

## **Water Water Everywhere**

*Cruising sailors have to be extremely careful about what they drink according to scientist RICHARD CHESHER (Ph.D) who sheds light on how to quench your thirst with safety.*

The World Health Organization warns that over 80 percent of all surface waters on our planet, and an increasingly large percentage of all ground water, is unsafe to drink without treatment. Since a cruising sailor never knows for sure about the local water, it's always wise to find out, "Is this water safe to drink?", before filling up water tanks from a marina tap. Otherwise you can quickly confirm the old alcoholic's adage that water can be hazardous to your health. People who live or cruise aboard boats for any length of time have to give very serious thought to water.

We drink at least 4 litres of water a day, and our bodies are like large filters. Any impurities in the drinking water get concentrated in us. People on shore get fluids from many different sources. If anything is wrong with one source, the contaminants are diluted by all the other sources of fluids. Cruising people, on the other hand, get almost all of their fluids from a single source - their boat's water tanks. If the water is contaminated, the whole lot gets percolated through their bodies for weeks.

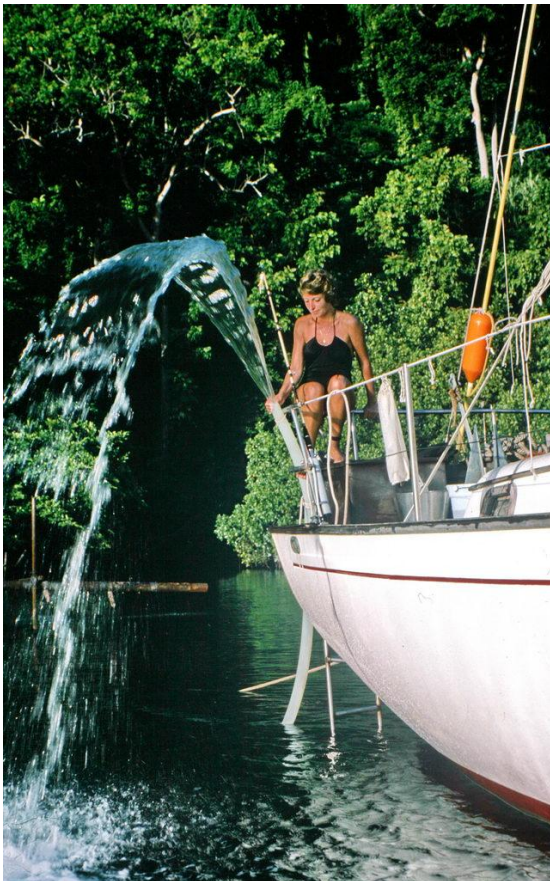
## No worries here, mate

Limiting your cruising to Australia, reduces the threat of polluted drinking water. That's no guarantee, however, and it never hurts to ask if the water is OK to drink when filling up in a strange port.

Unfortunately, local people often don't know if their water is contaminated or not.

I sailed into Cairns, Queensland, in 1977 and read a notice in the local newspaper that the public water was unsafe to drink due to a temporary breakdown in the water supply system. A saleslady in Woolies mentioned there was some kind of bug going and many sales people were off sick. When I told her about the notice in the paper and suggested perhaps the "bug" was in the water, she said, "No way, I've been drinking this water all my life, it's perfectly safe." To be sure, you have to call the Department of Health (not the Water Board) and ask.

## Bugs in paradise



One safe water supply in the Solomon island: a pipe directly from a cave in the Florida Group. But do bats carry diseases? You bet.

People are sure to get into trouble if they take a carefree attitude about water overseas with them. I have, from time to time, warned many sailors about local water supplies in the Pacific Islands. A surprising number of them ignored the warning and later told me they felt terrible all the time; a constant battle with diarrhea, flu, colds, bugs, and upset stomach aches. "It can't be the water," one yachtsman with 'Tongan Belly' said, "the locals here drink it."

What most cruising people don't know is that 80 percent of hospital admissions in some island countries are for diseases carried by contaminated water. Also, local people become tolerant of many of the pathogens in water they drink all their lives. People on passing yachts have no immunity to these same pathogens and get tummy-ravaged in each new port.

Water quality analyses from many Pacific islands read like the table of contents of a text on tropical parasitology. Bacteria, viruses, protozoa, worms and other parasites lurk happily in the drinking water of

paradise. Some of the more dangerous are the bacteria which cause leptospirosis. Because these bacteria have no protein shell they do not respond well to most antibiotics and will lay you out for six to eight weeks.

The more common bacterial problems will give you a sore tummy, vomiting and diarrhea for a few days. Freddy got one of the worse forms in Suva, Fiji, by eating ice cream in an ice cream parlour. The problem wasn't the ice cream, it was the water they kept the spoon in. She says, "When you have a bad case of vomiting, nausea and diarrhea you don't feel much like sailing". We were delayed two weeks while she recovered.

In addition to the bacteria, protozoa abound in contaminated water supplies. These can provide years of discomfort unless promptly treated with the proper medicine.

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Moir's water catching awning has gutters along each side to duct water into the tanks. It can stay up in 30 knot winds and still catch rain. The 25mm diameter tubes make sure the water flows freely from the gutters into the tanks during heavy rains. We have taken on 500 litres in 30 minutes.

### **Chemical cocktails**

Biocides and various heavy metals are also a problem in the islands. Studies of ground water sources in Guam, Tonga and Hawaii revealed T Lindane, Heptachlor T, Aldrin, Endosulfan T, Paraquat, 2-41 and DDT.

Pesticides and herbicides come from use of these poisons in agricultural areas over ground water supplies. Where the water lens is very porous coralline rock or where there are rock faults, contamination can be significant.

Heavy metals contaminate rain catchment tanks from paints used on roofs which erode as they age. One paint company in the South Pacific puts lead in their roofing paint even though the tins are clearly marked 'lead free'.

The manager told me it was "OK, because the lead is in the hardener so it won't come out". This is completely untrue. So avoid getting water from catchment tanks where the roof has been painted.

In 1979, Freddy and I got acute lead poisoning in Papua New Guinea. We were taking our drinking water from a big cement rainwater tank at the Belasona Slipway near Samari. We drank the water for four months, refilling several times, not knowing the inside of the catchment tank had long ago been painted with red lead to seal it.

Acute lead poisoning really makes you pay attention. I very nearly died. Frederique and I - and even our cat Walter - were semi-comatose for six weeks. It was six months before we were strong enough to sail out of PNG again.

### **The problem is the pipes, not the source**

In Fiji, I was told, 'Oh, the water here is fine, it comes from a reservoir way up there in the mountains.' In Vava'u I was told 'No problem with the water here, it comes from a deep well.' But although the reservoir or the ground water might be OK at the source, the reticulation systems are almost always old and in poor condition. In times of peak water use, pressure in the pipes drops to below 0 and ground water gets sucked in. The near-surface ground water is contaminated by latrines, septic tanks, pig wallows, and so on. In Vava'u, Tonga, intrusion is so bad one guest house had constant plumbing problems with small pebbles getting caught in the faucets. In Saipan I turned on the water at the wharf and a brown, muddy dribble came out. In peak use hours in Lautoka, Fiji, I noticed the water was muddy enough to stain the deck.

Of course, some islands have perfectly adequate water treatment systems to chlorinate their water. Unfortunately, like so many things in the tropics, the chlorinators only work sometimes and you never can tell when they are working or when they are not. On Vava'u, I discovered the water treatment consists of dumping a small bucket of chlorine in a big stone reservoir every so often and stirring it with a stick.

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## **The solution to pollution**

What this means, for the passing yacht, is shore water must always be assumed unsafe to drink. A large number of cruising people end up only drinking beer and assorted alcoholic beverages thinking to escape the deadly ravages of unfit water. Unfortunately, they usually get the water bugs anyway from ice, unboiled tea or coffee. In an emergency (and this is no joke) you can always drink the water in a green coconut. It is always safe and is a great thirst quencher.

## **Filtration**

Chemical treatment, boiling and filtration offer a complex solution to water pollution. After our run-in with lead poisoning, we fitted Moira with a charcoal filter (to remove smells and organic compounds like pesticides) and a deionizing filter with a special deionizing resin to remove heavy metals. Although some manufacturers claim activated charcoal filters remove dissolved heavy metals, they don't. The only filter (other than a reverse osmosis unit) which takes out heavy metals is a deionizing filter - the filter material is composed of thousands of little resinous beads about 1-mm in diameter. A few years ago, an expert on water contamination told me deionizing filters become inoperative in 'hard water'. Once and awhile, when there is little rain, we are forced to put shore water in the tanks and island shore water is usually very hard. Tests showed our deionizing filter was, in fact, inoperative. Even worse, after deionizing filters have absorbed a certain level of heavy metals they suddenly and unpredictably release the heavy metals again. This happens rapidly and whoever drinks the water gets a sizable slug of contaminants. Deionizing filters should, therefore, be changed at regular intervals.

## **Rainwater, boiled with a little bleach**

Rainwater offers a reasonable solution to the chore of getting safe potable water. But even rainwater can have problems, the most obvious being drought.

The late 1980's were a time of extended drought in the Pacific islands. Without rain, streams became polluted, wells became salty, catchment tanks went dry. We used shore water for showers, washing dishes and laundry but kept the rain water in our tanks just for drinking. Until it ran out. Then we were forced to add shore water to our tanks. We poured laundry bleach into its plastic cap (about 20ml) and added this to each 250 litre tank to kill bacteria and discourage protozoa. We also boiled the water just to be safe. Once the tanks were contaminated with shore water, we continued boiling the water for months after the rains resumed.

I designed a water catching awning which works well in winds of up to 30 knots. We normally leave it up all the time we are in port. It is made from a fibre-impregnated non-toxic vinyl (Banner, from Bainbridge Fabrics). We collected water from the decks, too, until I had an analysis made of deck run off which showed leechates from the gelcoat, paints and lacquers contained lead and toxic organic chemicals. Now we only collect rain water from the awning.

## **Filtered rainwater**

Filtered rainwater may be safe to drink for short periods, but it lacks minerals essential to good health. Cruisers relying on rain water year in and year out should take mineral supplements, especially calcium/magnesium tablets, or use dairy products to get extra calcium.

Rainwater is also highly corrosive and contaminants can leech into it from fittings, pipes and solder joints. Some PVC and GRP tanks leech lead into the water. Boats should never have copper water piping or copper water tanks. The copper ions build up in the pipes overnight and when you get your first cup of water in the morning, it comes with a heavy dose of copper. Copper toxicity can result in

long-term neural damage. Like lead poisoning, the effects are not noticeable for months. Because it is rare, metal toxicity is frequently misdiagnosed as chronic fatigue, nervous disorders, persistent flus, parasites, and so on.

Copper is relatively easy for the body to detoxify than heavy metals and is seldom a real problem unless one drinks copper-laden water exclusively over a long time. Getting the lead out - or any heavy metal - is a big problem. It is normally done under rigid medical supervision using special chelating chemicals that latch onto the metal and allow the body to excrete it.

A more natural remedy and preventative is garlic. Garlic is a powerful chelating agent. In ancient Rome, water pipes were made of lead. In fact, the word plumbing refers to the Latin name for lead - plumbum. Analyses of Roman skeletons of that age showed many people had chronic or acute lead poisoning. One reason for garlic's popularity in Italy and southern France might be that those who ate plenty of garlic felt fine while those who didn't became sick and died.

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Frederique with an island-style emergency desalination unit. You can be sure coconut water is okay to drink but getting it out of the container is sometimes a challenge.

## **Powersurvivor to the rescue**

There is only one really safe and healthful option for a long-term cruising water supply. A desalinator. For more than 10 years, I wanted one. I searched for desalinators in the advertisements of numerous yachting magazines and checked catalogue after catalogue. I wrote to half a dozen desalination firms around the world and examined the literature from each. All the desalinators were too expensive, too big, used too much power, and made more water than we actually needed. Two gallons a day would be plenty.

There are two kinds of desalinators. One distills water using heat from the engine (flash evaporation) and one passes sea water through an organic membrane (reverse osmosis). To effectively distill water from engine heat (about 80 degrees Celsius) the boiling chamber must be placed under a partial vacuum. I have seen units on larger vessels that work fine, but have not found one on a small yacht.

There are two types of reverse osmosis plants; a thick and a thin membrane. The thicker membrane is used for low pressure filtration of sweet water. It removes virtually every impurity from city water, river water, or ground water. They generally operate on household voltage and water pressures and

are not designed for yachts. Still, they are small and reasonable priced and make the best alternative to a thin membrane desalinator.

I talked to numerous people who had water makers on their yachts. They all said they had problems with them. The problems came from either make-shift engineering or sporadic use. Every reverse osmosis water maker I examined aboard yachts were attempts to use pre-existing pumps, motors and filters strung together on a steel frame. V-belts wore and snapped, mounts broke, bearings went out, valves popped ... the list of watermaker ailments on yachts was impressive. I did learn one important fact about reverse osmosis problems. Even when properly stored with biocides, reverse osmosis membranes degenerate. They like to be used and hate to sit idle.

In July, 1989, I was told there was a yacht in Neiafu harbour with a new kind of desalinator. When I went over to see it, I thought perhaps someone had given me the name of the wrong yacht, because Serenity was only 8.4m long.

"You guys got a water maker aboard?" I asked doubtfully.

"Sure do, come aboard," said the young man. I tied up and climbed aboard.

"Jim Crow," He held out his hand, "and this is my wife Madge." Jim opened a little hatch in Serenity's cockpit. I looked in, my mouth dropped open and I knew I had found my water maker. It was a 'PowerSurvivor'.

Jim turned it on, put a glass under the tube leading from the neat, trim, black unit and in a few minutes the glass filled with crystal clear water. "Try this," he said, grinning. I hesitated - by habit, I never accept water or ice when on another yacht - and then laughed, this water came straight from the sea. I drank the water down. It was beautiful.

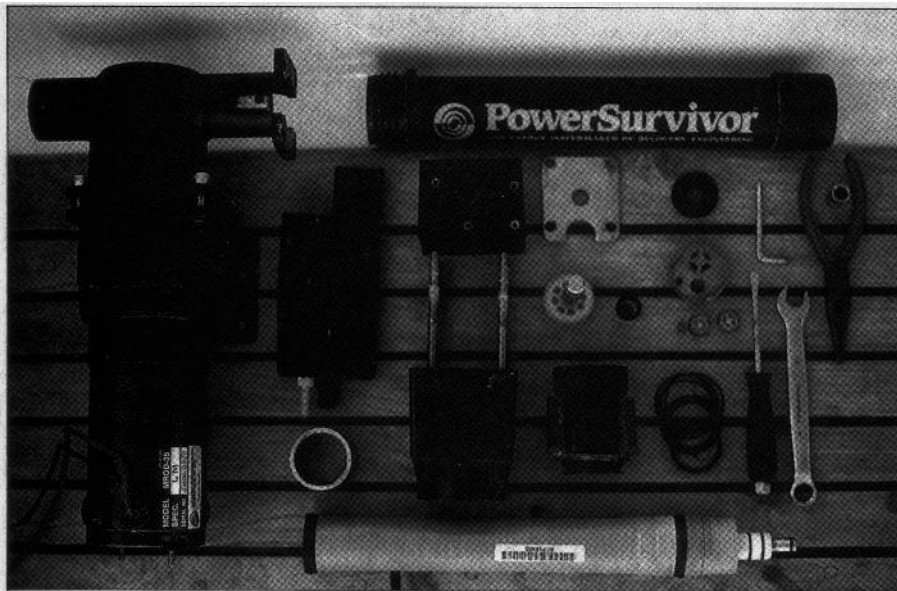
"Had any problems with the thing?" I licked my lips, looking at the PowerSurvivor pumping calmly away in the small locker.

"Not a bit," Madge said.

I asked Jim for the name and telephone number of the manufacturer in Minneapolis, Minnesota, and called Recovery Engineering that very morning, settled on a price, and sent them a check. A month later, I installed the water maker. It took three hours between the time it was in its box to the time it was fully installed, pumping fresh water into our sink.

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The PowerSurvivor stripped to bits with the necessary tools to do it; impressive engineering! It never hurts to ask if the water is OK to drink when filling up in a strange port.

The Power Survivor is the only desalinator I've seen engineered from the ground up to do one job; make fresh water from sea water. It is compact, one piece, made of completely noncorrosive materials. It uses only 4 amps of 12 volt DC battery power to pump about 1.4 gallons of fresh water an hour. It even comes with a detachable handle for manual pumping in an emergency. I quick-mounted my unit so it could be removed and taken with our life raft emergency bag if we ever have to abandon ship.

The reverse osmosis process uses high pressure (about 750 PSI) to force sea water through a membrane with such small holes the salt molecules and all organic molecules can't pass through. All contaminants and pathogens are removed, but about 1 percent sea salts remain which provide much needed minerals and a splendid taste.

Freddy and I use two gallons a day for drinking and cooking. We pump this right into plastic water jugs in the sink and, if no rainwater is available, we pump another three gallons into our tanks for showers and washing dishes. We don't drink any water from our tanks now. We drink the PowerSurvivor water straight, without additional filtration, boiling or worrying.

We ran our PowerSurvivor every day for a year (except when in Pago Pago harbour where the water was too polluted, and once during a cyclone in New Caledonia when the water was so muddy it would have clogged our prefilter in minutes). In the year of daily use we did absolutely no maintenance. Turn it on and turn it off, that's it.

At the end of a year, I stripped the pump and filter unit down to its individual parts and put it back together again in two hours. None of the seals seemed particularly worn and there was no corrosion or breakage inside the unit. I was impressed by the engineering. The whole thing is beautifully made; simplicity itself. The extended cruising kit provides a set of spare seals and extra prefilters. A membrane cleaning kit has a special housing to wash the osmotic membrane with a special cleaning solution.

After two years of continuous operation, our PowerSurvivor developed a small leak that I couldn't seem to fix, so I sent it back to the factory. They rebuilt it and it has been working now for another two years. I consider my PowerSurvivor water maker to be one of the most essential pieces of gear a aboard.

The water from the PowerSurvivor tastes good. It tastes excellent. It tastes fantastic. Once we started drinking it, the rainwater from our tank (which we thought tasted OK before) became intolerable. Tea and coffee tastes much better made with desalinated water.

But most important of all, Freddy and I have noticed a marked improvement in health; a new vitality. It didn't happen in a day, but after a few months we began to notice how good we felt. Really good. We drank more water than before. Best of all, I never have to ask myself the question, "Is this water safe to drink?"

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Note: PowerSurvivor was eventually bought out by a consortium of accountants and became a techno-victim. We now have a far superior watermaker from EchoTecwatermakers.com [1](#)

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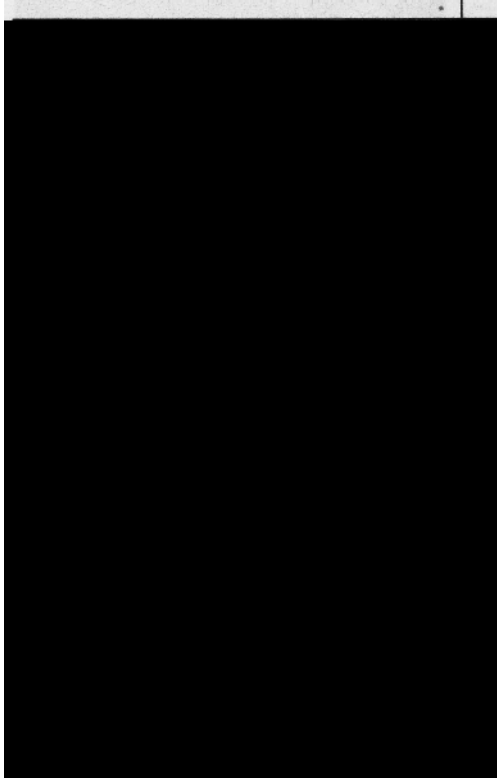
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FEATURE

**Water Water Everywhere**

*Cruising sailors have to be extremely careful about what they drink according to RICHARD CHESHER (Ph.D) who sheds light on how to quench your thirst with safety*

FROM THE HELM





Fresh water is a precious commodity for the cruising sailor. See special feature page 30. Richard Chesher picture

Cruising marine scientist and contributor Richard Chesher will be back in the South Pacific islands as this magazine hits the newsstands. Like most of us, Chesher knows the importance of maintaining an adequate fluid intake. Drinking water, not rum, is essential to good health; although some may have a preference for the latter. Chesher suggests our daily intake of fluid is around 4 litres a day. This may seem an exaggerated amount when given as a simple statistic, but when spread across the day and including tea, coffee, alcohol, etc., such a figure is realistic.

For sailors sitting at a mooring in Port Phillip Bay waiting for the weather to clear this amount may seem extreme, but consider someone manually winding up ground tackle on a steamy day in Papua New Guinea where regular fluid intake is necessary to negate the effects of perspiration. Regardless of where you are sailing, it is important to drink fluids for good health. Just how much and what type of drink is up to the individual, but regardless of individual choice, it is hard to beat plain fresh water. Not only in its ability to quench thirst, but also on a cost basis. Filling your tanks with water from the town supplies at the local marina is a damn sight cheaper than buying it in bottles from the local supermarket. The main problem, and one many sailors are unaware of, is the variability of water quality available at the different marinas and harbours around the Pacific.

Chesher has researched the issues behind water quality throughout the Pacific region and has discovered some interesting facts. He has written a feature in this issue called Water Water Everywhere and it would make invaluable reading for anyone heading into the Pacific. But the feature is not purely for those sailors heading offshore, it has some equally relevant information for coastal sailors in this country.

In his search for a reliable source of good drinking water, Chesher was led to making his own with the help of a desalinator. After considerable time looking for the right device, a fellow cruiser introduced Chesher to the Powersurvivor. He is now a convert to the Powersurvivor desalinator and, considering it uses 4 amps of 12 volt DC batter power to produce 1.4 gallons of fresh water an hour, it is not surprising.

Chesher was so impressed by the Powersurvivor he quickly began to use it full time and it has now be running, almost daily, for four years. In that time it only required one factory service.

It certainly is encouraging to learn of something which is well-made, reliable and efficient. But not only that, it almost always provides that essential cruising commodity - fresh drinking water - no matter where you are.

- Neil Patchett