Lasers and *Labridae* in Lyme Bay

What can we learn about wrasse territoriality from their laser-chasing behaviour?

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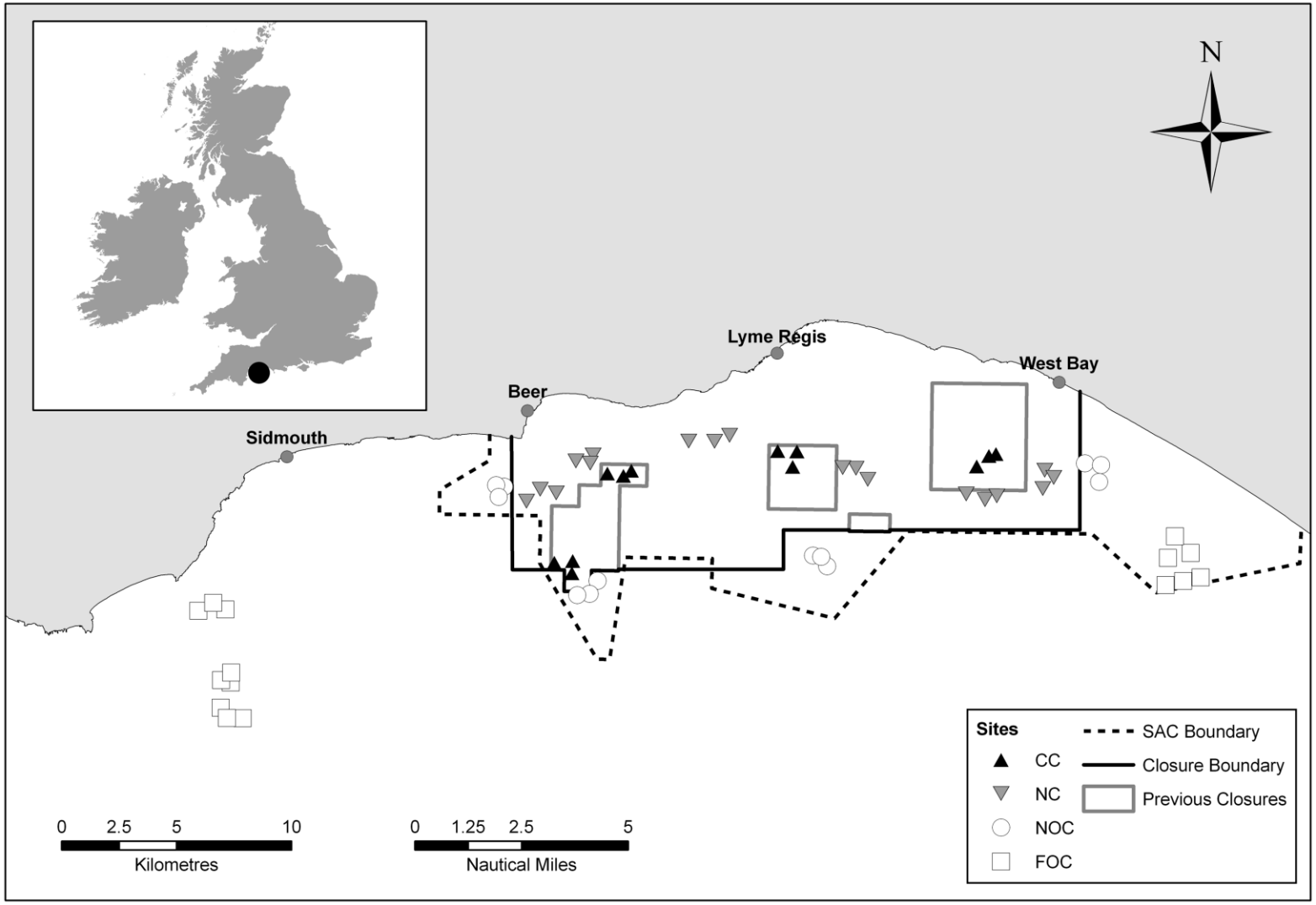
Study site: Lyme Bay Reserve

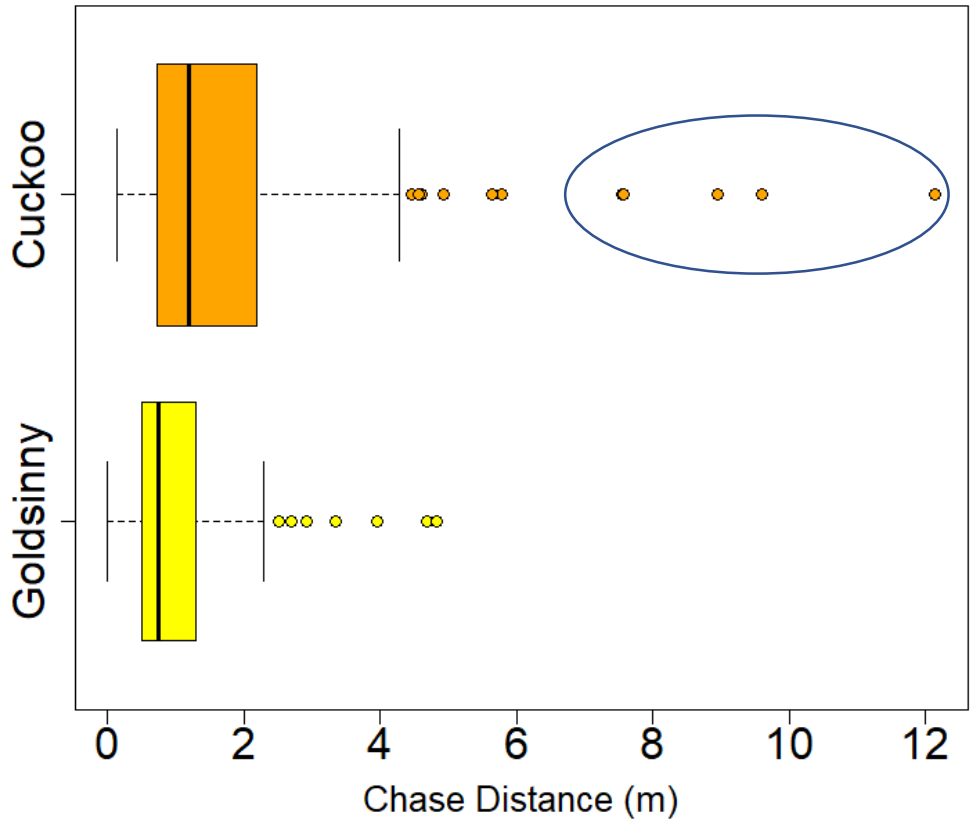


Aim: to explore aspects of wrasse territoriality using an observed behaviour, “laser chasing”

- Objective 1: Are there differences in the likelihood of ‘laser chasing’ between species, sizes and sexes?
- Objective 2: Are there relationships between the length of chase and wrasse? Can we use this behaviour to answer questions about aggression and territory size?
- Objective 3: Are there implications for wrasse conservation, management and welfare?

How do different wrasse species interact with towed apparatus?

- Cuckoo Wrasse more likely to ‘chase’ the laser than Goldsinny
- Cuckoo Wrasse chase distances significantly greater than Goldsinny chase distances



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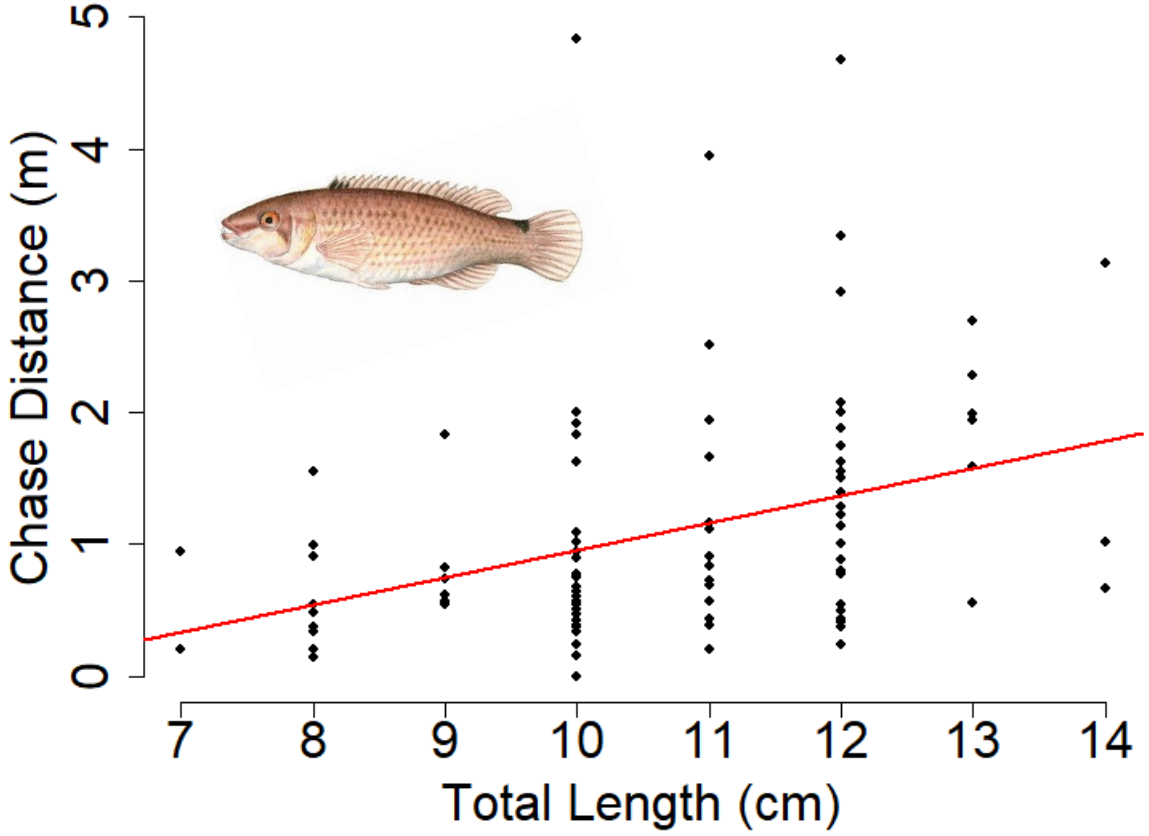
Permutation test: p > 0.001 . Mean Goldsinny Chase: 1.04m, 95%CI 0.89-1.21m. Mean Cuckoo Chase: 1.83m, 95%CI 1.51-2.18m

Are larger wrasse more territorial?

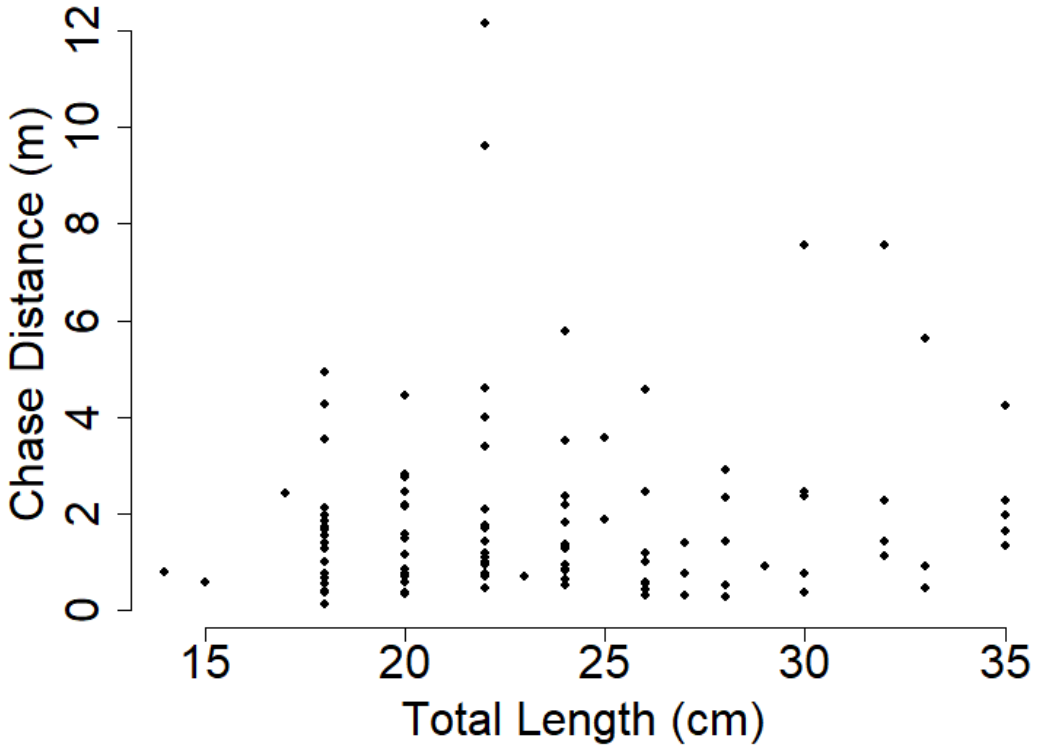
- Goldsinny Wrasse: larger wrasse tended to make longer chases



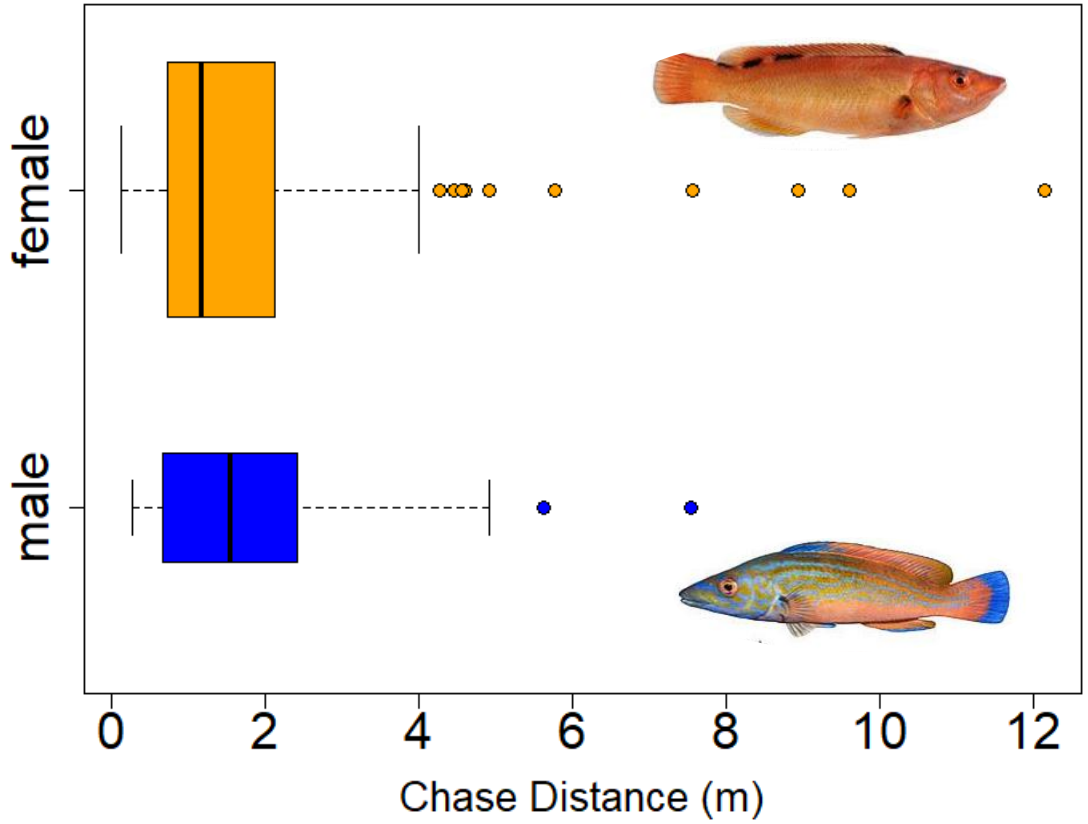
Spearman's rank: r_s=0.41, $p < 0.01$, n=104

Are larger wrasse more territorial?

- Cuckoo wrasse: no apparent relationship between length and chase-distance, or sex and chase-distance



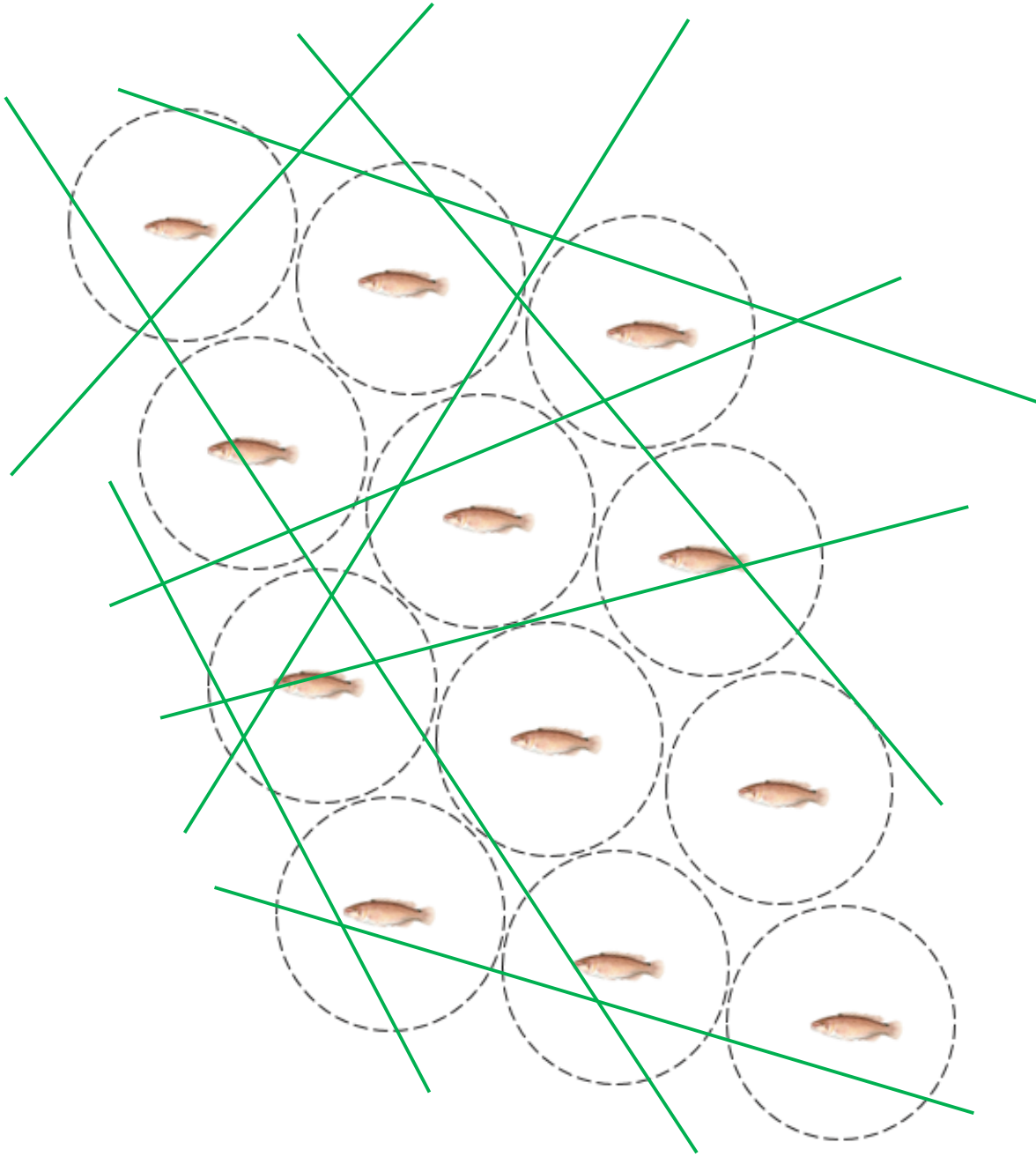
Spearman's rank: r_s= 0.07, p = 0.45, n=120



Permutation test: P=0.43, n=120

Territory size

- Assumptions: landscape of circular territories of radius *r*, ($A = \pi r^2$)
- Average intersection of random lasers = *r*
- Goldsinny: median chase distance = 0.8m, gives 2m^2 territory size, (max chase = 5m, gives 19m^2 territory size)
- **Hilden (1981)** directly observed Goldsinnies had an average territory size of 1.4m^2, (range 0.5-2m^2)
- Cuckoo wrasse: median chase distance was 1.4m, gives 6.2m^2 territory size (max chase, 75m^2 territory)



Further questions

- Apply method to different situations
- Are wrasse territorial toward laser at different times of year?
- Are there differences in territoriality between fished/unfished areas?
- Are we selecting against behavioural traits by fishing?
- Does territoriality/territory size vary with habitat type? Eg. wrasse in inshore kelp forests?

Questions, please!

Acknowledgements

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References

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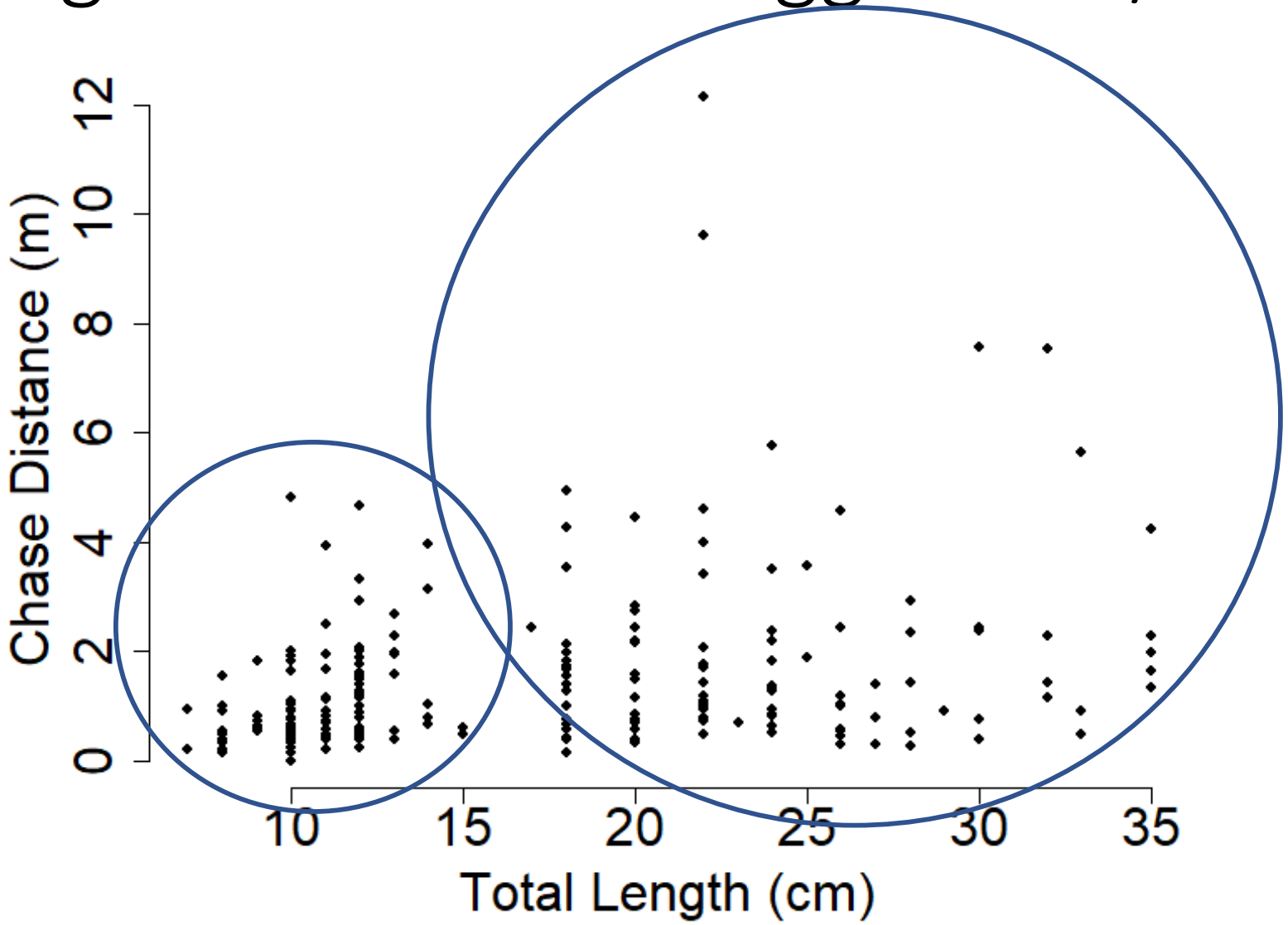
Hilldén, N.-O., 1981. Territoriality and reproductive behaviour in the goldsinny, Ctenolabrus rupestris L. Behavioural Processes, 6(3), pp.207–221.

Sheehan, E. V. et al., 2013. Recovery of a Temperate Reef Assemblage in a Marine Protected Area following the Exclusion of Towed Demersal Fishing C. J. Fulton, ed. PLoS ONE, 8(12), p.e83883.

Are larger wrasse more aggressive/territorial?



Methods

Collate all wrasse occurrences in towed video surveys from Lyme Bay in 2011 and 2013

Identify species and sex visually, estimate length where possible

Classify wrasse sightings into categories of aggressive and non-aggressive 'interaction'

CHASE | INTEREST | NEUTRAL | FLEE

Calculated 'chase-distance' using GPS data (2013) or average tow speed (2011)

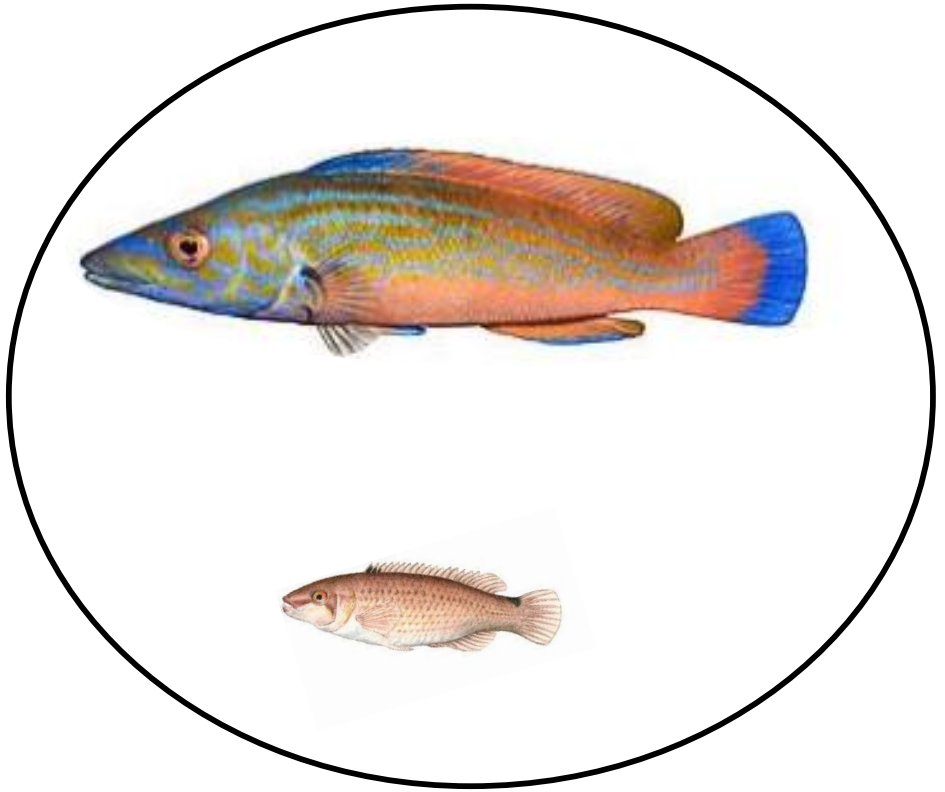
Calculate 'aggression ratio' (C/I+N+F) for species, sizes, length groups, and sites

Territory size model

Statistical analysis

Results: How many wrasse?

- Nearly all of the 533 occurrences of wrasse were in areas closed to towed fishing gear within Lyme Bay Reserve, versus areas outside
- Goldsinny (297) and Cuckoo (204) most frequently observed on towed video
- Few Ballan (14) and Rock Cook (18), no Corkwing



Biological explanations for differences in ‘laser-chasing’?

- Cuckoo wrasse larger animal, larger territory
- Mating strategies
  - Cuckoo are brood spawners (all protect nest/territory?)
  - Goldsinny are midwater spawners (only males protect territory?)
- Population structure
  - Cuckoo wrasse are protogynous hermaphrodites, but some are born male (primary males)
- Other factors?

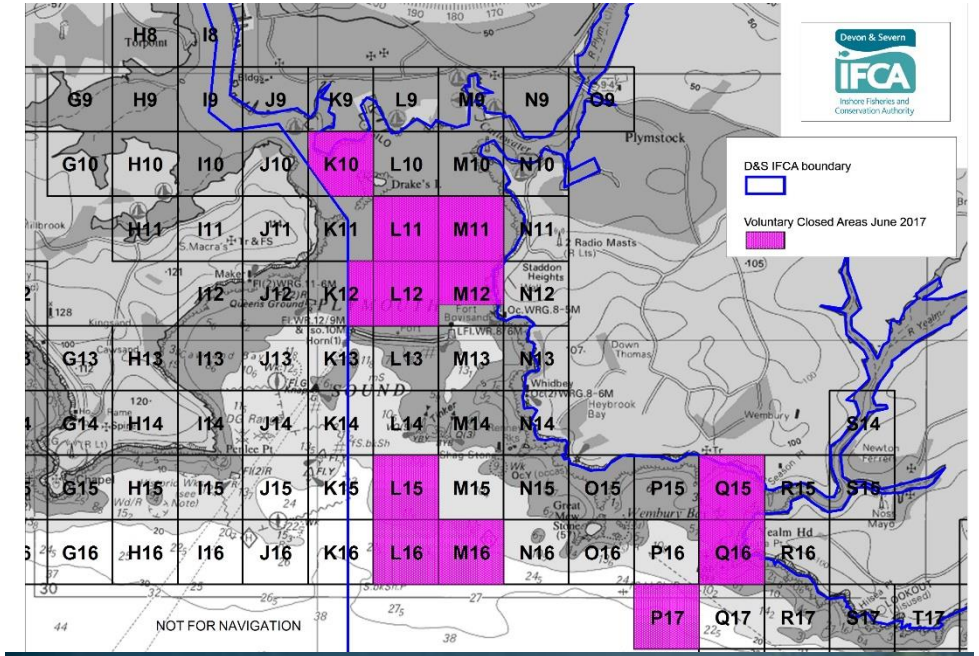
Aspects of territoriality and aggression

- Why do wrasse chase lasers? Perceived threat? But recreational anglers take wrasse with moving lures – why?
- Diet is sedentary – molluscs and crustaceans
- Territorial behaviour includes ‘mouth-fighting’ (Hillden 1981)
- In Cuckoo wrasse, reaction to laser often involves repeatedly raising dorsal fin in a threatening display – classic territoriality?

Implications for wrasse conservation and welfare

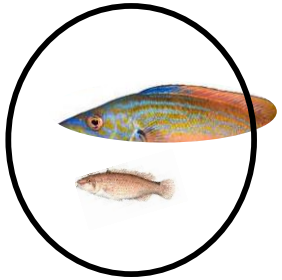
- Given small territories, small marine protected areas appropriate for effective protection of wrasse

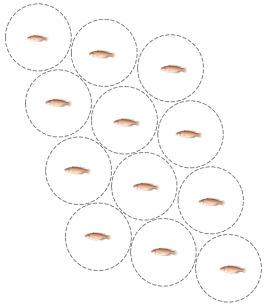
- Captivity potential to be highly stressful *"Territories were established in two aquaria. In aquarium A the bigger male occupied the whole aquarium as a territory, while the other male had to remain hidden behind a stone*." Hilden 1981



Summary

- Laser-chasing: a novel way of investigating territoriality, relatively cheap and ‘high-volume’ compared to direct observation or tagging
- Different species interact with external stimuli differently, perhaps related to their biology
- Chase-distances may give some insight into territory size - some wrasse territories may be larger than previously observed
- Method has potential for development to directly investigate territoriality





What is a territory? What does it mean to be ‘territorial’?

- “Territory is the sociographical area that an animal of a particular species consistently defends” – widespread throughout the animal kingdom
- Important distinction: territory vs ‘home range’
- Knowledge about territory and home range is essential when designing spatial protection measures (see Kramer & Chapman, 1999)
- We can investigate territoriality through direct observation, or tagging

The wrasses

- Wrasse family (*Labridae)* – diverse group of marine fishes
- Many interesting traits – nest guarding, ‘proto-tool use’, hermaphroditism, cleaning
- In Europe, wrasse are now fished to provide cleaner fish for salmon aquaculture
- Concerns over potential for exploitation

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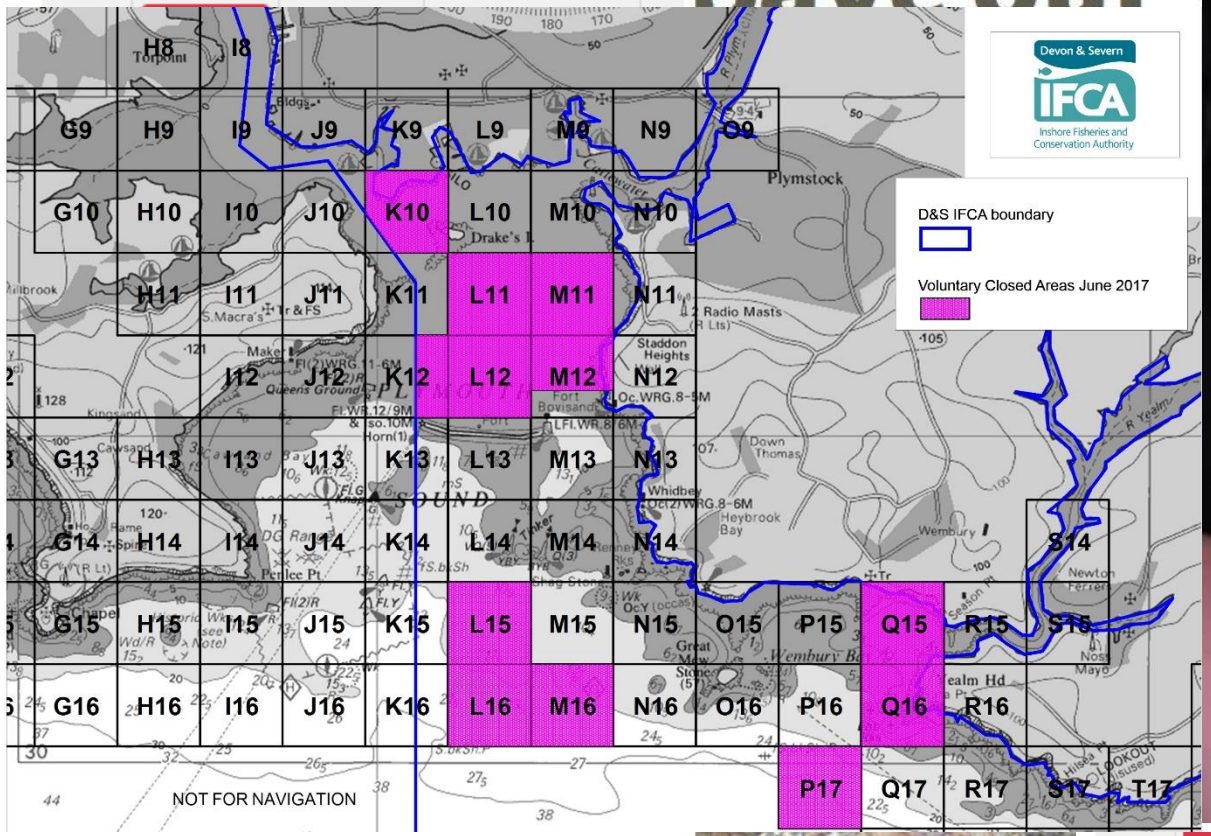

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Male corkwing wrasse by Paul Naylor

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