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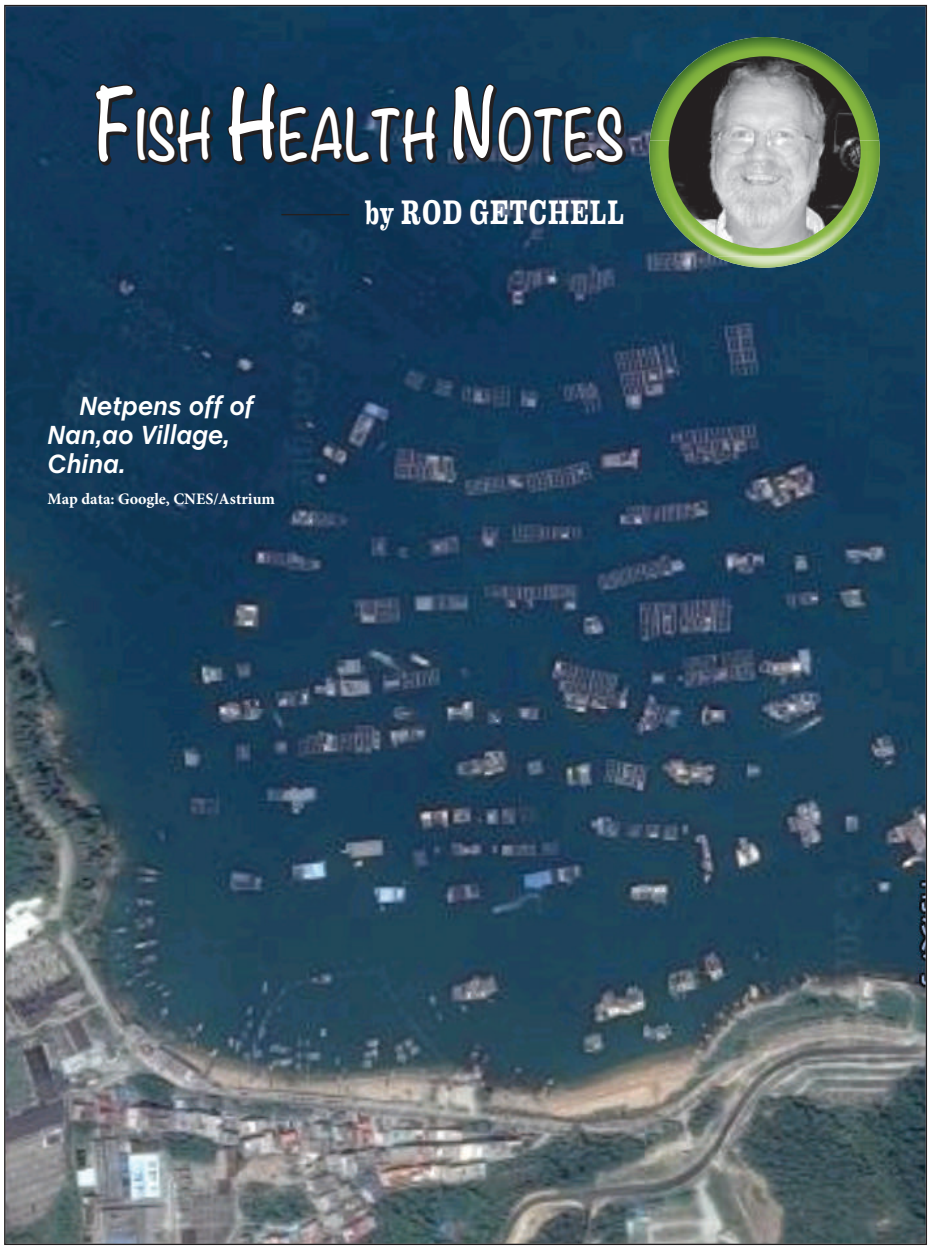
SPECIAL SUPPLEMENT
For selected readers
EAST COAST SHELLFISH GROWERS ASSOCIATION
NEWSLETTER

Crossing the border into Mainland China and learning firsthand about cage culture using copper-alloy mesh



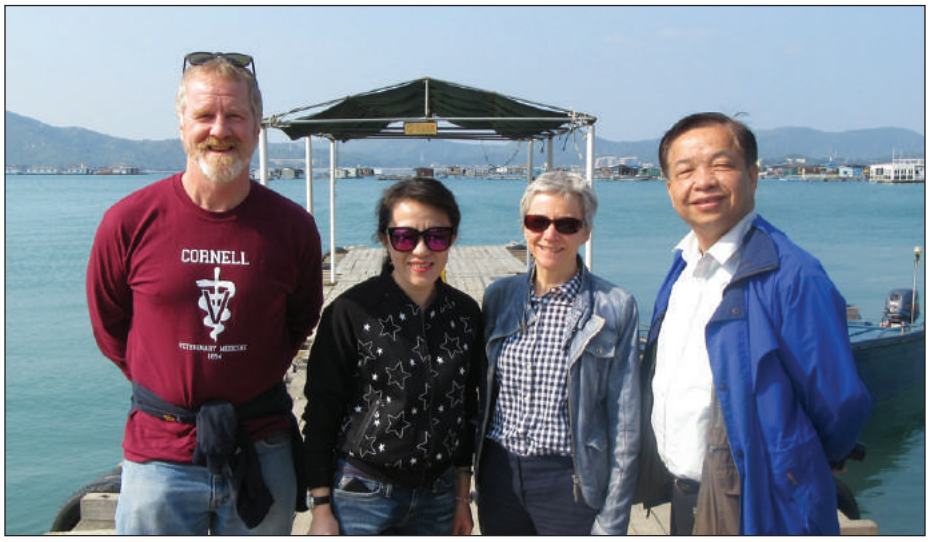


Photo courtesy of Rod Getchell

Rod Getchell, Sharon Yang, Hélène Marquis, and Wo Wing Cheng in Nan,ao.

In a unique, two-part series, exclusive for Fish Farming News, Fish Health Notes columnist Rod Getchell shares with us his recent experiences traveling to Hong Kong and Mainland China – getting a close-up look at fish farming technique in this world-leading aquaculture production region.

—Editor

SHENZHEN, CHINA – In the last issue of *Fish Farming News*, I wrote about our January visit to City University of Hong Kong (City U).

On that same trip, we had the chance to visit fish farms in Mainland China where aquaculture is thriving.

We first traveled by train from Hong Kong to Shenzhen, a rapidly growing city on the southeastern coast of China.

We were guests of our City U colleagues, Dr. Wo Wing Cheng and Mr. Kai Hong Mo, who had arranged for us to be escorted from Shenzhen by Sharon Yang, a senior business development executive for the Wieland Group.

The Wieland Group is one of the world's leading manufacturers of special products made from copper and copper alloys, and Sharon had a demonstration cage full of pompano she wanted to show us. I'll tell you more about that later.

Sharon drove us from the cacophony of a densely populated city to a quiet village called Nan'ao, located on the eastern side of Mirs Bay (see map).

We stepped onto a workboat manned by two local fish farmers, and off we went to see traditional fish rafts, as well as a series of modern circular cages containing gilt-head bream Sparus aurata and pompano Trachinotus blochii (see photos).

At the time of our visit, Chinese New Year was approaching, and the men running one operation with 80 circular cages were preparing to harvest large amounts of fish.

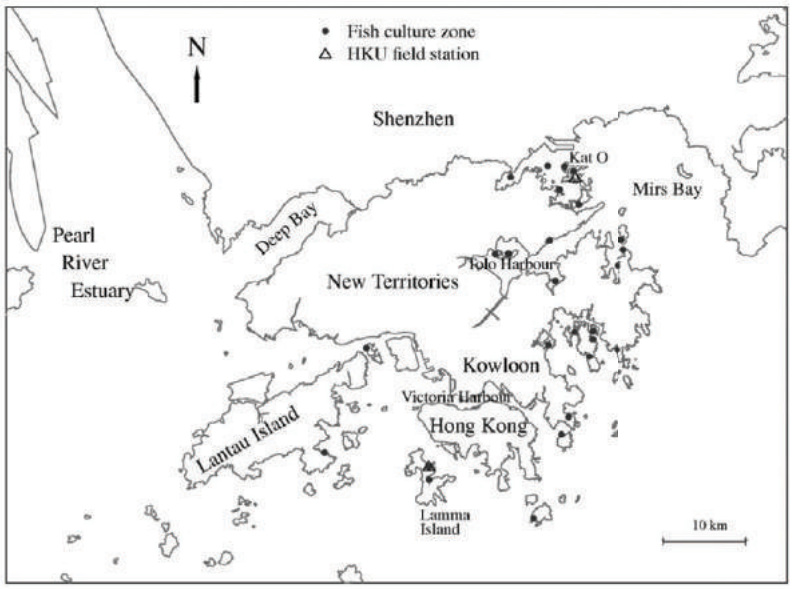
Demand is huge at that time of year and the price is good. Purchasing live fish for a special dinner is a traditional way to celebrate.

You might ask, "How can the Chinese raise so many fish?"

In 2013, roughly 100 billion pounds of fish were farm raised in China.

The question was partially answered when the local Nan'ao farmers showed us a cage of goldlined seabream (Rhabdosargus sarba) that were confined to a large fine-mesh plankton net (see photo).

During the winter, cool water temperatures stimulate these broodstock to release eggs that are fertilized and



Map courtesy of University of Hong Kong.

Locations of marine fish culture zones in Hong Kong, New Territories, and Mirs Bay.

At left, copper-alloy mesh cage filled with gilt-head bream.

Rod Getchell photo

Local fish farmer describing goldlined seabream broodstock egg collection.

Rod Getchell photo

float to the surface. Up to one kilogram of eggs can be scooped out each day and shipped to fish hatcheries throughout Southeast Asia.

In addition to pelleted feed, these fish are fed additional protein in the form of fresh chopped shrimp (see photos).

The obvious on-site monitoring and care of fish stocked in this complex of family-owned rafts was impressive.

Biofilm battle

Sharon and our two fish farmers next brought us over to the circular test cage they had fitted with copper-alloy mesh instead of the standard polymer twine. The lack of biofouling was immediately obvious.

Fish farmers in the South China Sea are in a constant battle with the biofilm-producing organisms that foul their nets. City U researchers see this problem as one

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Fish Health Notes

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of the projects their aquaculture students can take on at a seawater site closer to Hong Kong.

The "net" we visited had been in the bay for about six months and had practically no biofilm visible. The previous standard twine net was still piled along the side of the cage.

We were told the traditional nets needed to be cleaned every six weeks –- a labor-intensive effort in this small village.

After the farm visit, Sharon was kind enough to give us a presentation that provided data from previous, well-controlled studies of these anti-fouling cages.

The levels of copper, tin, zinc, and ferro phosphorus in the water within the cages and the tissue levels in the fish were well below hazardous levels established by environmental authorities.

What was really interesting was the data on the mean weight gain at these test sites with copper-alloy cages.

There was a significant difference in weight gain between

Copper-alloy mesh.

Below left, large bag of dried fish feed.

Below, fresh shrimp feed for broodfish.

Rod Getchell photos

those fish raised in the copper-alloy cage that gained weight, versus the nylon twine enclosures.

Currently, chain-link woven copper-alloy mesh is being used in cages on commercial and experimental fish farms in Chile, China, Hawaii, the US, Tasmania, Korea, Japan, and Scotland.

A search of the cuaquaculture.org site (link below) provided interesting examples such as Atlantic salmon being raised in 28 copper-alloy cages at Van Diemen Aquaculture in Tasmania.

Other fish species being tested include sea bass, pompano, turbot, yellowtail, cobia, and trout.

Industry studies promote copper-alloy nets as a replacement for fabric nets because their rigidity prevents any changes in shape, their toughness offers a degree of protection against predators, and their composition resists biofouling.

Copper's biofouling resistance is achieved by the slow release (corrosion) of copper ions from the surface of the copper-alloy materials.

Evaluating the environmental performance of copper-alloy mesh in marine aquaculture is not a simple matter. The corrosion behavior of copper materials changes over time and depends on seawater composition, temperature, and flow.

In seawater, metallic copper oxidizes to cuprous oxide (CuO); this dissociates to release the cuprous ion (Cu+). This ion further oxidizes to the cupric ion (Cu++), which is mainly responsible for the toxicity that prevents the growth of biofouling organisms.

The anti-biofouling effect is limited to organisms that are in contact with the copper material surface (i.e., experience the higher concentrations of cuprous and cupric ions in the stagnant water layer next to the surface).

At the end of its working lifetime, the material will have lost only a fraction of its initial mass, and the remaining metal can be completely recycled to produce new net material.

An article in the February 2016 issue of the journal *Aquaculture* describes the environmental impacts of culturing Atlantic salmon in copper-alloy mesh net-pens that were studied during a pilot study in Chile in 2012.

The analysis compared culturing fish in copper-alloy net-pens versus nylon net-pen systems. The researchers from Earth Shift Global and the International Copper Association quantified the environmental performance of both systems in compliance with the International Organization for Standardization 14040 and 14044 protocols.

Results of the study indicated that use of the copper-alloy mesh resulted in improvements in several key performance characteristics, including reductions in feed inputs, on-site energy use, application of antibiotics, and labor hours.

For more information on the research conducted on copper-alloy mesh cages check out: <http://www.cuaquaculture.org/research-studies/> or <http://www.cuaquaculture.org/applications-projects/case-studies/>.

Thanks for reading Fish Health Notes.

Dr. Rod Getchell works in the Aquatic Animal Health Program at the Cornell University College of Veterinary Medicine.

Farmed seabream.
Rod Getchell photo