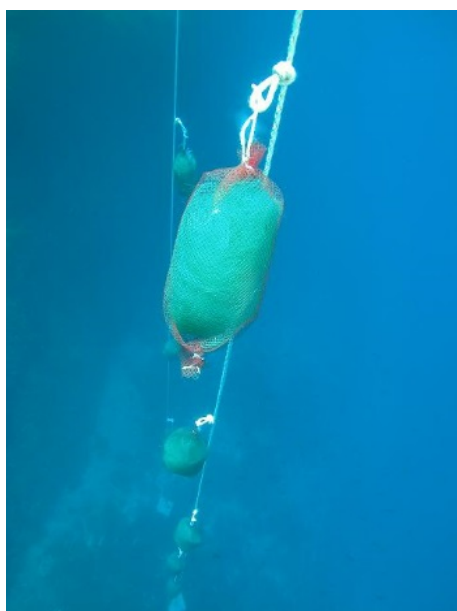


# SHORT GUIDANCE FOR THE CONSTRUCTION, INSTALATION AND REMOVAL OF *PINNA NOBILIS* LARVAL COLLECTORS



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## CONTEXT

An unprecedented mass mortality event is impacting *Pinna nobilis* populations throughout the Mediterranean Sea (<https://www.iucn.org/news/mediterranean/201907/mediterranean-noble-pen-shell-crisis-pinna-nobilis-june-2019-update>; Vázquez-Luis et al. 2017). The eventual recovery of impacted populations will depend mainly on the existence of unimpacted populations, resistant individuals and recruitment. Therefore, it is extremely important to assess larval recruitment to evaluate if larvae coming from unaffected sites or resistant individuals are reaching the impacted areas, thus potentially contributing to eventual recoveries.

Larval collectors have been successfully used to assess *P. nobilis* recruitment in different contexts and areas (Cabanellas-Reboredo et al. 2009, Kersting & García-March 2017, Wesselmann et al. 2018). Additionally, if needed, this methodology might eventually be used to provide juveniles to restock populations (Kersting & García-March 2017).

Here we describe how to construct, install and remove larval collectors in order to assess larval settlement in *P. nobilis*.

## CONSTRUCTION

### Collector bags

The collector bags consist of entangled nylon filament, onion bags or any similar material composed of fine filaments that endure underwater, placed inside polyethylene (or similar plastic) mesh bags (Fig. 1). Different designs can be applied here, the important thing is to have entangled filaments (settlement substratum for larvae) and a plastic mesh bag containing that substratum that acts as a protection against predators (but allows larvae to access the inner filaments). The outer plastic mesh bag must be securely closed using cord or nylon cable ties. At one of the ends the same cord used to close the bag can be used to anchor the bag to the main rope (see next step).

Entangled nylon can be obtained by recycling old trammel nets (or similar); usually fishermen throw them away when old or broken. This material can be reused many times if rinsed in water and dried after each use as larval collector. Onion or vegetable nets/bags can be obtained by recycling used ones or can be bought in gardening or agriculture shops (as well in internet shops).



**Fig. 1.** Two different bag designs. Left. Entangled nylon (trammel net) inside plastic mesh bags. Right. A similar outer plastic bag but using onion nets as substrata inside. Photographs: D. K. Kersting, I. Hendriks.

### Main rope

The bags are attached to a main rope (Fig. 2). The whole system is fixed to a small concrete mooring (or similar, but it must be heavy enough to prevent dislocation by waves and currents) and the rope is kept vertical by a submerged buoy. Submerged buoys (depth > 3m) prevent the whole system to be seen from the surface and potential entanglements with boats.



**Fig. 2.** Collectors' bags attached to the main rope and buoy ready to be deployed. Photograph: D. K. Kersting.

There are several ways to distribute the bags along the rope. In deeper sites the bags can be attached in approx. 1,5 m intervals throughout the rope (Fig. 3), thus covering a wider depth range. In shallow sites the bags can be attached in a single point (Fig. 3). It has been observed that *P. nobilis* larvae settle in collectors in a wide depth range, so both deeper (for example 15 m) and shallower (for example 5 m) collector installations are possible.



**Fig. 3.** Larval collector bags attached in 1,5 m intervals in a deep site (left) and a shallow site installation (rightly). Photographs: D. K. Kersting, I. E. Hendriks.

## INSTALLATION AND REMOVAL

### Where?

The collectors should be preferably placed in a location exposed to open-waters, as *P. nobilis* larvae are transported by currents. Of course, they can be installed as well in other sites if needed, for example to check for potential recruitment in semi-enclosed lagoons.

The presence of adult *P. nobilis* populations is not a prerequisite to install the collectors. They can be installed in locations where the species is not present or in areas where the ongoing mass mortality event has killed all individuals. *Pinna nobilis* larvae can travel long distances transported by currents, therefore the larvae arriving to a certain site may come from distant areas.



## When?

The main reproduction period of *P. nobilis* is from May to August and the main settlement period is estimated to occur between July and September (in the W Mediterranean). These periods could change depending on environmental conditions (for example water temperature) in the different Mediterranean regions. We suggest to install the collectors in June and remove them in October-November. While this would be the ideal installation and removal period, later installations and removals are possible. It must be taken into account that later installations will lower the possibility of covering the whole main larval settlement period. While the main problem of a later removal of the collectors is a higher exposure to storms in some regions and the fact that at some point juveniles might not have enough room between the filaments to keep growing.

## How to remove settled juveniles?

The collectors should be carefully removed, avoiding crushing the bags. The bags should be preferably maintained underwater until the removal of the juveniles.

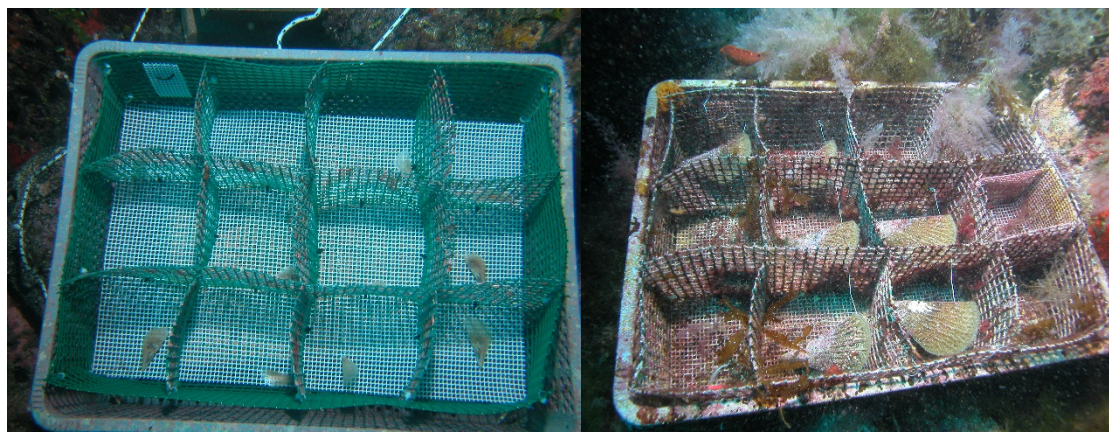
At the end of the installation period juveniles' sizes (antero-posterior length) may range approx. from 0,5 – 9 cm. In general, they can be seen by the naked eye inside the tangled fibers (Fig. 4). They have to be removed carefully in order not to break the fragile valves. Juveniles should be immediately placed in seawater after their extraction from the collector bag (Fig. 4).



**Fig. 4.** *Pinna nobilis* juveniles settled inside the collectors. Notice different morphologies and sizes. Juveniles have to be kept in seawater immediately after extraction from the bags. Photographs: D. K. Kersting.

## What to do with the juveniles?

Juveniles can be placed in protection cages in the field where they will continue growing, giving the possibility of re-implanting them in suitable substrata when a certain size is reached (Fig. 5). See Kersting & García-March (2017) for further information.



**Fig. 5.** Left. Juveniles just extracted from the collectors and placed in the protection cage (in the field). Right. *Pinna nobilis* individuals of approx. 2-3 years of age in the protection cage. Notice the photographs have been taken without the mesh protection covering the cages. Photographs: D. K. Kersting.

## Bibliography

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