

## Multiple Techniques for Marking Subtidal Marine Mollusks.

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### Abstract

Marking individual organisms in the field is a common method used in ecological studies. Mark-recapture techniques are used to estimate abundance, mortality, habitat use, dispersal, and growth rates or to track behavior. For many subtidal marine organisms, marking methods are logistically difficult and recovery rates are low. The hard calcareous shells of marine mollusks are particularly well suited for tagging studies, facilitating several marking and tagging techniques. I compare the effectiveness of several techniques used to mark the subtidal marine snails *Norrisia norrisi* and *Kelletia kelletii*. On *Norrisia*, nail polish and grease pencils lasted only 2–4 days, whereas Dremmel tool markings were permanent but snail mortality was high, perhaps due to shell weakening or stress. Scratching the periostracum was most effective, was completed *in situ*, and lasted up to six mo. Tags embedded in Z-spar, or dabs of Z-spar only, can last years, but may increase visibility and thus mortality. Individual *Kelletia* are large enough to be identified with glued, numbered tags, although multiple tags per shell are needed since tag loss is relatively high. Filing notches in the aperture of *Kelletia* shells is faster, can be completed *in situ*, and is permanent, though it is not possible to distinguish individuals.

### Methods and Results for *Norrisia*

Norris' top snail (*Norrisia norrisi*) is a common inhabitant of kelp forests near the Wrigley Institute for Environmental Studies (WIES) on Santa Catalina Island, California. As part of a study on the diel vertical migration of *Norrisia* on the giant kelp *Macrocystis pyrifera*, snails were measured and marked for 10 mo at a field site on the leeward side of Santa Catalina Island at Pumpnickel Reef (33°26.53' N, 118°28.35' W) (Lonhart 1996). Several techniques for marking the snails were tried, but only one proved satisfactory.

The goal was to determine if movement of *Norrisia* on giant kelp at various times of the day and night varied with size of the snail. To minimize changes in snail movement and behavior on kelp, each snail was marked with its shell size, making it easy to determine the size of a snail without disturbing it on subsequent surveys.

I tested a variety of marking techniques during pilot studies. Snails were marked at the WIES lab with one of five instruments: a graphite pencil, a grease pencil, a round file, a Dremmel™ tool, or a metal scribe. Snail size was written directly on the brown periostracum with either graphite or grease pencils. Both pencils were easy to use in the lab and underwater, but markings lasted only 2–4 d. The other three methods were more invasive, directly marking the shell itself. A groove was notched with the round file at one of several positions on the shell aperture or surface, each position representing a

certain size range. This method was labor intensive, but could be done in the lab or underwater. Markings were permanent and even though apertural notches were filled in during subsequent growth, the scar of the notch remained. The Dremmel™ tool with a small engraving bit was used to grind individual snail sizes into the shell. These marks were very easy to see, but snails could only be marked in the lab. Dremmel tool marks were also permanent but snail mortality was high, perhaps due to shell weakening or handling stress. A metal scribe (a caliper shaft) easily scratched individual sizes into the periostracum of the shell. These marks were easy to see in the field, marks could be made underwater, and they lasted up to 6 mo.

### **Methods and Results for *Kelletia***

Kellet's whelk (*Kelletia kelletii*) is a large subtidal gastropod commonly found in both kelp forests and soft-bottom communities. As part of a study on the demography and growth of whelks in a recently invaded community, whelks were measured and marked at two field sites in Monterey Bay: McAbee Beach (36°37.00'N, 121°53.45'W) and the Hopkins Marine Life Refuge (HMLR; 36°37.18'N, 121°54.10'W). Three marking techniques were used: Z-spar™ epoxy, numbered tags with Super Glue™, and aperture notching. Each technique has had limited success.

Tagging whelks with numbered discs embedded in epoxy was first reported by Rosenthal (1969). A similar method was used to tag intertidal populations of whelks in central California (J. Blecha, personal communication), where numbered metal tags were embedded in Z-spar near the shell spire. These tags lasted  $\geq 5$  yr and were easily spotted (S. Lonhart, personal observation). Researchers at HMLR also tagged whelks with Z-spar, but instead of embedding tags, numbers were "punched" into the hardening epoxy with a toothpick and have lasted up to 4 yr in the field. A second technique, first used on *Kelletia* by Danielle Zacherl at UC Santa Barbara, glued small (5 by 3 mm) plastic, numbered tags with Super Glue onto the shell. First the shell of the whelk was ground until the white calcareous layer was visible, glue was applied after the spot dried, and a tag was embedded in the drying glue and covered with additional glue. Tags remained on the shell for  $\geq 2$  yr, although estimated tag losses were over 50% within the first yr.

A third technique notched the outer aperture of the whelk with either a round file or a Dremmel tool with a conical grinding bit. Placement of the semi-circular notch corresponded to a discrete sampling period. Notches slowly filled in as the whelk repaired the damage, leaving a clearly visible and permanent scar in the shell.

### **Discussion**

For most mark-recapture studies, it is necessary only to distinguish marked from unmarked snails and not among marked individuals. In the *Norrisia* study, data were collected by size class for snail movement on kelp, not for individual snails. The most effective method for marking each snail with its size and tracking subsequent movements was using a metal scribe. Unlike the other methods, the scribe was easy to use underwater, marks were clear but unlikely to attract predators, and marks lasted up to 6 mo. Additionally, as snails grew between surveys, new sizes were scribed on new shell growth, anterior to older marks. This method can be modified to distinguish individuals by marking snails with unique codes. However, this technique is reasonable only for snails with a thin layer of periostracum on the shell; many snails lack a periostracum.

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In the *Kelletia* studies, Z-spar and other epoxies lasted years, but may increase visibility to predators or increase drag, potentially increasing mortality (Rosenthal 1969). Z-spar is bulky once applied, can break with age, and may attract predators; at HMLR most of the recovered whelks tagged with Z-spar were dead. Because tag loss was at least 50% over a 2 yr period in Monterey Bay, numbered tags applied with Super Glue were marginal. Multiple tags should increase longevity in the field. In subsequent tagging, whelks with two tags, one placed near the spire and one on the body whorl, rarely had both tags missing. Filing notches in the aperture of *Kelletia* shells is faster than using glue or epoxy, can be completed *in situ*, is unlikely to attract predators, and is permanent, though it is not possible to distinguish individuals.

In conclusion, many methods can be used to mark marine mollusks. One consistently useful technique to estimate local abundance has been to notch the shell itself, leaving a permanent mark. In addition, since shell growth of mollusks is incremental, growth lines can be used to estimate age and growth rates.

### Literature Cited

- Lonhart, S. I. 1996. The vertical distribution and diel migration of *Norrisia norrisi* on *Macrocystis pyrifera* at Santa Catalina Island. M.Sc. thesis, California State University, Long Beach.
- Rosenthal, R.J. 1969. A method of tagging mollusks underwater. *Veliger*, vol. 11, no. 3: 288-289

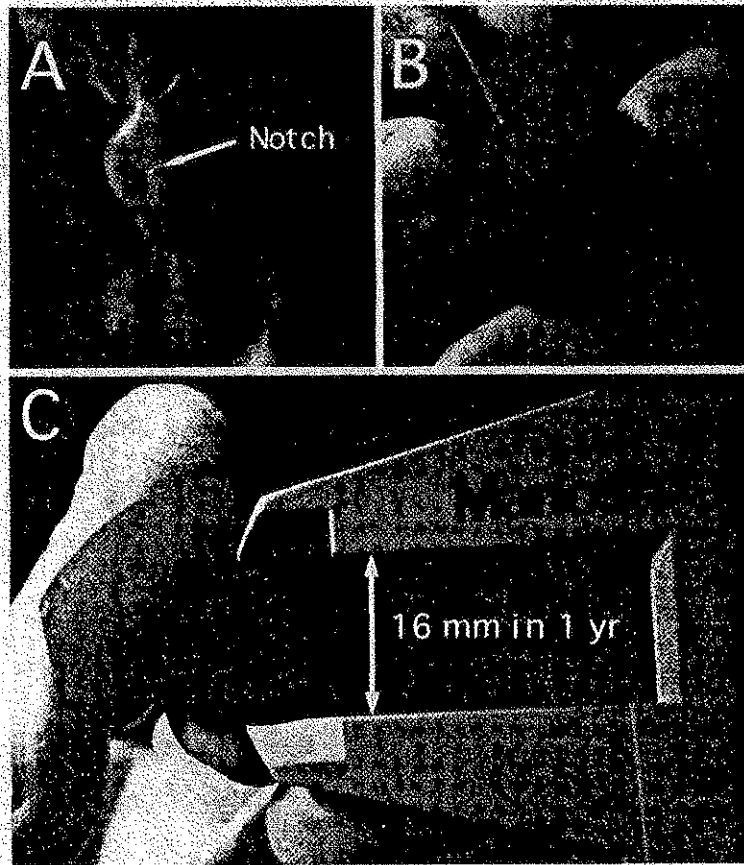


Figure 1. In August 1992, I filed a notch into the aperture of a 29-mm *Norrisia norrisi*. (A) The notch was completely filled with new shell by December 1992. (B) In August 1993 the notch was clearly visible. (C) This snail added 16 mm of shell in one year, but increased in diameter only 6 mm.