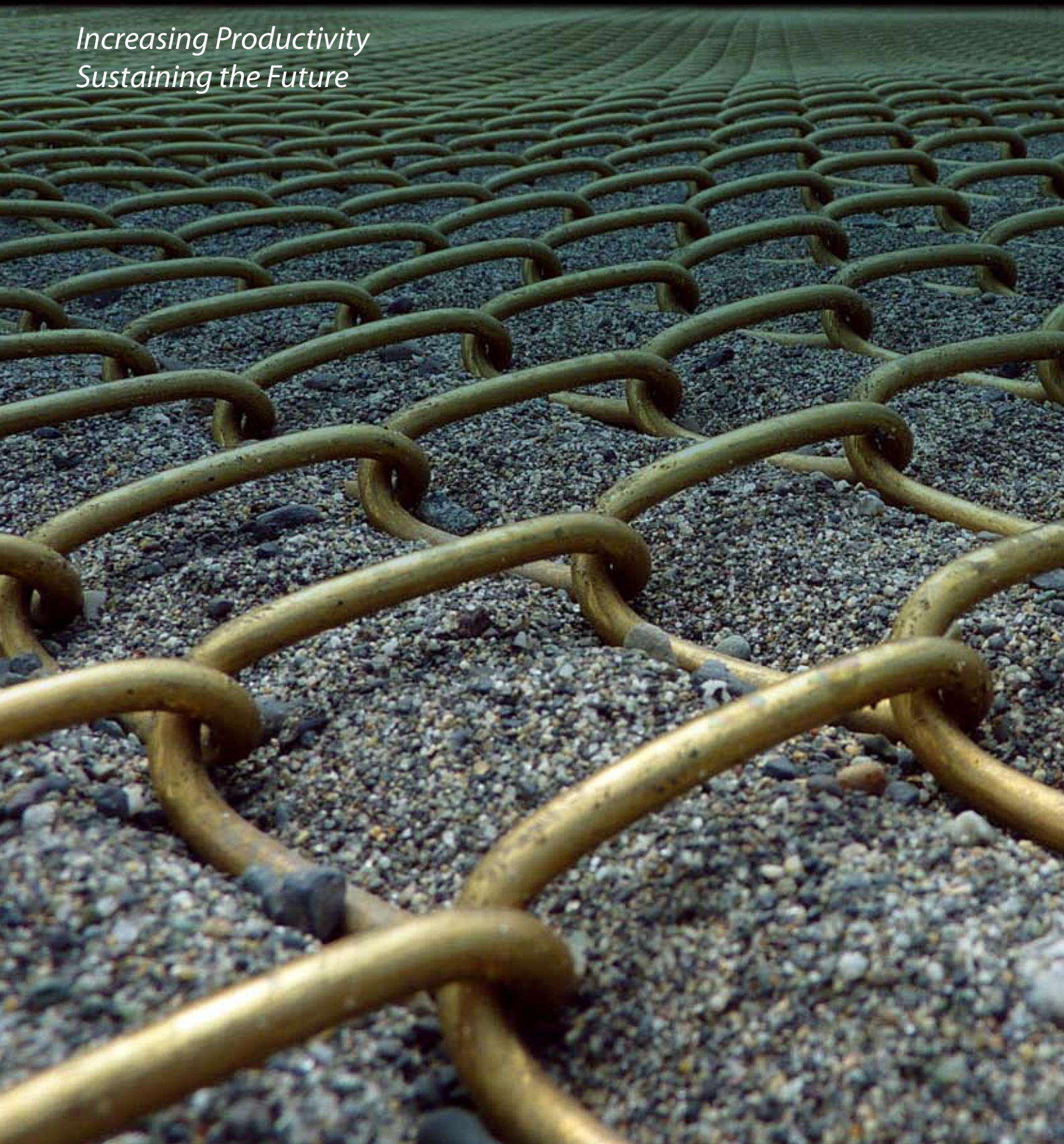


# Copper Alloys in Marine Aquaculture

*Increasing Productivity  
Sustaining the Future*



## Why choose copper alloy cages

Copper is an essential micro-nutrient, helping achieve good health and development in all forms of life. Due to its natural metallurgical and biological properties, copper alloys are a perfect material for both surface and submersible marine aquaculture enclosures for near- and off-shore sites.

Copper alloy mesh aquaculture cages improve the sanitary conditions, productivity and sustainability of operations for farmers raising salmon, trout, sea bream, sea bass, cod, cobia, yellow tail and other species.

### Improves fish health and production.

Copper alloy mesh naturally inhibits biofouling, improving water flow and circulation, helping maintain higher oxygen levels that inhibit parasites and pathogens from growing and infecting fish. This reduces the need for added antibiotics and anti-fouling chemicals. Feeding costs can be reduced by 15%.

### Maintains cage volumes.

Clean copper alloy mesh allows cages to maintain their shape against strong ocean waves and currents, even those offshore. Larger cage volumes prevent fish crowding and help maintain high oxygenation that ultimately improve yields. The mesh also possesses high mechanical strength and formability, which is essential in the creation of effective marine aquaculture containment structures.

### Excludes predators and prevents escapes.

High-strength copper alloy mesh resists predator attacks and reduces escapes of farmed fish, preventing competition and interbreeding with wild fish stocks.

### Reduces maintenance.

Copper alloy meshes do not need to be removed or cleaned to dispose of biofouling that can grow on traditional enclosures. This lowers overall costs associated with maintenance and diver risk.

### Long-lived and recyclable.

Copper alloy mesh lasts for 5 years or more depending on application conditions. It loses little mass over time, and is fully recyclable. Recycled material is used in initial production of copper alloy mesh, which further reduces CO<sub>2</sub> emissions, compared with traditional polymer nets.

High-strength and corrosion-resistant copper alloy meshes are compatible with cages commonly used in the marine aquaculture industry, allowing for rapid implementation at existing cultivation centres.

*Have you considered copper alloys?*



## A range of copper alloys to meet your needs

Currently three copper alloys are available for sustainable marine aquaculture.



	Copper-Zinc	Copper-Nickel	Copper-Silicon
<b>Composition</b>	64% copper-zinc brass alloys contain approximately 1.0% tin and nickel and other effective micro-alloying elements.	90% copper, 10% nickel alloy with small amounts of iron and manganese.	Copper-silicon containing 1% manganese and micro-alloying elements.
<b>Service life</b>	5 to 8 years depending on application conditions.	10+ years.	5+ years depending on application conditions.
<b>Attributes &amp; applications</b>	Resistant to mechanical abrasion and wear.  Suitable for flexible mesh containment systems. High resistance to general corrosion, mechanical abrasion and wear. Resistant to dezincification, and stress corrosion cracking.	High corrosion resistance while protective layer is in place.  Suitable for situations where material will not be subjected to mechanical abrasion. Commonly attached to rigid structures; can be welded.	Superior weldability. High strength and good shock resistance.  Suitable where rigid mesh is appropriate or where panels can be assembled with flexible connections.
<b>Forms</b>	Available in wire, bar and tube. Wires can be fabricated into a variety of rigid and flexible mesh forms (e.g. chain link, woven), and mesh opening sizes. Bar and tube can be used as structural elements.	Available in wire, bar, tube and sheet. Wires can be produced into a variety of rigid mesh forms (e.g. welded mesh). Sheets can be processed into expanded metal and flattened to avoid sharp surfaces. Bar and tube are common structural members.	Available in wire, mesh and fastener products.
<b>Mesh formats</b>	4 mm wire in chain link form with 40 mm square mesh opening; 2.5 mm wire in woven form with 25 mm square mesh opening.	Expanded metal mesh in diamond pattern; wide range of standard sizes with 80% or greater open area.	Resistance welded mesh with 13 x 13 mm, 25 x 25 mm and 50 x 100 mm openings. Additional formats under development.

## Current use and future applications

*Copper alloy mesh technology began in 1975 with small salmon farming enclosures in Northeastern USA. Since then, alloy technology has evolved and now is being successfully used in Japan, Australia and Chile, providing productive and sustainable solutions for fish farmers. Development of future applications and trials of improved copper alloy materials, mesh forms, and aquaculture system configurations are underway with a variety of species in China, Korea, Panama, Norway, South Africa, Turkey and the United States.*



**Australia**

At Van Diemen Aquaculture, Copper-Zinc mesh cages have been used since 2005 to raise Atlantic salmon. Based on demonstrated success in improving fish health, the first installation of 6 rigid cages has been increased to 28 cages, with further expansion in progress. Growers have reported a 15% reduction in feeding costs over the past 3 years. Fish mortality decreased from 20% to 10% and losses from attack by predators were reduced from 5% to less than 0.1%. Net cleansing is now only performed once or twice a year.



**Turkey**

A cooperative project involving the University of New Hampshire and Çanakkale University is developing copper alloy aquaculture cages for sea bass and sea bream farming in the Mediterranean region.



**Norway**

EcoSea Farming and the International Copper Association are cooperating with Norwegian aquaculture organizations to trial copper alloy mesh cages for use in exposed conditions in Norway and other European locations.

### For further information:



**European Copper Institute:**  
[www.eurocopper.org](http://www.eurocopper.org)  
 +32 (0)2 777 70 70  
[ndc@eurocopper.org](mailto:ndc@eurocopper.org)



**International Copper Association:**  
[www.copperinfo.com](http://www.copperinfo.com)  
[hstillman@copper.org](mailto:hstillman@copper.org)



**EcoSea Farming:**  
[www.ecosea.cl](http://www.ecosea.cl)  
[rsanchez@ecosea.cl](mailto:rsanchez@ecosea.cl)