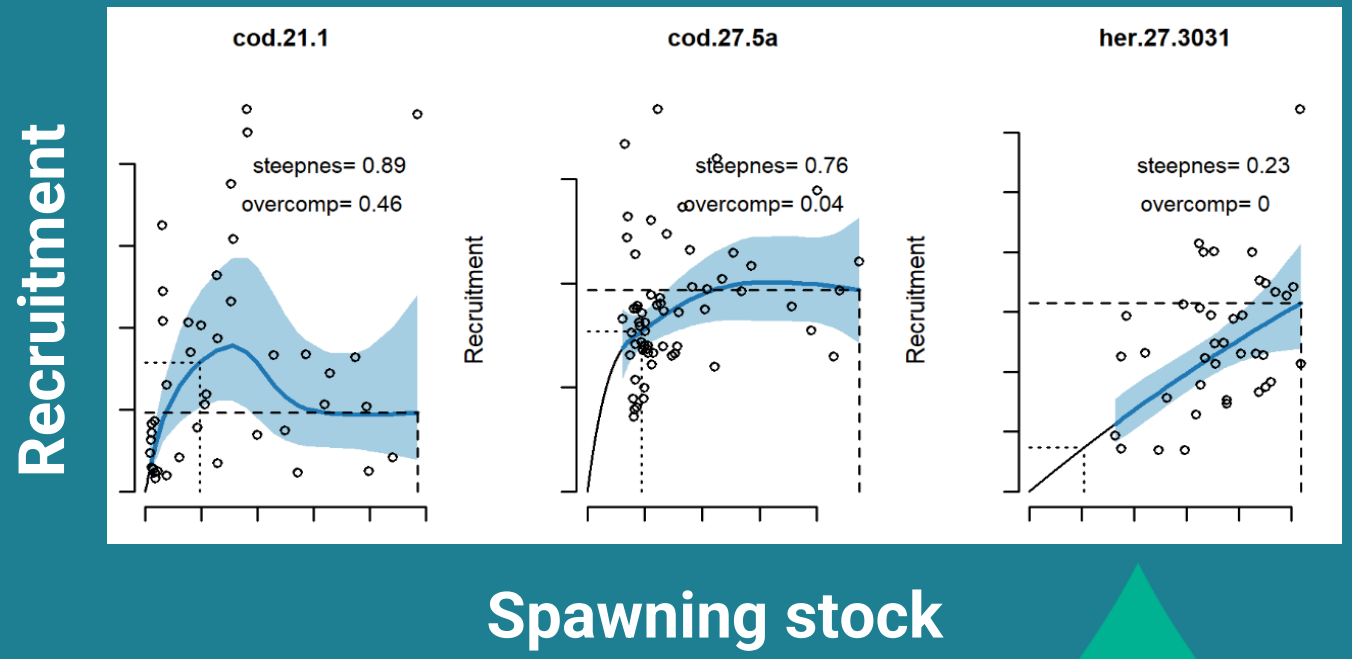
What happens when density is high?

- If there is the same amount of food, there's less food for each
- Less food → less growth
- Less growth → less survival
- Probably larger fish are better competitors, so many large fish may mean fewer small fish survive
- If larger individuals are cannibalistic, even fewer small fish survive when there are many large fish



How do density dependent effects on juveniles look?

- There are three broad types of relationship between recruitment and stock size:
  - Decreasing recruitment at high stock size (overcompenation)
  - Stable recruitment at high stock size
  - Increasing recruitment at high stock size (steepness)



Total number of stocks: 79 in all

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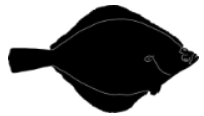
18 

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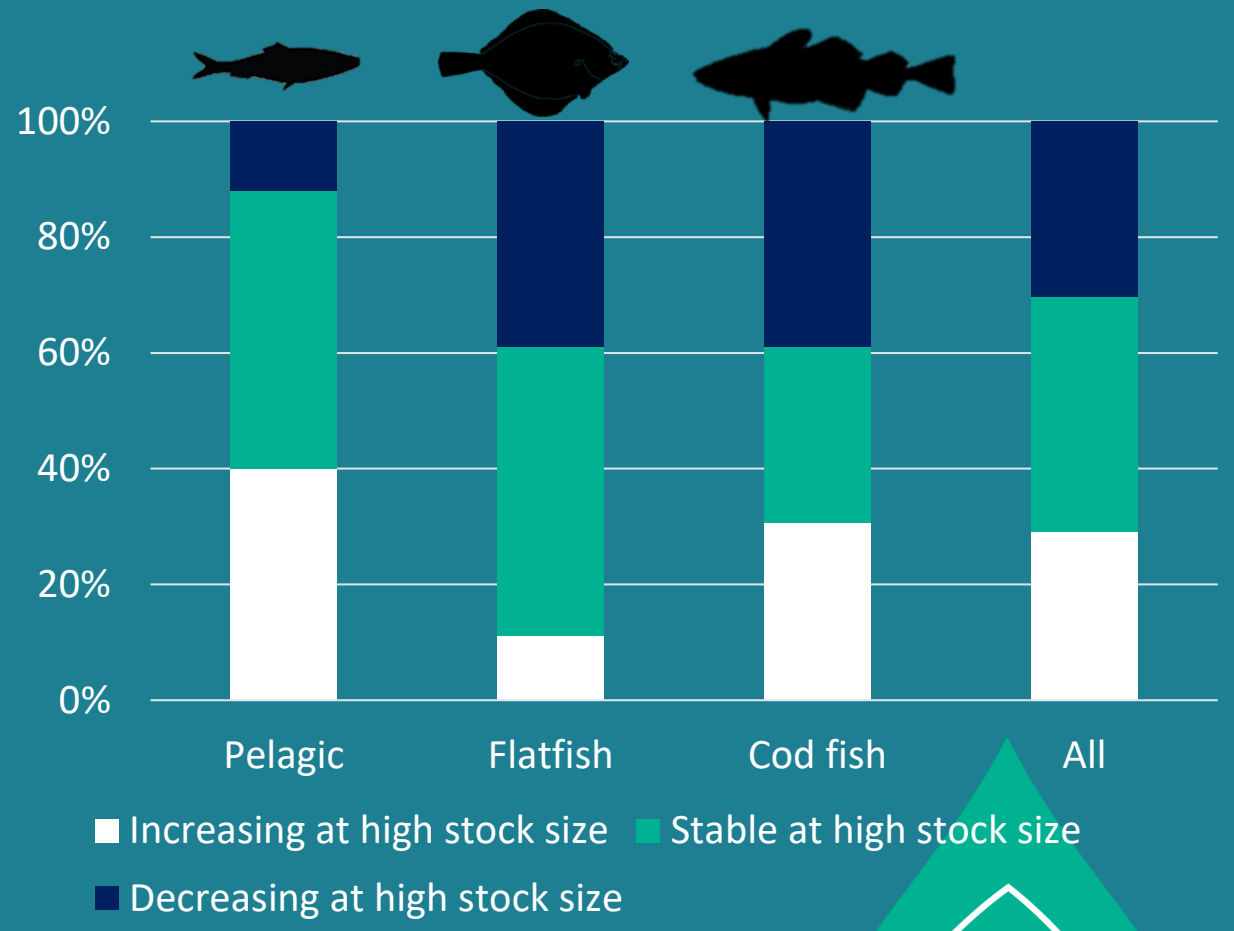
How do density dependent effects on juveniles look?

- Increasing recruitment at high stock size is common in pelagic fish and cod fish but uncommon in flatfish
- Stable recruitment at high stock size is common in all
- Decreasing recruitment at high stock size is common in flatfish and codfish but uncommon in pelagic fish



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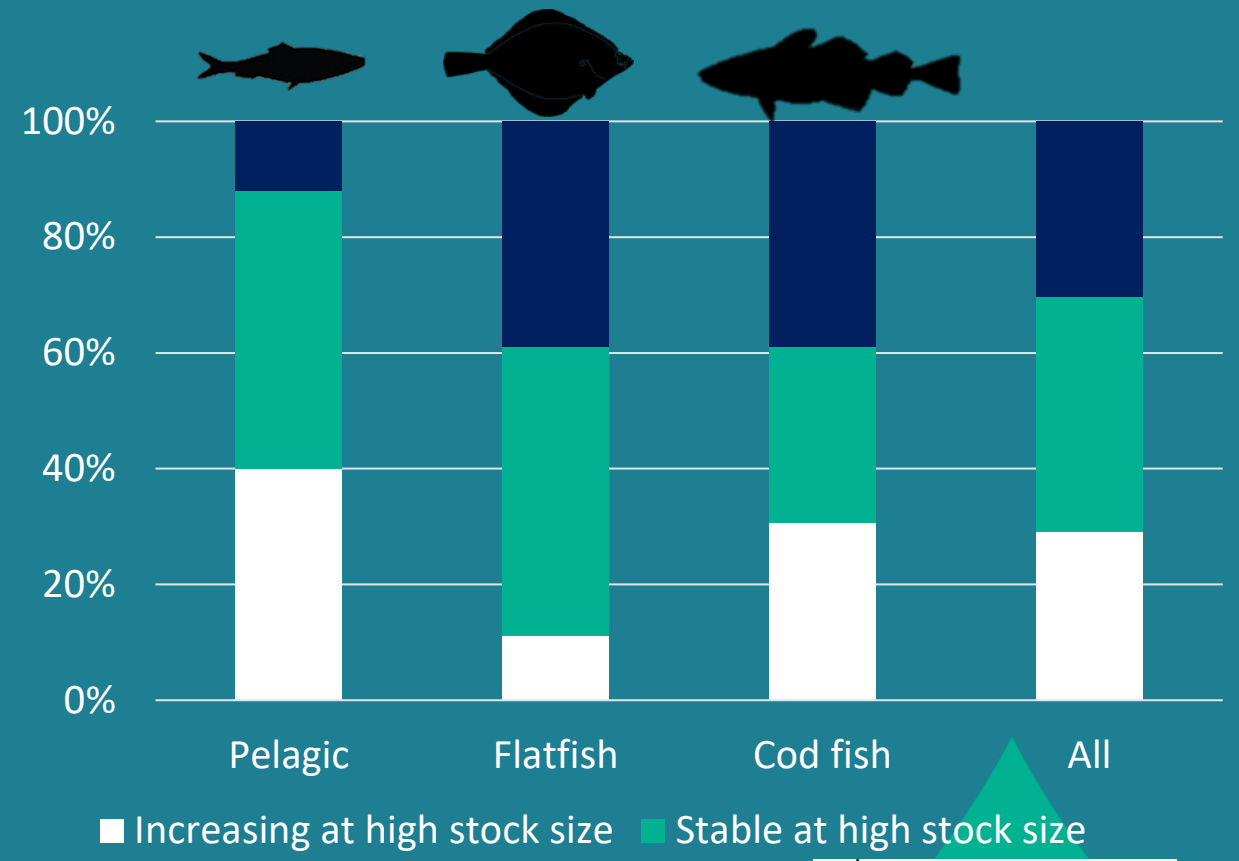
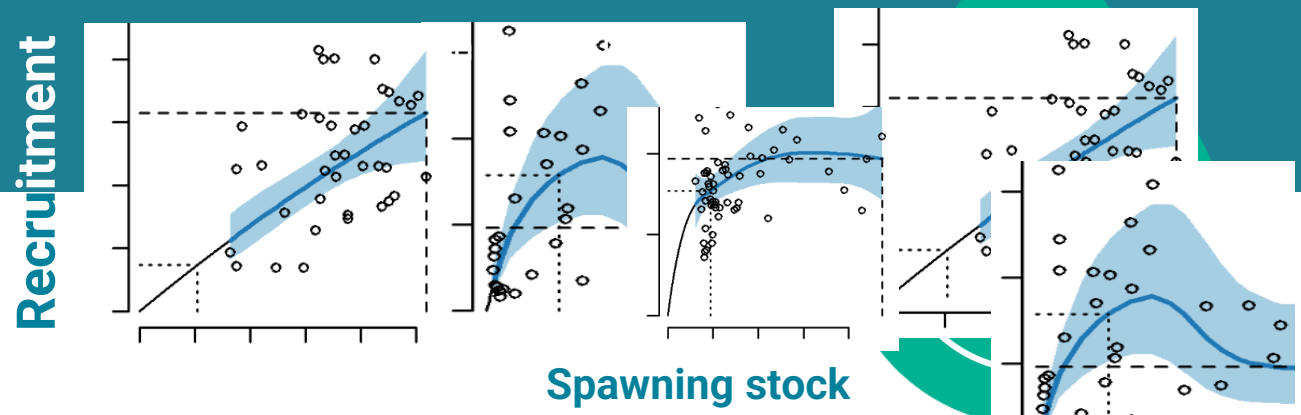
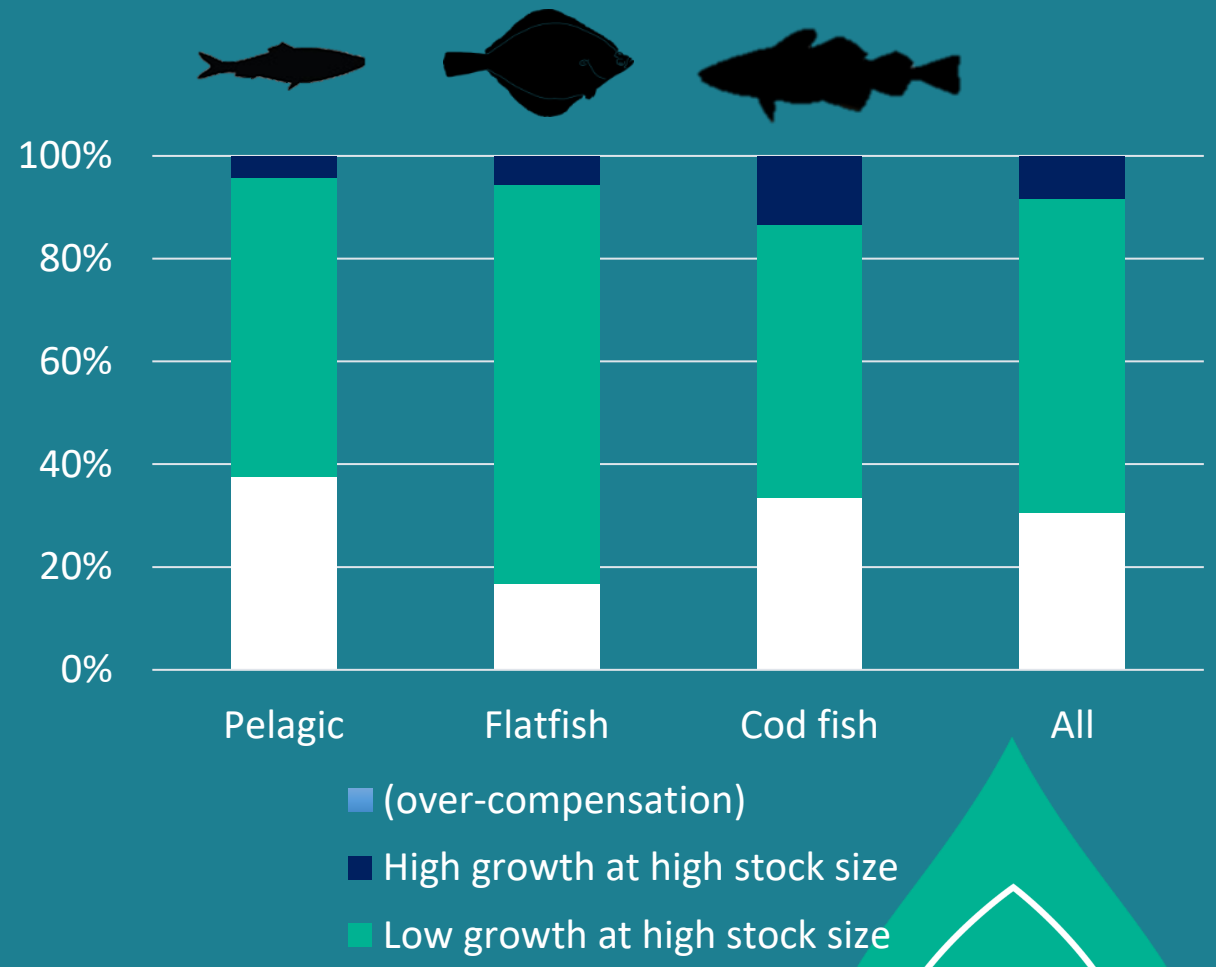


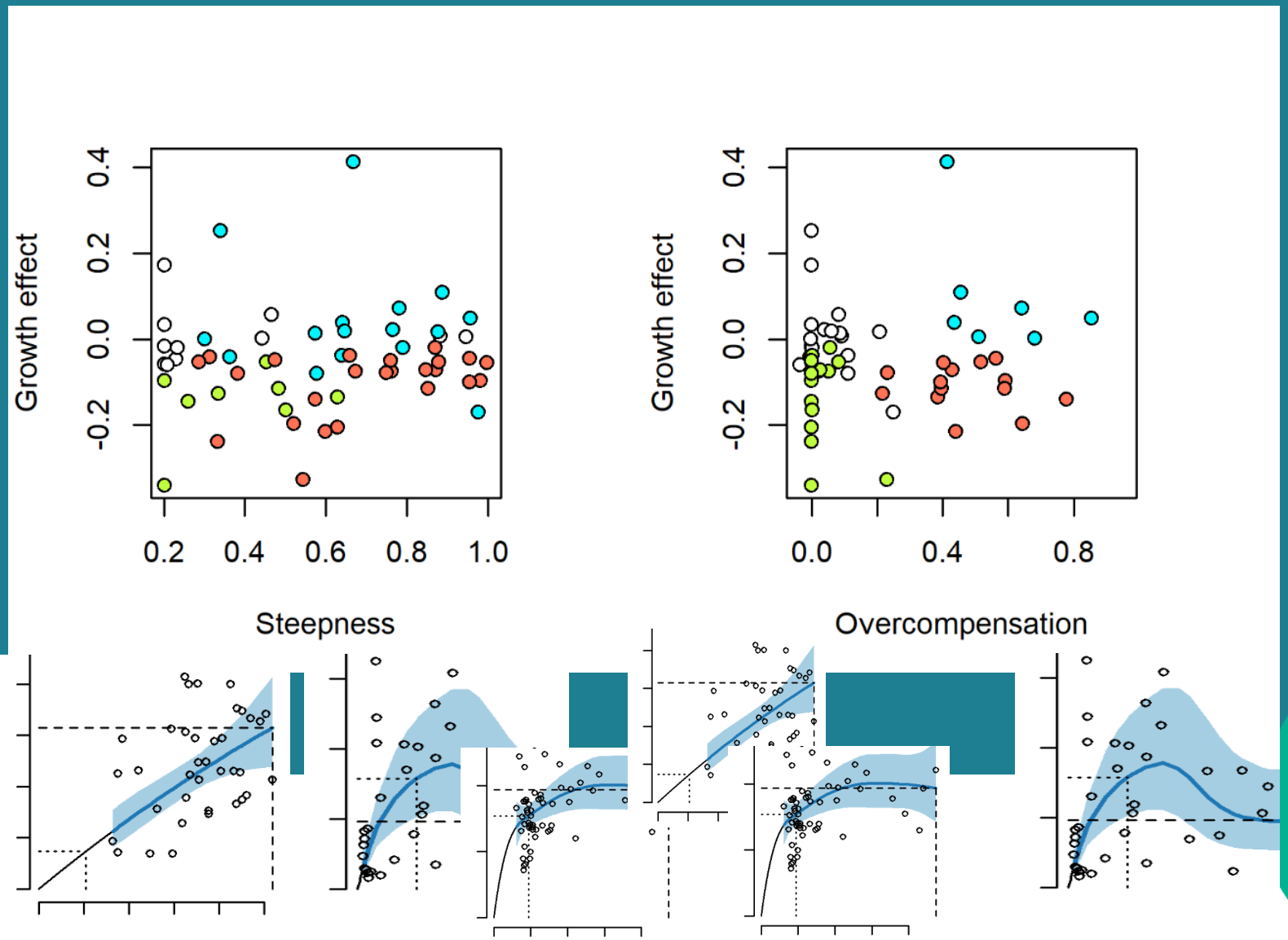


How do density dependent effects on adult growth look?

- Low growth of adults at high stock size dominated all three groups
- Juvenile growth was more variable and less density dependent
- The negative effect on growth where significant ranged from 2-34% decreased weight at age



Can stock recruitment density dependence tell us something about growth density dependence?



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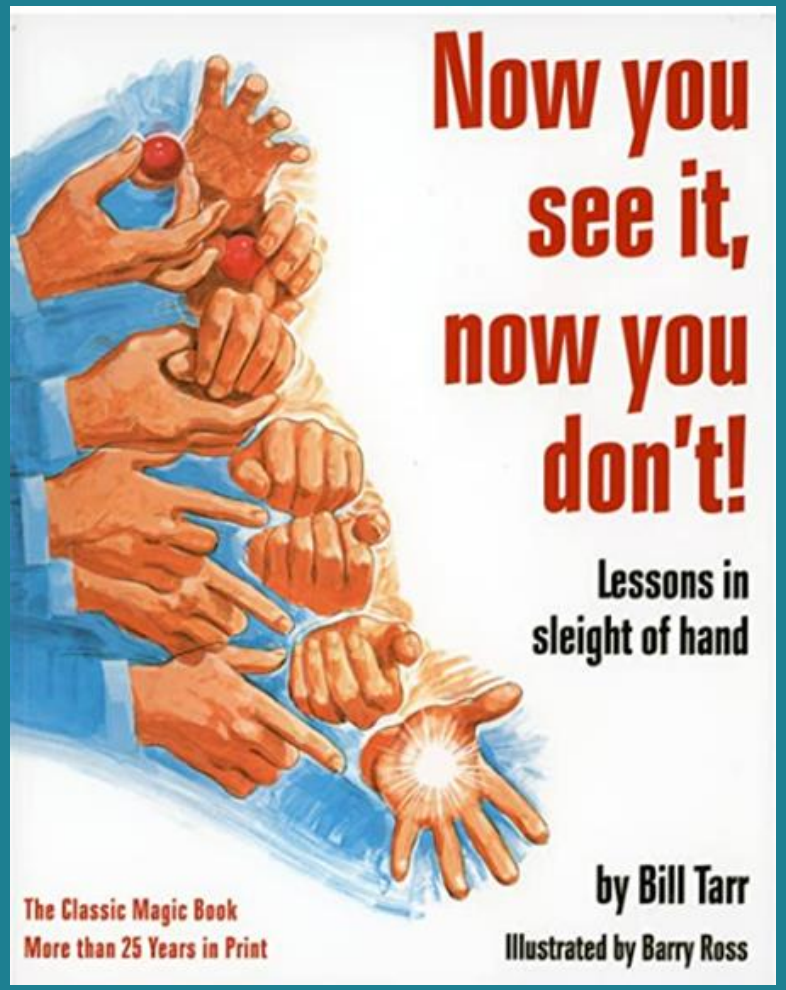
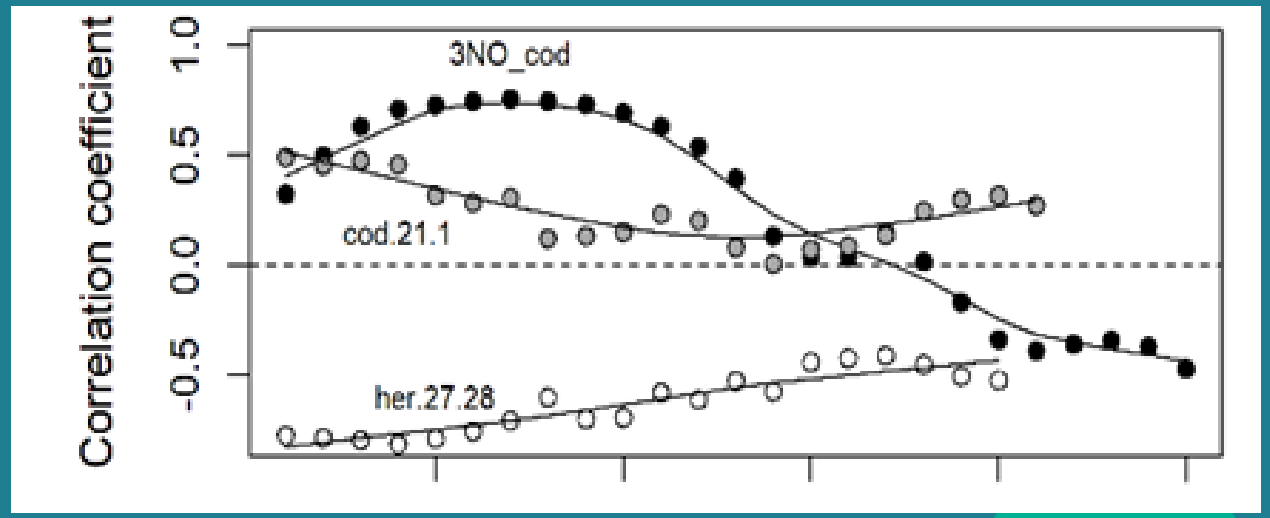
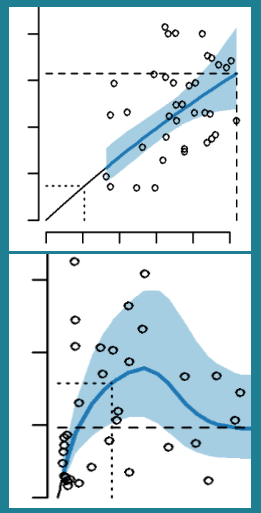
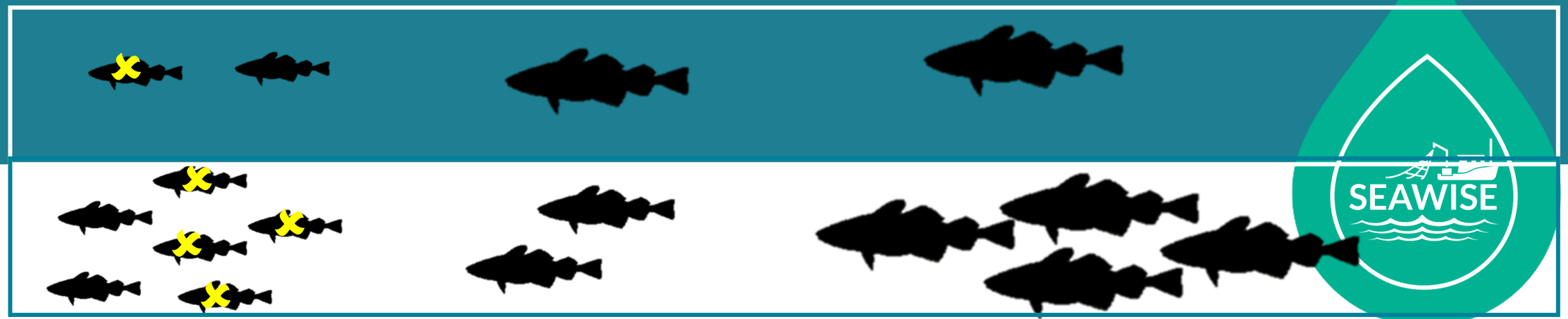


Some are consistent, others not…



In conclusion….



- Incresing recruitment at high stock size fitted best in 22% of the stocks, mostly in pelagics
- Overcompensation is uncommon in pelagics, but common in flatfish and cod fish
- Growth effects may be larger than recruitment effects or the other way around
- Growth effects may vary a lot over time for cod fish but seem consistent for pelagics