

Listen to the ocean

Scaling up experimental climate change research: *from individuals to the ecosystem* (an ecologist's point of view)

W1: Addressing uncertainty in projecting climate change impacts in marine ecosystems



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UK Ocean Acidification
Research Programme

NERC SCIENCE OF THE
ENVIRONMENT



Workshop call

How confident are we of the robustness and usefulness of projections to inform climate change adaptation and mitigation strategies in the context of ecosystem-based management of marine resources?



Internal variability



Plasticity in predator-prey behaviour



Resource use, individual energy budget, mortality, community structure and species distribution













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Scaling up experimental ocean acidification and warming research: from individuals to the ecosystem

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Impacts of ocean acidification and warming

Taxa	Response	Mean Effect
 Califying algae	Survival	
	Calcification	
	Growth	
	Photosynthesis Abundance	-28% -80%
 Corals	Survival	
	Calcification	-32%
	Growth	
	Photosynthesis Abundance	-47%
 Coccolithophores	Survival	
	Calcification	-23%
	Growth	
	Photosynthesis Abundance	
 Mollusks	Survival	-34%
	Calcification	-40%
	Growth	-17%
	Development Abundance	-25%
 Echinoderms	Survival	
	Calcification	
	Growth	-10%
	Development Abundance	-11%
 Crustaceans	Survival	
	Calcification	
	Growth	
	Development Abundance	
 Fish	Survival	
	Calcification	
	Growth	
	Development Abundance	
 Fleshy algae	Survival	
	Calcification	
	Growth	+22%
	Photosynthesis Abundance	
 Seagrasses	Survival	
	Calcification	
	Growth	
	Photosynthesis Abundance	
 Diatoms	Survival	
	Calcification	
	Growth	+17%
	Photosynthesis Abundance	+12%

dependence on (and type of) calcifying structures
ability for acid-base regulation

life-stage
life-cycle

Warming: increased metabolic rates
size + O₂ demand
stronger + variable

Short term
Single generation
Single stressor

Single, individual level responses
No trophic complexity

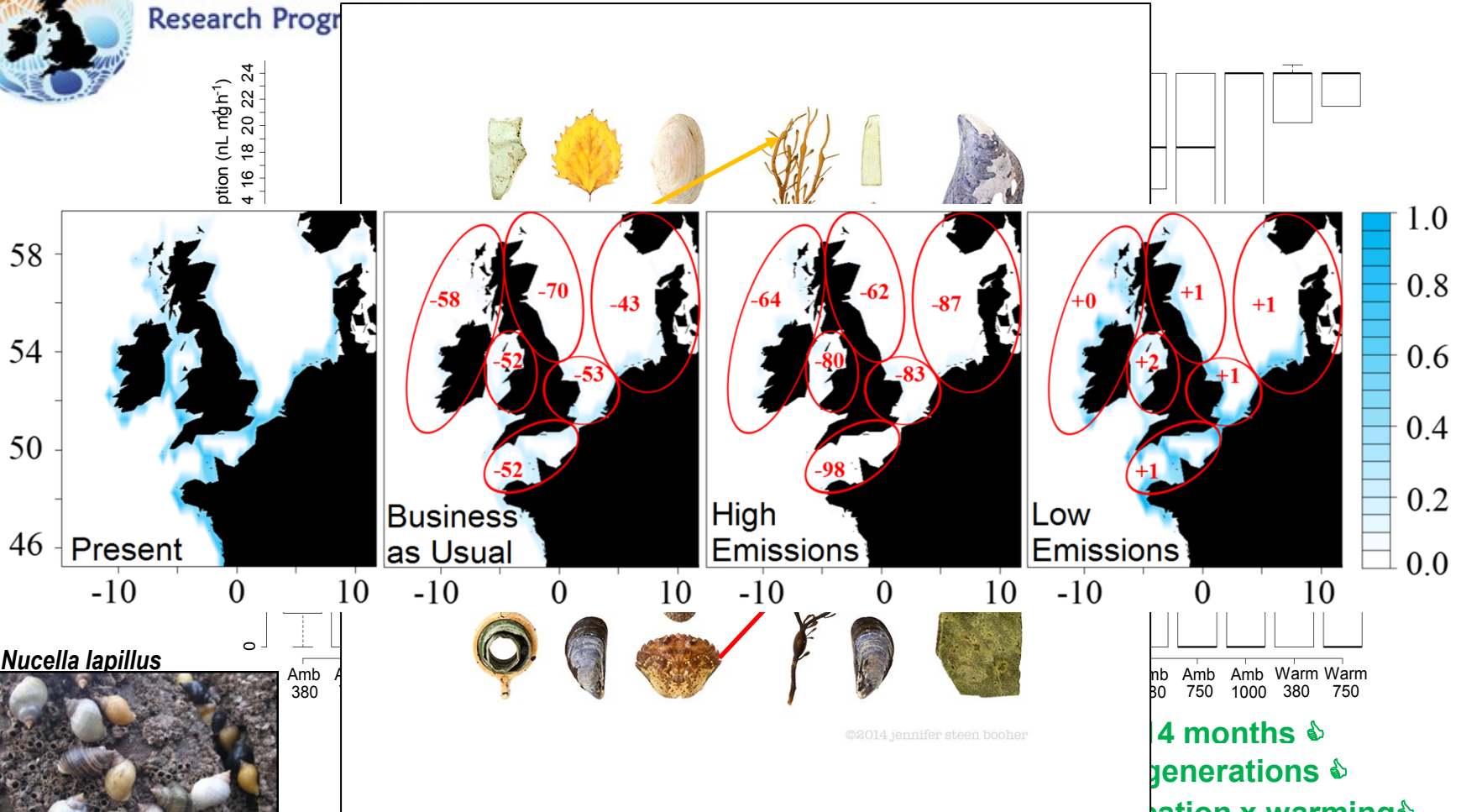
Impacts of ocean acidification

Sources: Kroecker et al. 2013 Glob Change Biol
Ocean Acidification International Coordination Centre



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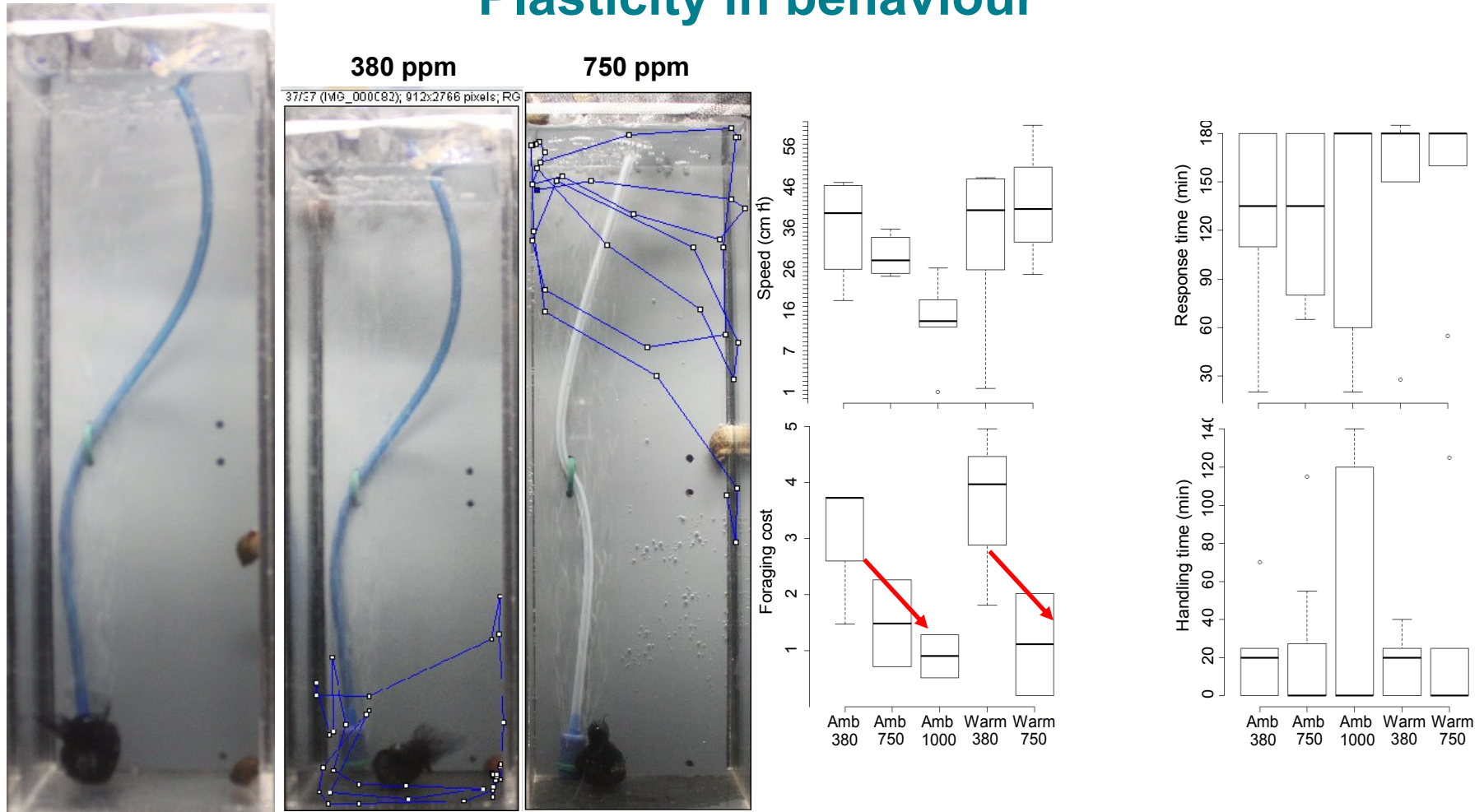
Recent work



Source: Queiros et al. 2015 Glob Change Biol 21:130-143

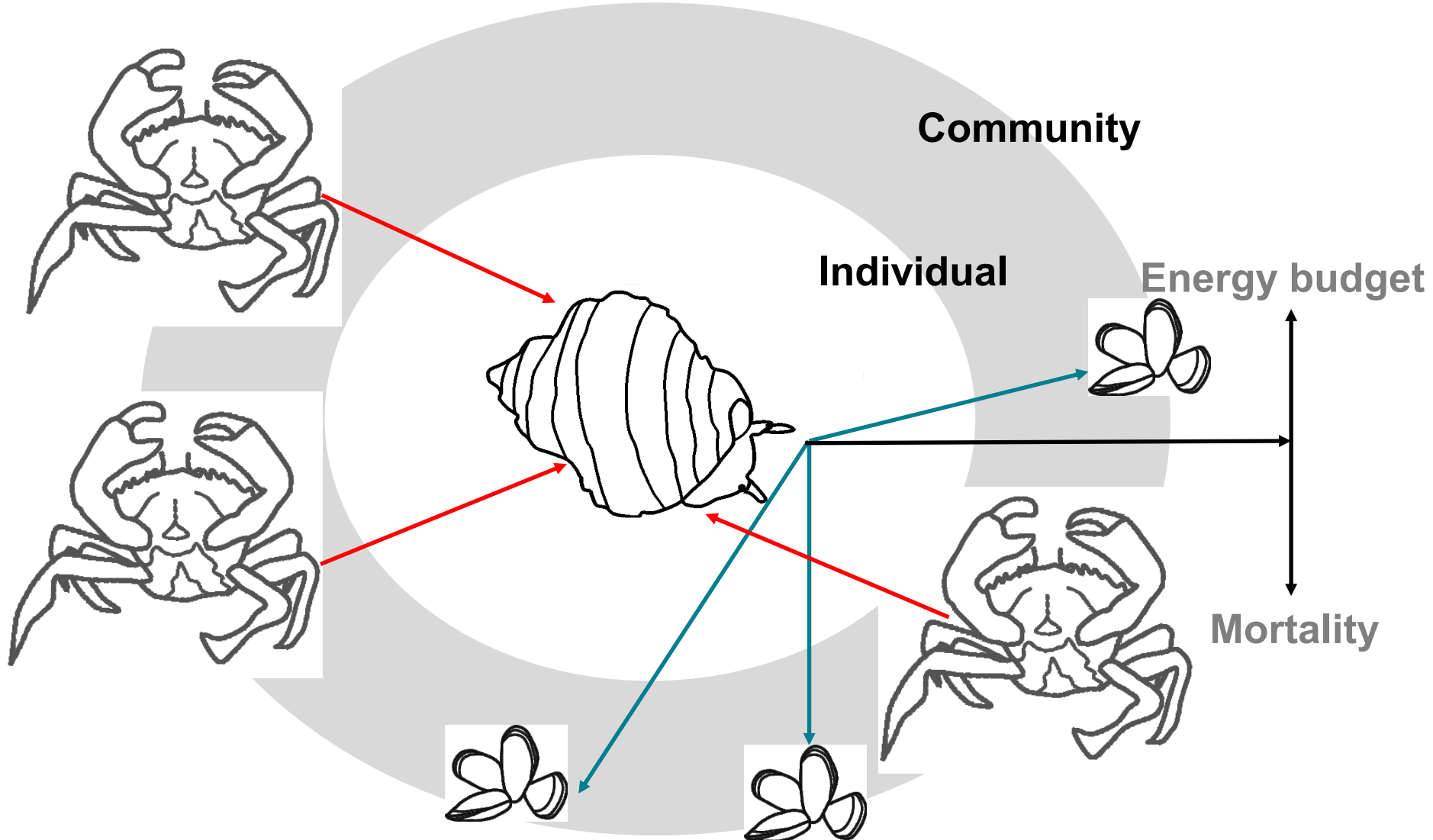
4 months 🍀
 generations 🍀
 acidification x warming 🍀
 8 processes 🍀
 3 trophic levels 🍀

Plasticity in behaviour



Source: Queiros et al. 2015 Glob Change Biol 21:130-143

Uncertainty



Improving projections under climate change

How confident are we of the robustness and usefulness of projections to inform climate change adaptation and mitigation strategies in the context of ecosystem-based management of marine resources?



Increase the trophic complexity of experimental climate change research👍

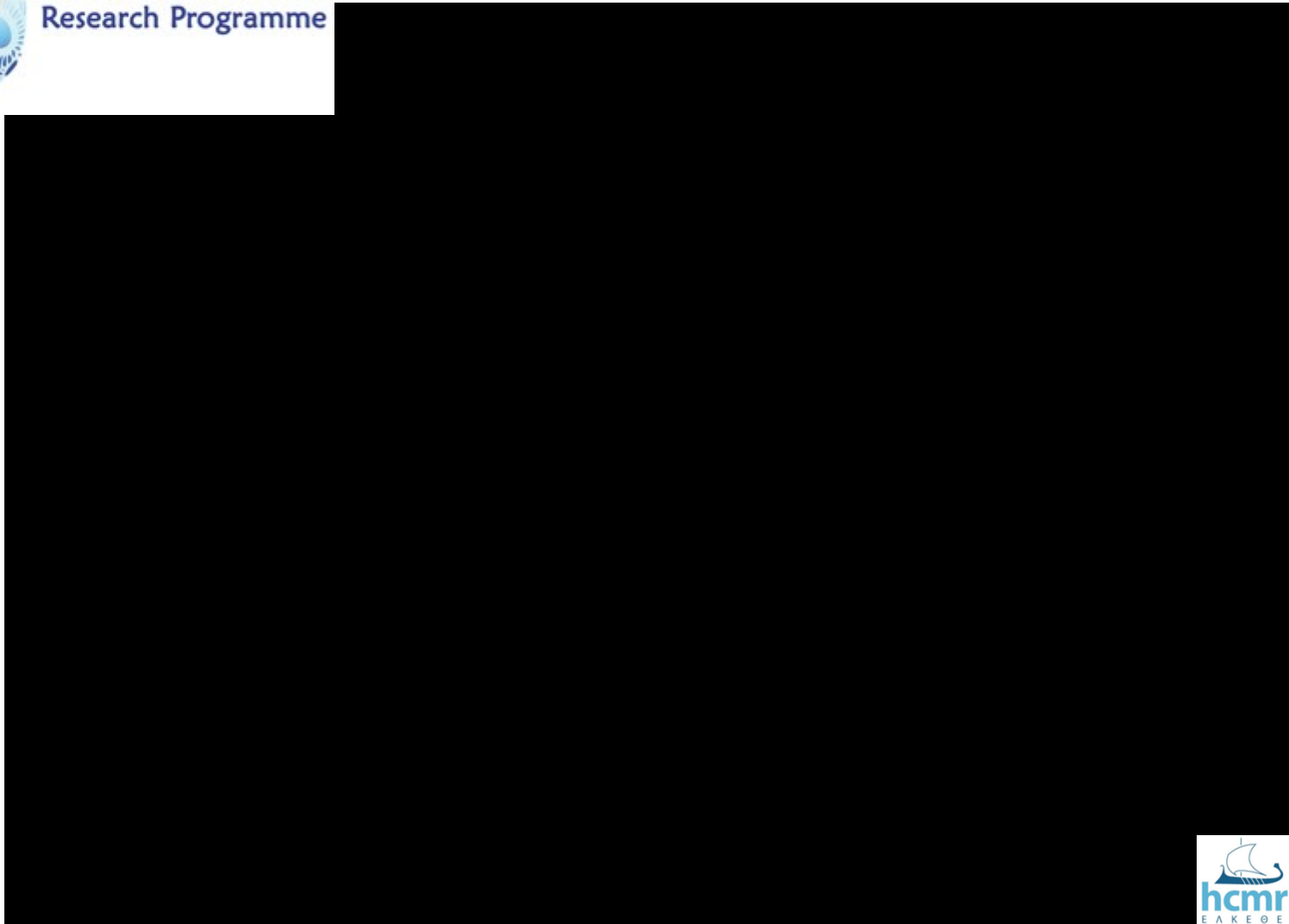
Multiple responses 👍

Long term experiments👍

Multiple stressors👍



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