Chapter 6

Economic considerations: costs of set-up and labour requirements

6.1 SET-UP COSTS OF A MODULAR HATCHERY

The equipment and materials required for the set-up of the hatchery/nursery complex and for the carrying out of the rearing protocols are given in detail in Appendix 22. This list is given as an aid to assessing the needs for setting-up and operating a modular hatchery and assist in costing out such a hatchery. In-depth economic studies have been conducted on other scallop species (Paquotte and Fleury, 1994; Dredge *et al.* 2002), which provide the capacity for modelling. The intent here is to provide baseline information which can thereafter be used in modelling, if required.

For ease of understanding, the list provided has been divided into several sections. Firstly, equipment and materials required for each section of the complex is given with price at the time of publication of this document. It must be noted that all prices are given in US Dollars (USD). Although prices will vary among sites, this can provide a general estimate of the funds required. Additionally, a list of suppliers used for the construction of the Bermuda modular hatchery is given, and may be useful for construction of hatcheries in North and South American regions. Secondly, the list provides small equipment and materials required for conducting the protocols described in this manual. Once again, associated costs (at the time of publication) and suppliers are provided.

Set-up costs and rearing costs involved for this "portable" model hatchery are summarized in Table 6.1 below. Rearing costs refer to requirements for farming scallops as outlined in the protocols of this manual. The price of PVC pipe and parts required for the whole complex is estimated at the price purchased in Bermuda. It has to be kept in mind that Bermuda has a high cost of living and prices given here need to be adjusted to a given region. The amount of PVC required can be estimated from the technical drawings. In total, in Bermuda, it is estimated that USD 16 000 is required for PVC parts. Set-up costs amount to USD 47 500 in Bermuda, and include all equipment outlined in Appendix 22 for set-up. Initial rearing costs amount to USD 25 100 and include all equipment outlined in Appendix 22 for rearing of scallops. The total cost for a turn-key modular hatchery, excluding labour costs, amounted to USD 88 600 in Bermuda. Yearly operating costs are not included here.

Table 6.1: Summary of the set-up costs for the hatchery/nursery complex. Set-up costs do not include shipping, PVC pipe/connections, construction materials (cement, concrete blocks, etc.) and electrical components. An estimated figure is given separately for PVC parts based on expenses made in Bermuda (***Note****: Table figures taken from Appendix 22 have been rounded off*).

Facility section	Set-up costs (USD)	Rearing costs (USD)	Estimated PVC costs (USD)
Seawater system	3 000		5 000
Heating seawater system	4 000		500
Housing containers (hatchery, nursery, algae)	12 000		
Broodstock	4 000	1 500	500
Algae	10 000	13 000	500
Hatchery	3 500	1 500	5 000
Nursery (indoor & outdoor)	6 000	600	4 000
Transfer	1 000	1 500	500
Growout (for 25 000 adult scallops – 90 m longline)	4 000	7 000	
Grand Total	47 500	25 100	16 000

Note:
- Rearing costs for broodstock include materials for spawning procedure (Appendix 22).
- Rearing costs for algae include materials for master and sub-culture, live & dry algae (Appendix 22).
- Rearing costs for hatchery include materials for construction of sieves and miscellaneous equipment (Appendix 22).
- Rearing costs for nursery include materials for construction of sieves for indoor and outdoor raceways (Appendix 22).
- Rearing costs for transfer include transfer materials (Appendix 22).
- Rearing costs for growout include growout materials (Appendix 22).

PVC costs for seawater include main seawater intake line, pump house, main supply to heating unit, algal unit and hatchery complex; as well as main drain pipe system. PVC parts for hatchery include main ambient and heated seawater line to all tanks and air line.

6.2 OPERATIONAL LABOUR REQUIREMENTS

Running costs for the entire operation are given in Table 6.2 below. These costs are shown as percentages, as prices and salaries vary widely among countries, and should provide a basis for assessing operational costs for a region. Running costs include electricity, replacement of equipment and consumables. The percent labour column results from an evaluation of the time involved in carrying out the tasks necessary for rearing of scallops at each phase of its life cycle. Both running and labour percentages are given for a 12-month period and are based on the hatchery operating at full capacity, yielding a production of 600 000 to 800 000 spat per year, of 2–9 mm shell height and ready for transfer to the field. It can be seen from Table 6.2 that highest running costs are associated with the larval rearing (hatchery) phase and the growout phase (juveniles to adults). The algal culture phase is least expensive in running costs due in part to the reliance on dry algae for the nursery phase (see Chapter 4). Running costs for the nursery phase are dependent on duration of spat rearing and the strategy followed for transfer to the field. Labour requirements follow a similar trend with the highest requirements during the larval rearing (hatchery) and growout. These requirements are based on rearing larvae in a conventional static system where water is changed every other day; it is anticipated that changing to a flow-through system would reduce the labour requirements for this phase (see Chapter 3). Growout is the most labour intensive part of the operation in Bermuda although needs are not distributed evenly throughout the twelve months and occur in bursts. For example, according to the cycle described in Bermuda, where larvae are reared in the winter months and spat are

transferred to the field in early summer, growout is most intensive during the summer months at the beginning of this phase. By late fall (October/November) growout requirements are much reduced.

Table 6.2: Operational costs as a percentage of time for full time aquaculture activities from spawning to growout.

Section	Running costs (in %)	Labour (in %)
Algae	13.7	14
Hatchery	28.3	33
Nursery	18.7	23
Growout	39.3	30

6.3 FINAL PRODUCT

This manual has strived to provide step-by-step guidelines for the production of scallop. Scallops are considered a seafood delicacy and the fresh product is, in general, very much appreciated by chefs. Several marketing studies have been conducted in Bermuda demonstrating the high demand for such fresh seafood on this island. Due to the difficulty in developing a cost-efficient growout methodology for sand scallops, large scale rearing is not commercially feasible for this species at this time. However, methods described for the calico scallop have proved successful on a commercial scale. Calico scallops are generally sold at 1.5–2 years old; the whole animal is used and often served in its shell. Scallops, with ripe gonads, are usually preferred by the restaurant trade. A second marketing scheme, selling 30 mm scallops to Italian restaurants, also became successful as young scallops are cooked whole in the shell and mixed in with pasta dishes. The colourful shell of calico scallops and the low price of younger individuals are found to attract this market (Figure 6.1).

Figure 6.1: Zigzag and calico scallops (adults and juveniles) ready for market and sold fresh to restaurants in Bermuda.

The rapid growth rate of these tropical species makes them a good candidate for culture, minimizing risks and costs associated with a long growout period.

This work provides an additional technology for the culture of tropical and sub-tropical scallop species. The techniques have been well tested over the past four years and scaling-up production for commercial purposes can be easily done following the Bermuda protocol by simply increasing the tank capacity (the number of tanks or tank volume) for larval and post-larval rearing. This technology can be adapted to other tropical and sub-tropical regions and to other species. Furthermore, the concept of the module hatchery housed in mobile containers provides a relatively inexpensive facility for the rearing of bivalves, minimizing initial capital costs for the set-up of a commercial operation. Due to the flexible nature of the facility, species-specific requirements can easily be accommodated with the current design. Finally, this type of modular or "portable" hatchery can be advantageous for those areas limited in space (like Bermuda), and/or in areas which are potentially prone to pollution issues. The only requirement for such a hatchery is access to clean seawater.