Green crab size based predation trials conducted in laboratory mesocosms at Romberg Tiburon Center, Tiburon, CA in 2015

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Data Type: experimental
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Project
» RAPID: A rare opportunity to examine overcompensation resulting from intensive harvest of an introduced predator (Invasive_predator_harvest)

Contributors	Affiliation	Role
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Abstract
Green crab size based predation trials conducted in laboratory mesocosms at Romberg Tiburon Center, Tiburon, CA in 2015.

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Dataset Description

Green crab size based predation trials conducted in laboratory mesocosms at Romberg Tiburon Center, Tiburon, CA in 2015.

Acquisition Description

We conducted short-term size-based predation (=cannibalism) experiments in which five smaller green crabs were placed in a laboratory mesocosm with a large adult green crab. Size ratios of large to small crabs were experimentally varied using adult crabs of three size classes and juvenile crabs as small as were available representing recent recruits. Adult crabs were starved for 48 hours prior to the trial. Alternate prey in the form of small clams were also available in the mesocosms. Experiments were run for 24 hours after which are remaining crabs were retrieved and remeasured. All crabs were collected from Seadrift Lagoon, CA.

See Turner et al. (2016) *Biological Invasions* 18: 533-548 for additional methodological details: Turner, B.C., de Rivera, C.E., Grosholz, E.D., & Ruiz, G.M. 2016. Assessing population increase as a possible outcome to management of invasive species. Biological Invasions, 18(2), pp 533–548. doi:10.1007/s10530-015-1026-9

Processing Description

Data were entered and checked in MS Excel spreadsheets. Statistical analyses were run with either (R Development Core Team) or SAS (Statistical Analysis Systems).

BCO-DMO Processing:
- re-formatted date to yyyy-mm-dd;
- re-formatted time to HHMM;
- modified parameter names to conform with BCO-DMO naming conventions (changed to lowercase from mixed case; replaced spaces with underscores);
- replaced commas with semi-colons.

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Related Publications

Turner, B. C., de Rivera, C. E., Grosholz, E. D., & Ruiz, G. M. (2015). Assessing population increase as a possible outcome to management of invasive species. Biological Invasions,

18(2), 533–548. doi:10.1007/s10530-015-1026-9

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Parameters

Parameter	Description	Units
trial_number	Trial number (2-10)	unitless
time_point	Observation points 1-3	unitless
date	Calendar date (yyyy-mm-dd)	unitless
tank_number	Number identifying the tank. There was one tank for each set of one predator and five prey crabs, with three tanks in each of three larger tubs	unitless
tub_number	Number identifying the tub. There were three tubs each containing three tanks.	unitless
predator_size	Carapace width of single large crab in millimeters	millimeters (mm)
origin	Collection location of crabs	unitless
time	Time of observation for 'time point' in Pacific time (HHMM)	unitless
prey_found	Number of prey crabs recorded at time point (NA at time zero because crabs were added then)	unitless
prey_size_1	Carapace width of prey crab #1	millimeters (mm)
prey_size_2	Carapace width of prey crab #2	millimeters (mm)
prey_size_3	Carapace width of prey crab #3	millimeters (mm)
prey_size_4	Carapace width of prey crab #4	millimeters (mm)
prey_size_5	Carapace width of prey crab #5	millimeters (mm)
notes	Additional comments about crabs	unitless

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Project Information

RAPID: A rare opportunity to examine overcompensation resulting from intensive harvest of an introduced predator (Invasive_predator_harvest)

Coverage: Europe

The usual expectation is that when populations of plants and animals experience repeated losses to predators or human harvest, they would decline over time. If instead these populations rebound to numbers exceeding their initial levels, this would seem counter-intuitive or even paradoxical. However, for several decades mathematical models of population processes have shown that this unexpected response, formally known as overcompensation, is not only possible, but even expected under some circumstances. In what may be the first example of overcompensation in a marine system, a dramatic increase in a population of the non-native European green crab was recently observed following an intensive removal program. This RAPID project will use field surveys and laboratory experiments to verify that this population explosion results from overcompensation. Data will be fed into population models to understand to what degree populations processes such as cannibalism by adult crabs on juvenile crabs and changes in maturity rate of reproductive females are contributing to or modifying overcompensation. The work will provide important insights into the fundamental population dynamics that can produce overcompensation in both natural and managed populations. Broader Impacts include mentoring graduate trainees and undergraduate interns in the design and execution of field experiments as well as in laboratory culture and feeding experiments. The project will also involve a network of citizen scientists who are involved with restoration activities in this region and results will be posted on the European Green Crab Project website. This project aims to establish the first example of overcompensation in marine systems. Overcompensation refers to the paradoxical process where reduction of a population due to natural or human causes results in a greater equilibrium population than before the reduction. A population explosion of green crabs has been recently documented in a coastal lagoon and there are strong indications that this may be the result of overcompensation. Accelerated maturation of females, which can accompany and modify the expression of overcompensation has been observed. This RAPID project will collect field data from this unusual recruitment class and conduct targeted mesocosm experiments. These will include population surveys and mark-recapture studies to measure demographic rates across study sites. Laboratory mesocosm studies using this recruitment class will determine size specific mortality. Outcomes will be used in population dynamics models to determine to what degree overcompensation has created this dramatic population increase. The project will seek answers to the following questions: 1) what are the rates of cannibalism by adult green crabs and large juveniles on different sizes of juvenile green crabs, 2) what are the consequences of

smaller size at first reproduction for population dynamics and for overcompensation and 3) how quickly will the green crab population return to the levels observed prior to the eradication program five years earlier?

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1514893

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