

Eco-Friendly Antifouling Solutions:

1) Cooper Free Antifouling Paints

At present, the leading contender to replace copper in biocidal antifouling paints is Ecomea (Tralopyril), a biocide manufactured by Swedish [Janssen PMP](#) that is available in a number of different antifouling. Examples include:

- [Interlux](#): Pacifica Plus (Ecomea/Zinc, solvent based), Micron CF (Ecomea/Zinc, solvent based) and Micron Navigator (water based, coming out spring of 2021)
- [Pettit](#): Hydrocoat Eco (Ecomea/Zinc, water based), Ultima Eco (Ecomea/Zinc, solvent based) and Odyssey Triton (Ecomea/Zinc/Copper Thiocyanate, solvent based)
- [West Marine](#): CFA Eco (Ecomea/Zinc, water based, discontinued)
- [Sea Hawk](#): Smart Solutions (Ecomea, solvent based)

Interlux rep David Atwater recommends for our area:

- Micron CSC as a traditional copper and solvent based ablative paint for cruisers, Micron Navigator as a copper free and water based ablative paint alternative, Micron 66 for top of the line self-polishing paint (saltwater only)
- Fiberglass Bottomkote Aqua for well performing, economic hard paint for racers
- Trilux 33 for aluminum boats, especially power boats (speed tolerant), or Micron Navigator (for sailboats)

David can be contacted at (360) 220-3165 or david.atwater@akzonobel.com

[INTERLUX Micron Navigator](#) | **NEWEST COPPER FREE TECHNOLOGY** | to be released spring of 2021

Aluminum Safe, Ecomea (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)

Overcoat: 5 Hours; Launch: 8 Hours (59 F)

Multi-Season Ablative Paint, water based, copper free, outperforms Pacifica Plus, Micron CF

[INTERLUX Micron® CF Antifouling Paint](#) | [West Marine](#)

Aluminum Safe, 3.9% Ecomea (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)

Overcoat: 6 Hours; Launch: 9 Hours (50 F)

Multi-Season Ablative Paint, solvent based, Copper free

[PETTIT PAINT Odyssey Triton Antifouling Paint](#) | [West Marine](#) **NEWEST TECHNOLOGY FROM PETTIT**

Aluminum Safe, 15% Cuprous Thiocyanate, 6% Ecomea (Biocide), 6% Zinc Pyrithione (Anti-Slime)

Overcoat: 8 Hours; Launch: 16 Hours (50 F)

Multi-Season Ablative Paint, solvent based, reduced Copper

[PETTIT PAINT Hydrocoat® ECO Ablative Antifouling Paints](#) | [West Marine](#)

Aluminum Safe, 6% Ecomea (Biocide), 4.8% Zinc Pyrithione (Anti-Slime)

Overcoat: 6 Hours; Launch: 48 Hours (50 F)

Multi-Season Ablative Paint, water based, Copper free

[PETTIT PAINT Ultima ECO Antifouling Paint | West Marine](#)

Aluminum Safe, 6% Ecomea (Biocide), 4.8% Zinc Pyrithione (Anti-Slime)

Overcoat: 6 Hours; Launch: 9 Hours (50 F)

Multi-Season Ablative Paint, solvent based, Copper free

[SEA HAWK Smart Solution Antifouling Paint | West Marine](#)

Aluminum Safe, 2.9% Ecomea (Biocide), no Anti-Slime additive

Overcoat: 12 Hours; Launch: 16 Hours (41 F)

Multi-Season Ablative Paint, solvent based, copper free, creates a slick film when launched.

2) Water Based Antifouling Paints:

Water based paints are a joy to work with because they have minimal solvent odors (and are healthier for painters). They are a favorite on the Eastern Seaboard where boats get painted in the winter indoors (and solvent restrictions require it). They tend to bond better to the old ablative paint coat because of their low solvent content.

However, water based paints require dry weather conditions because otherwise they wash away with rain when still wet.

[INTERLUX Micron Navigator | NEWEST COPPER FREE TECHNOLOGY | to be released spring of 2021](#)

Aluminum Safe, Ecomea (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)

Overcoat: 5 Hours; Launch: 8 Hours (59 F)

Multi-Season Ablative Paint, water based, copper free, outperforms Pacifica Plus, Micron CF

[INTERLUX Fiberglass Bottomkote Aqua | West Marine](#)

Not Aluminum Safe, 35% Cuprous Oxide (Biocide), no anti-slime additive

Overcoat: 5 Hours; Launch: 8 Hours (59 F)

Multi-Season Hard Paint, water based

[PETTIT PAINT Hydrocoat® Ablative Antifouling Paint | West Marine](#)

Not Aluminum Safe, 40.4% Cuprous Oxide (Biocide), no anti-slime additive

Overcoat: 6 Hours; Launch: 48 Hours (50 F)

Multi-Season Ablative Paint, water based

[PETTIT PAINT Hydrocoat® ECO Ablative Antifouling Paint | West Marine](#)

Aluminum Safe, 6% Ecomea (Biocide), 4.8% Zinc Pyrithione (Anti-Slime)

Overcoat: 6 Hours; Launch: 48 Hours (50 F)

Multi-Season Ablative Paint, water based, Copper free

[SEA HAWK Monterey Antifouling Paint | West Marine](#)

Not Aluminum Safe, 55% Cuprous Oxide (Biocide), no Anti-Slime additive

Overcoat: 1 Hours; Launch: 12 Hours (73 F)
Multi-Season “Hard” Ablative Paint, water based

3) Favorite Paints for Aluminum Boats (contain significantly less copper):

[INTERLUX Trilux 33 Antifouling Paint | West Marine](#)

Aluminum Safe, 24% Cuprous Thiocyanate (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)
Overcoat: 20 Hours; Launch: 30 Hours (50 F)
Multi-Season Ablative Paint, solvent based

[PETTIT PAINT Vivid Antifouling Paint](#)

Aluminum Safe, 25% Cuprous Thiocyanate (Biocide), 2.8% Zinc Pyrithione (Anti-Slime)
Overcoat: 16 Hours; Launch: 48 Hours (50 F)
Multi-Season Hybrid Paint (has benefits of ablative and hard paints), solvent based

[PETTIT PAINT Odyssey Triton Antifouling Paint | West Marine](#) **NEWEST TECHNOLOGY FROM PETTIT**

Aluminum Safe, 15% Cuprous Thiocyanate, 6% Ecomea (Biocide), 6% Zinc Pyrithione (Anti-Slime)
Overcoat: 8 Hours; Launch: 16 Hours (50 F)
Multi-Season Ablative Paint, solvent based, reduced Copper

[INTERLUX Micron Navigator](#) | **NEWEST COPPER FREE TECHNOLOGY** | to be released spring of 2021

Aluminum Safe, Ecomea (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)
Overcoat: 5 Hours; Launch: 8 Hours (59 F)
Multi-Season Ablative Paint, water based

Irgarol is a highly effective anti-slime additive (herbicide) that was very common in paints before 2014. Due to its persistence and toxicity in the environment (doesn't break down), it has been banned by many countries and is internationally phased out. Some formulations of Pettit Trinidad SR, Ultima SR 40 and Ultima SR 60 still contain Irgarol and should be avoided.

4) Traditional Copper and Solvent Based Paints with a Good Track Record (Irgarol free):

[INTERLUX Micron 66 Antifouling Paint | West Marine](#)

Not Aluminum Safe, 40% Cuprous Oxide (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)
Overcoat: 8 Hours; Launch: 18 Hours (59 F)
Self Polishing Multi-Season Paint, solvent based, good for stationary boats that don't get used regularly

[INTERLUX Micron CSC Antifouling Paint | West Marine](#)

Not Aluminum Safe, 37.2% Cuprous Oxide (Biocide), no anti-slime additive
Overcoat: 16 Hours; Launch: 16 Hours (50 F)
Multi-Season Ablative Paint, solvent based

[INTERLUX Ultra® Antifouling Paint | West Marine](#)

Not Aluminum Safe, 55% Cuprous Oxide (Biocide), Biolux (Zinc Pyrithione, Anti-Slime)
Overcoat: 4 Hours; Launch: 9 Hours (59 F)

Multi-Season Hard Paint, solvent based, good for warm water (high fouling potential), fast launch formula

[PETTIT PAINT Ultima SR-40](#) (Irgarol free, enhanced version)

Not Aluminum Safe, 47.5% Cuprous Oxide (Biocide), no anti-slime additive
Overcoat: 12 Hours; Launch: 24 Hours (50 F)

Multi-Season Ablative Paint, solvent based

[SEA HAWK Cukote Antifouling Paint | West Marine](#)

Not Aluminum Safe, 47.5% Cuprous Oxide (Biocide), no anti-slime additive
Overcoat: 2 Hours; Launch: 12 Hours (73 F)

Multi-Season Ablative Paint, solvent based

5) **Non-Biocidal Alternatives**

Ultrasonic Antifouling

- Sonihull <https://www.nrgmarine.com> (successfully used by SV Delos to prevent biofouling)
- Ultrasonic Works (ultrasonicworks.com)
- Ultrasonic Antifouling (ultrasonic-antifouling.com)

Foul Release Paint (ultra slick)

This option prevents fouling organisms from attaching through a super slick paint surface. It's been used on navy boats and commercial tankers for years and increases fuel efficiency and speed significantly.

The hull has to be stripped down to the gelcoat/metal, recoated with a specific barrier coat and then spray painted with the clear ultra slick paint.

- SeaSpeed V 10 X Ultra Clear [SEA-SPEED V 10 X Ultra Clear](#) (successfully used by SV Delos)
- Interlux's Intersleek Line [Intersleek 900 \(akzonobel.com\)](#) and [Intersleek-1100SR](#)

e-Paint photo-activated peroxide release (popular in Florida and sold at LFS).

6) **Looking into the future,**

- [Pettit Paint](#) is working on an eco-friendly paint with **Selectope®**.
Approved for large vessels in 2012, Selectope®, is the sedative medetomidine that prevents barnacle fouling by temporarily inducing "hyperactivity" in barnacle larvae, repelling them from the ships hull with non-fatal effect. It is effective at only 0.1% concentration in wet paint and considered environmentally safe at these levels.
- [Interlux](#) is currently testing biocide free foul release paints for recreational boaters. These can be brushed on.

Some Background Info:

Washington State Regulations on Copper in Antifouling Paints

- 2011, Washington State Legislature passed the Recreational Water Vessels – Antifouling Paints Law: after Jan 2018, no new recreational vessels with copper paint, after Jan 2020, no paints with more than 0.5% copper
- 2017, WA Dept Ecology: [Report to the Legislature on Non-copper Antifouling Paints for Recreational Vessels in Washington](#)
- 2018, Legislature delays the ban on copper paints to allow more time for research
- 2019, New report from Dept Ecology recommends further delay of copper ban (for at least 5 years) but asks for ban of Irgarol (anti-slime additive)
- 2024 reconvene and evaluate
- 2026 legislative action
 - Probably following EPA and CA benchmarks using leach rate model of 9.5 microgram/liter (most manufacturers already comply with that)

Looks like we are on a path to regulate the amount of copper in antifouling paints but not ban copper entirely.

The 2017 report of the Department of Ecology concludes:

- Current data are not sufficient to show that non-copper paints are less harmful to marine environments than paints that contain copper. In some cases, these non-copper paints contain biocides that may pose a significant risk to water quality and marine life.
- The EPA is considering leach rate regulations for copper in antifouling paints. This action will result in an overall copper reduction, but may increase the use of non-copper biocides that are considered worse for the environment.
- Studies on the impacts of these biocides are needed to help Ecology understand whether current or future paint product formulations pose an unacceptable risk to Washington State waters.

The following information is extracted from the [2017 Report to the Legislature](#)

How do antifouling paints work?

- Biocidal Paints: leach toxins into the water that prevent hard (barnacles/mussels) and soft (algae slime) growth
- Non Biocidal Paints:
 - (soft) create a slippery surface designed to make it hard for marine life to stick. Self-cleaning when boats are moving.
 - (hard) glassy, endure frequent, aggressive cleaning

Why are copper-based antifouling paints a problem?

- Copper-based paints typically contain about 40 percent cuprous oxide. Painted boat hulls continuously release copper into marina waters. When large numbers of boats are berthed together, the copper level in the local water rises. Studies have attributed over 90 percent of this copper to leaching from copper-based paints.
- Copper is most toxic to the **early life stages of mussels, oysters, and sea urchins**. It can build up (bioaccumulate) in algae, plankton, and crustaceans (Ranke & Jastorff, 2000; Thomas & Brooks, 2010).
- **Copper does not bioaccumulate in fish**, as they are able to regulate the level of copper in their systems. However, **it can affect the sense of smell** (olfaction) in juvenile salmon returning to freshwater spawning streams, which can affect their ability to avoid predators.

Salmon detect and avoid water with levels as low as 17 micrograms per liter of copper, but the overall impact of this on salmon fitness or survival is not known (Sommers et al., 2016). The levels at which these effects have been observed are far above copper levels measured in Puget Sound recreational marina waters (Washington State Department of Ecology, 2017). **In salt water**, other dissolved substances can help **protect against this effect on olfaction up to at least 50 micrograms per liter of dissolved copper** (Baldwin, 2015). Further details on the effects of copper are available in recent reviews and pesticide registration summaries (Arai et al., 2009; Dafforn et al., 2011).

The ideal biocide has:

- **A short lifetime in the environment (low persistence)**. Irgarol is expected to persist in seawater for a very long time. Breakdown products are also expected to be long-lived and toxic. Sea-Nine and Ecomea break down relatively quickly and there are no indications that their degradates are long-lived or very toxic.
- **Low potential to build-up in the food chain (low bioaccumulation)**. Sea-Nine and Ecomea break down rapidly in seawater, so while there is limited data on bioaccumulation, they are not expected to build up in marine plants or animals. Zinc is an essential mineral, so most organisms need zinc to survive and have developed special ways to move it in and out of tissues to prevent harmful accumulation.
- **Low toxicity to non-target species, i.e., nonfouling plants, oysters, and fish**. Biocides are toxic to many species, even non-fouling organisms like the Eastern oyster. Products often contain multiple biocides so that one biocide’s strengths complement another biocide’s weaknesses. However, “biocide boosters” like Irgarol or zinc pyrithione, designed to target plants, also affect marine animals.

Table 5. Data on toxicity of each biocide on marine species (USEPA, 2017). Lower values indicate higher toxicity. All figures are parts per billion (ppb).

| Organism \ Biocide | Sea-Nine | Irgarol | Ecomea | Zinc Pyrithione |
|-------------------------------|----------|---------|--------|-----------------|
| Marine plant, EC50 | 18 | 0.452 | 2.7 | 0.65 |
| Marine shrimp lifecycle, LOEC | 1.224 | 260 | 0.51 | 4.2 |
| Marine shrimp, LC50 | 4.7 | 400 | 0.98 | 4.7 |
| Eastern oyster, EC50 | 9.4 | 3200 | 0.64 | 22 |

Three of the four noncopper biocides registered in Washington State cannot be used on recreational boats in the EU.

EU biocide approvals:

- **Irgarol:** Denied registration for any antifouling use as the evaluation process determined its use posed “unacceptable risks to marine waters and sediment organisms” (phased out worldwide)
- **Econea and Sea-Nine:** Evaluated as safe for use on boats in shipping lanes and outside commercial harbors (areas with high dilution), but risks were identified for waters inside commercial and smaller vessel harbors. Econea and Sea-Nine are not approved for use on boats less than 81 feet long.

Conclusions:

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- The EPA is considering leach rate regulations for copper in antifouling paints. This action will result in an overall copper reduction, but may increase the use of non-copper biocides that are considered worse for the environment.
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