Growth estimates of the Argentinean surf clam *Donax hanleyanus* (Bivalvia: Donacidae) derived from fluorescent marking

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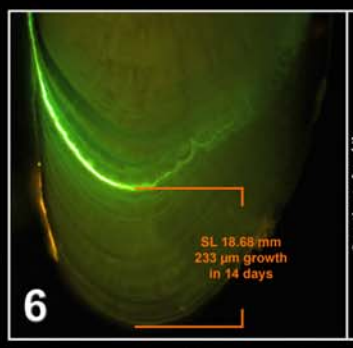
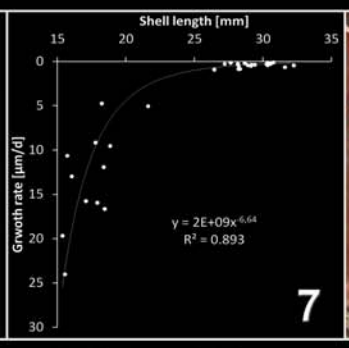
Introduction:
Growth rate is a basic parameter to describe population dynamics and determines together with recruitment the sustainable yield. Due to the economical importance of bivalves growth rates are well studied using different methods (e.g. length-frequency analysis, tagging-recapture experiments, growth ring readings). Fluorescent marking is direct, efficient and allows micro-growth measurements. The aim of this study was to determine *in situ* growth rates of *D. hanleyanus* (Fig. 4) inhabiting exposed Argentinean sandy beaches.

Material & Methods:
- 260 *D. hanleyanus* (13.5 to 35.0 mm long) were collected at Mar Azul (Fig. 2) in March 2006.
- 195 specimens were stained (50 mg Calcein /l for 3 h, following Herrmann *et al.* 2006) in a dark aerated tank.
- A non-treated control group (65 *D. hanleyanus*) was maintained in resembling tanks without stain.
- Test clams were reared *in situ* using cages (Fig. 5) and sampled every week (5 weeks) (Fig. 8, 9).
- Empty shells of scarified clams were cleaned and dried at room temperature.
- For mark detection shells were cut transversely using a diamond saw before embedding in resin and successively polishing on glass slides (Silicon carbide powders, Aluminum oxide suspension).
- Fluorescence microscopical detection of marks and growth measurements using blue light.

Results:
Calcein provides a distinct green fluorescent mark conspicuous in 82 % of the shells. Growth increments were measured in ~50 % of the shells, in 21 % microgrowth rings were observed. Maximum growth was found in juveniles (e.g. SL = 16.41 + 0.36 mm, 28 days). The relationship between SL and growth was best described by a potential function (Fig. 7).

Conclusions:
Calcein marking did not affect survivorship or growth of *D. hanleyanus* and thus is a useful non-lethal marker. Once incorporated Calcein emits green fluorescence under blue light, clearly distinguishable from autofluorescence (Fig. 1). The stain marks a distinct starting point, allowing individual growth measurements in contrast to collective growth estimates provided by other methods. For better insights the whole size range of the *D. hanleyanus* population should be covered and the experimental time prolonged, which however is difficult due to the wave exposure of the habitat.





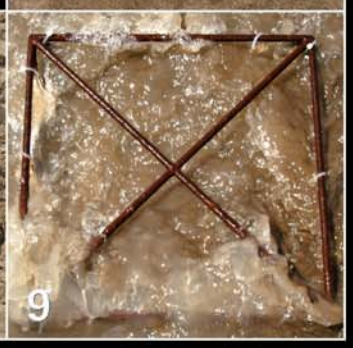


Fig. 1: Transverse section of *D. hanleyanus* (SL 18.68 mm). Fig. 2: Sampling site. Fig. 3: Exposed sandy beach of Mar Azul. Fig. 4: Alive sampeled *D. hanleyanus*. Fig. 5: Experimental steel cages (40 cm x 40 cm x 40 cm, 1-mm nylon mesh). Fig. 6: Magnification of marked shell edge: green fluorescent mark produced during 3 hrs immersion in Calcein solution (50 mg/l). Fig. 7: Shell length vs. daily growth rate. Fig. 8: Cages were dug out for sampling and potentially elimination of dead specimens every 7th day Fig. 9: Clams were reared *in situ* in experimental steel cages up to 36 days.

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