NCU-G-88-004 C2

BLUEPRINTS

UNC Sea Grant UNC-SG-BP-88-1

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Shedding Soft Crabs in a Closed Well-Water System

The shedding of blue crabs is a multimillion dollar industry along the East Coast. The North Carolina industry alone grew more than 700 percent between 1983 and 1986, with landings rising from 87,570 pounds to 596,468 pounds.

Crabbers shed blue crabs in three types of systems: floating, flow-through and closed recirculating.

The oldest method of shedding soft crabs is the floating shedder — a floating box that allows water to flow in and out. It is placed near the shoreline, and crabs are shed in the box.

Although inexpensive, floating shedders are difficult to work, dependent on good quality water and subject to wave action and temperature fluctuations. Poor water quality, strong waves and temperature changes can cause crab mortalities.

In an onshore flow-through system, shedding boxes are built on land, and water is pumped from a nearby creek or bay. This is a more expensive system, and it also can be affected by poor water quality and temperature changes.

To eliminate the problems of water quality and proximity to the water, some crabbers have turned to closed recirculating systems.

Present recirculating systems use shedding trays, a reservoir, mechanical filters, biological filters, protein skimmers, pumps and plumbing to provide suitable water for shedding crabs.

These systems do not control water temperature, require constant monitoring and need 20 to 30 days start-up time for bacteria to grow before peelers can be shed. Bacteria are needed to convert harmful ammonia (from crab wastes) into harmless nitrate.

But UNC Sea Grant, working with commercial shedders, developed a temperature-controlled, well-water shedding system. This system can be used anywhere sufficient well water is available. It uses cool groundwater and heating elements to regulate water temperatures between 70 F and 75 F.

This system requires little monitoring for ammonia, nitrate or nitrite. It needs no biological filters, protein skimmer or preliminary start-up because ammonia does not build up in this system. To eliminate buildup, water continuously seeps from the reservoir and is replaced by fresh well water.

Inexpensive test kits can be purchased to monitor water quality. If problems arise, the water can be diluted or replaced to eliminate problems. It is not as important to reuse the water as it is to have good water for the crabs.

Temperature controlled freshwater system

Figure 1 illustrates a typical closed freshwater shedder used for an onshore flow-through system. The trays are lighted for night work. They are plumbed with:

- two control valves and drains per tray,
- an aerator at each valve to add oxygen,
- a rubber hose on each aerator to reduce spray on the crabs, and
- a screen on each drain to keep premolt and soft crabs out.

Water is pumped from a reservoir that is supplied by a well. PVC pipe, measuring 1½ inches, supplies the water from the reservoir to the shedding trays, and a 3-inch PVC pipe returns the water from the trays to the reservoir. A valve in the return line drains the system if necessary.

The fresh well-water reservoir reduces the problems of water quality, oxygen content and water temperature. A variance in any of these factors can cause crab mortalities.

Drawings by Linda Noble

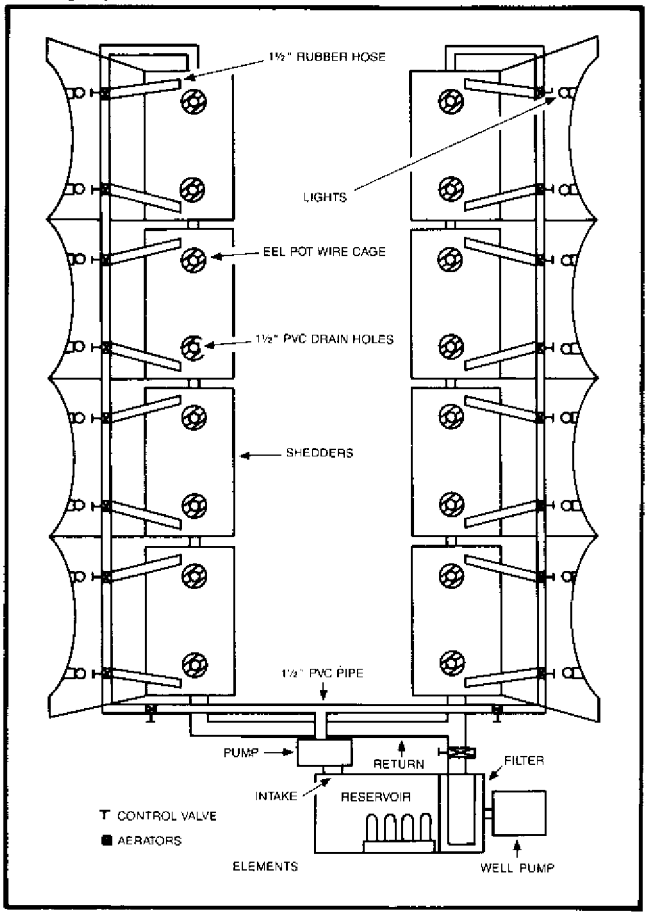

Figure 1: the freshwater system

Other systems maintain suitable oxygen levels, and some attempt to manage water quality. But none successfully manage all three factors.

Oxygen is added to the water as it returns to and passes through the filter box. Two aerators in the supply line of each shedding box also add oxygen.

The water temperature of groundwater ranges from 55 F to 65 F. This is too cold for crabs to shed. To warm the water to the ideal shedding temperature of 72 F, four 3,000-watt heating elements, are used. To cool the water temperatures in June, July and August, well water is added.

Modifications

The freshwater recirculating system has several design modifications. It requires the use of a groundwater well pump to supply the reservoir and a circulating pump to supply the shedding boxes.

Other items needed are:

- a 220-volt power line for the 3,000-watt elements and thermostat to control the elements;
- a thermostat to control the well pump, a mercury switch or water-level control switch to maintain the water level in the reservoir;
- a valve to drain the system;
- an overflow drain in the reservoir; and
- a filter box.

These modifications help maintain the proper water quality, oxygen content and temperature to shed crabs any time peelers are available.

Material list

The following is a list of materials you will need to build an eight-tank freshwater system.

Shedding Trays

8 sheets of 4-by-8 foot plywood ⅝ inch or thicker
192 linear feet of 1-by-12 inch pine
64 linear feet of 4-by-4 foot treated pine for stands
48 linear feet of 2-by-2 inch pine for light supports
2 tubes of waterproof non-oil base caulking
2 pounds of #8 common galvanized nails.

Reservoir

4 sheets of 4-foot by 8-inch plywood ⅝ inch or thicker
4 220-volt hot water heater elements
44 inches of 4-by-6 inch steel box
7 feet of perforated 3-inch drain field plastic pipe
1 ton of rock or clean oyster shells
8 feet of 1½-inch PVC pipe
2 1½-inch PVC elbows
2 underwater thermostats
1 water level-control or mercury switch
sufficient underwater wire to link thermostats
mercury switch and heating elements with the well pump and power supply (Quality of the wire will vary with the location of the well and power supply.)

Filter box

12 linear feet of 1-by-10 inch pine
4 feet of 2-by-4 foot window screen
4 feet of 2-by-4 foot chicken or crab pot wire
3 2-by-4 foot layers of 1-inch thick foam insulation

Plumbing

80 linear feet of 1½-inch PVC (may vary with design)
80 linear feet of 3-inch PVC
6 1½-inch PVC elbows
21 1½-inch control valves
16 aerators
16 3-by-3 inch by 1½-inch PVC tees
2 3-by-1½ inch elbows

- 1 3-by-3 inch elbow
- 16 1½-inch PVC male and female adapters for drains
- 1 pint of PVC glue
- 16 3-foot sections of 1½-inch rubber hose

Electrical

Be sure to meet the building code requirements for your area. Qualities of wire and lighting will vary with system design and lighting preferences. However, the better the lighting, the easier it is to see the soft crabs at night.

220 volts:
- 10 feet of underwater wire for elements and thermostat
- sufficient 220 wire to power supply

110 volts:
- 20 feet of underwater wire for mercury switch and thermostat
- sufficient 110 wire to connect pumps to power supply
- desired number of lights and light sockets

Pumps
- 1 low-volume pump at the well
- 1 high-volume pump to circulate water through the system. Water should be turned at least four times per hour. Each 4-foot by 8-foot by 4-inch tray contains approximately 80 gallons of water.

The filter

To build the filter frame (figure 2), use 1-by-10 inch lumber. The frame is 45½ inches long, 18 inches wide and 10 inches deep. Nail the freshwater filter against the short side of the 4-by-8-by-4 foot plywood reservoir below the return line from the shedding boxes and about 4 inches from the top.

Cover the bottom with window screen that may be nailed or stapled to the frame. To provide strength and support, nail or staple a layer of crab pot wire under the screen.

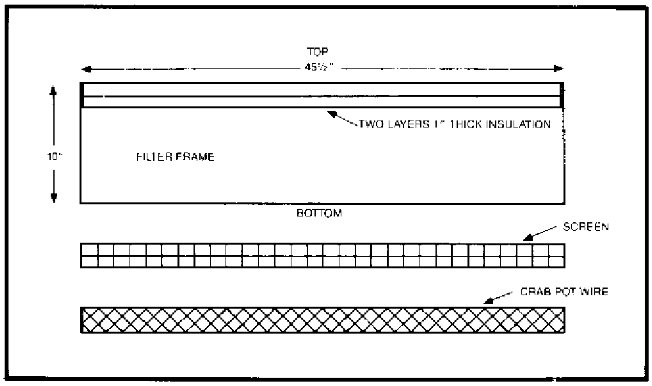

Figure 2: the freshwater filter

Then cut two layers of 1-inch thick foam rubber air conditioning insulation to fit snugly within the top of the frame. A snug fit should force the water through the insulation instead of passing through a crack along the edge.

Place two layers of insulation in the top of the frame. Cut a third layer and use it as a spare. Twice a week remove the top layer of insulation, replace it with the spare and clean it in a washing machine with regular detergent. The clean layer of insulation becomes the new spare.

Every two weeks, remove and clean the bottom layer of insulation the same way.

Heating element

A homemade heating device, shown in figure 3, uses four 3,000-watt elements like those in a hot water heater.

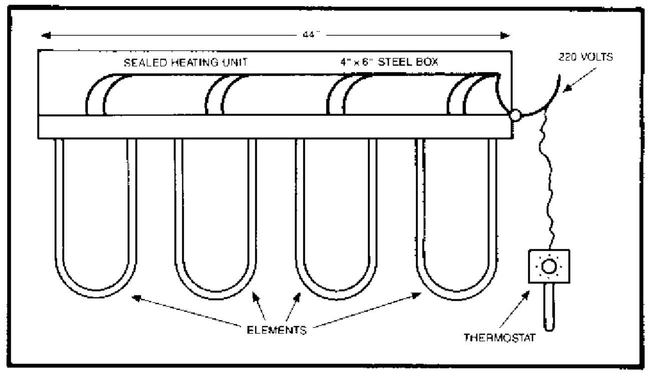

Figure 3: the heating unit

Attach these elements to a 4-by-44-by-6 inch steel box. Seal the elements with waterproof caulking or by welding. Or buy an equivalent heating element at your local hardware store.

Mount the element lengthwise in the reservoir about 2 feet from the bottom. The element always should be covered by water.

The heating device is activated by a thermostat switch on a probe near the reservoir bottom. When the water temperature reaches 72 F, the elements are turned off by the thermostat.

The well pump has a manual switch for start-up and a thermostat to activate the pump if the water gets too hot. To prevent the heating elements from burning up, a water-level switch activates the pump if the water level in the reservoir drops because of leakage.

To operate the pumps and light, use 110 volts of electricity. A separate line of 220 volts is necessary to supply the heating elements.

The reservoir

The reservoir is built of ½-inch plywood. It is 4 feet wide, 4 feet deep and 8 feet long. Bury it in the ground 2 feet to allow gravity drainage from the shedding tables. The ground also reinforces the box to eliminate the need for bracing. Drill six to eight 1½-inch holes in the bottom of the reservoir to allow leakage into the ground.

Insert a 1½-inch PVC pipe intake into a 5-inch perforated sewer pipe, and cover it with one ton of rock in the bottom of the reservoir. The reservoir should have an overflow drain in case excess fresh water is added when cooling, and it should be covered to keep out trash.

The reservoir shown in figure 5 can store up to 600 gallons of water. That should be enough water for eight to 15 shedding tables.

How the system works

The well pump fills the reservoir and remains on until the desired water level in the reservoir and shedding trays is achieved. Initially this should take about two hours or less if your well has a pumping capacity of 10 gallons of water per minute or more.

The heating device in the reservoir is activated only after it is submerged in water.

The circulating pump forces water to the shedding tables. Gravity returns the water through the filter box to the reservoir. Water seeps from the reservoir through the holes in the bottom. The water level switch activates the pump to replace lost water. Groundwater is pumped in to ensure good water quality.

If the water temperature falls below 70 F, the heating unit automatically warms cool water to 72 F. If the water temperature rises above 75 F, the pump automatically adds more cool groundwater. This cooling operation makes an overflow pipe necessary for release of excess water.

Other considerations

If you have a successful floating shedder system, flow-through system or closed recirculating system, don't change it. The freshwater shedding system is for those who want to shed crabs in cold and hot weather or for those who have poor surface or no natural surface water.

Freshwater systems require at least two pumps, two thermostats, a water control, mercury switch and heating units. These devices will increase the electric bill.

Also keep in mind that peeler crabs used in this system must be captured in waters with salinities of 15 ppt or less. Peeler crabs collected from waters with higher salinities may suffer total mortality unless artificial salt is added to bring salinity within 15 ppt of the level where the crabs were caught.

Some people question the stress of fresh water on blue crabs, but it is not a factor. The largest shedding facility between North Carolina and Mexico sheds soft crabs in zero salinity.

For more information, contact Wayne Wescott, Sea Grant Marine Advisory Service, P.O. Box 699, Manteo, N.C. 27954. Or call 919/473-3937.

Wayne Wescott
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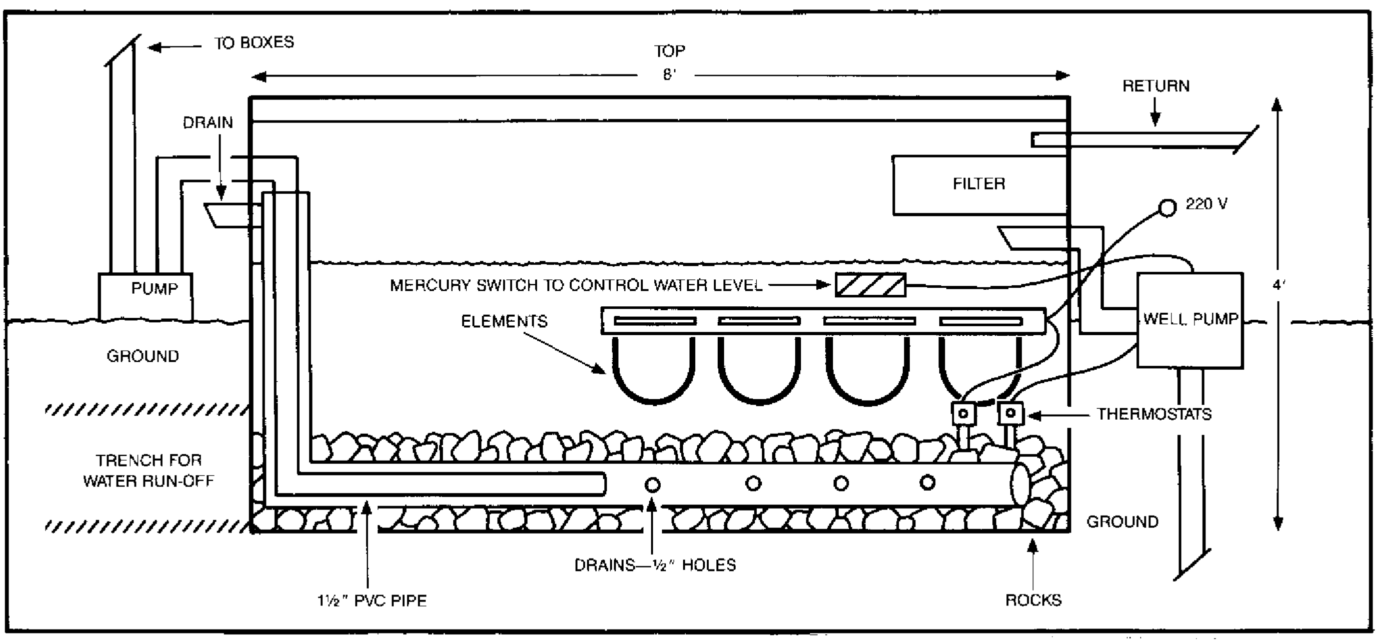

Figure 4: reservoir

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