Teachers' Resource Sheet on Marine aquaculture in Kiribati

What is marine aquaculture? Marine aquaculture, or mariculture, refers to the farming of plants or animals in seawater. In Kiribati, marine aquaculture is based on seaweed, milkfish, giant clams and sea cucumbers.

With the limited availability of land for agriculture on atoll islands, aquaculture offers a potential for growing fish and sea plants to provide food.

Seaweed farming

There are a number of different species of the seaweed *Eucheuma* and the closely related *Kappaphycus* that have been introduced to the Pacific region for aquaculture. The plants are farmed in the sea, and dried before being sold to large companies. The companies extract carrageenan* jelly from this sea plant for use as a thickener in food processing, cosmetics and drugs.

In Kiribati, seaweed farming started in the late 1970s when the first seaweed was introduced from the Philippines. The seaweeds are tied at 20 cm intervals on lengths of rope suspended between two stakes in growing positions in shallow water. By the late 1990s Kiribati became the main seaweed producer in the region.

Milkfish farming

Milkfish (*Chanos chanos*) can be farmed in either ponds or cages. In Kiribati, milkfish have been farmed since the early 1970s with the aim of producing baitfish for pole and line tuna fishing vessels as well as for human consumption. In Kiribati, milkfish are farmed using a method described as 'extensive'. In this method, fish are kept in ponds where they rely on the availability of natural food, and not on the supply of food by the fish farmers.

Baby milkfish, or fry*, are collected from nearby mangrove areas and kept in the ponds for about six to eight months before being harvested using gill nets and sold in local markets. In early 2000 the Government of Kiribati in collaboration with the Taiwan Technical Mission started a milkfish hatchery in Ambo. The hatchery has two tanks for keeping parent fish (the brood-stock*) in captivity. In 2013 the hatchery had its first successful spawning and continues to produce an average of 50,000 milkfish fry per month.

The ability to produce milkfish from the hatchery will greatly reduce the dependence on collecting fry from mangrove areas where their abundance is highly variable and transportation of fries to outer islands is possible through this program.

Giant clams farming

Giant clams are marine bivalves (molluscs with two shells) that are found in tropical areas. There are four species of giant clams found in Kiribati namely the *Tridacna squamosa*, *Tridacna maxima*, *Tridacna gigas* and *Hippopus hippopus*. The farming of giant clam in Kiribati is based on the *Tridacna maxima* (te were), and was started in late 1990.

The adult clams are collected from the wild and induced to spawn* (release their gametes*) in indoor tanks. The gametes (sperm and eggs) are collected and mixed together to allow the sperm to fertilise the eggs. After this, the fertilised eggs are kept inside a tank of sea water with minimum aeration until the eggs hatch and become free swimming larvae*.



This resource sheet is one of a series produced by the Pacific Community (SPC) to assist teachers in introducing fisheries topics into school curricula.

Each sheet should be used in conjunction with the Guide to Teachers' Resource Sheets, which contains suggestions for student activities and exercises. All words marked with an asterisk (*) are defined in a glossary in this guide.



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The free swimming clams are transferred to an outdoor tank on the fourth day of culture and kept there until the clams are visible (after six to eight weeks). Depending on the water quality, clams can be grown in outdoor tanks until they reach around 10–20 mm when they can be moved to a growout farm in the ocean and kept for another four to five months. At this stage the clams have reached market size of around 30–40 mm.

In Kiribati, clams are farmed for the aquarium market and for restocking coastal areas where they been depleted.

Sea cucumber (sandfish) farming

In their natural habitat, sea cucumbers play an important role in the marine environment as they act as vacuum cleaners, feeding on decaying organic material on the seafloor. The farming of sandfish, *Holothuria scabra* (Tanoika), which does not occur naturally in Kiribati, started in 2013 with the introduction of brood-stock from Fiji.

Sea cucumbers have separate sexes – each animal is either male or female. Adult female sandfish are kept in a small tank and induced to spawn by excess feeding around the time of the new or full moon. Eggs are collected from two or three females and sperm is collected from males kept in a separate tank.

Fertilization occurs when the sperm and eggs are left in a tank with minimum aeration for a day. The free-swimming larvae start to filter feed after the seventh day before changing to crawling juveniles which get their food by grazing. The life-cycle of a sea cucumber in the wild is shown in the accompanying diagram.

Sandfish are highly valued and farming them has the potential to generate income in local communities.

Giant clams life cycle

Giant clams are unique among bivalves in that they are able to obtain nutrients from a relationship with microscopic plant cells called zooxanthellae*, which become established n the mantle of the clam after settlement. After this, the now symbiotic* zooxanthellae ohotosynthesise* and produce nutrients which are used as food by the clam. This symbiotic relationship is found in a few other tropical invertebrates, including most shallow-water corals.



/lanagement. 2nd Edition. Wiley Blackwe



he life-cycle of sea cucumbers (from King, M. 2007. Fisheries Biology, Assessment and Aanagement. 2nd Edition. Wiley Blackwell).

