

# Harnessing the

*Nancy Griffin reports how a US company, utilizing the skills of experts from many different countries, is close to successfully processing the massive krill resource in the Antarctic Ocean to produce high quality foods for human and animal consumption*

**F**or generations, the colossal biomass of Antarctic krill (*Euphausia superba*), estimated at more than 300m tonnes, has tantalized seafood producers with its lure of low-cost, high-protein food.

But while several countries have tried to harvest the highly perishable crustacean in a cost-effective manner, none have managed to bring home a satisfactory product until now.

*Top Ocean*, a US company, has achieved what others have attempted, to produce a top quality frozen krill meat and a human-grade krill meal, as well as an animal-grade krill meal for use in aquaculture and other feeds.

'We are the first company ever to try to put together a comprehensive fisheries operation for krill,' says Dimitri Sclabos, *Top Ocean's* marketing manager based in Santiago, Chile. 'We are working on catching, processing, marketing, meeting international regulations and the national regulations of many countries, environmental and HACCP concerns, everything.'

The next move for the Kodiak, Alaska-based company, is to sell the animal-grade meal to more feed producers and market the meat to Europe, Japan and the USA.

When those products are fully established, *Top Ocean* plans to help non-profit organizations set up small businesses to sell human-grade meal in parts of the world where people are hungry.

The huge size of the krill stock has been known since the days of whaling. (Krill is the favourite food of some of whales that feed seasonally in the Antarctic.)

## THE VESSELS

Four years ago, *Top Ocean* bought two Super Atlantic trawlers found abandoned in Montevideo, Uruguay, after a Russian-Argentinean joint venture went out of business.

The vessels were built by the Russians in East Germany in 1980 to serve as mackerel fishing boats, or military craft, depending on need. Both are 101 metres (415 feet) long and weigh 4,000t.

The first vessel, also named *Top Ocean*, is fully operational and has made two successful trips to the Antarctic fishing grounds. However, unsatisfied with the quality of the product, each time the vessel returned to port, the company upgraded the processing equipment to improve the quality of the meat and the human-grade meal.

*Top Ocean II* is moored in a boatyard in Montevideo, Uruguay, waiting for the right processing equipment to be installed. When



**Top Ocean moored at the dock in Punta Arenas, Chile**

both vessels are fully operational, *Top Ocean II* will concentrate on producing meal for animal feed, while *Top Ocean* will produce both frozen human-grade krill meat and meal.

It was decided that *Top Ocean* will forego the most recent krill season, but the vessel will leave for the fishing grounds at the start of next season in the autumn of 2002. Trips average 50 days with a crew of 55, with eight days allotted to travel to and from the fishing grounds.

*Top Ocean* can process 15-20t of krill per hour and one trip can result in 1,200t of finished product.

In order to produce krill meat for human consumption, specialized peelers were devel-

oped for the tiny animals.

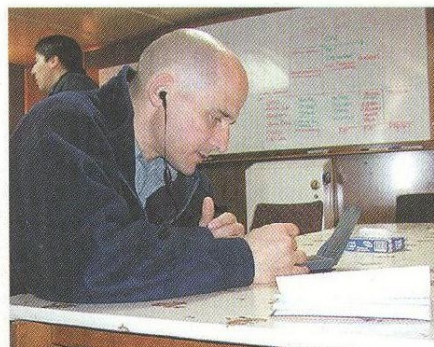
Krill from seawater holding tanks – up to 100t of krill is stored at one time – are briefly heated, flashed with cold water to loosen the shells, and then dropped into the peeler to separate the shells from the meat.

After a centrifuge takes the shells away, the peeled krill are moved on little rollers to conveyors, then to ultraviolet lights for a final inspection, and finally packed in plastic tubs and frozen.

Both the heating and ultraviolet processes are designed for microbiological control, but *Top Ocean* is understandably reluctant to provide further information.

No matter which product is being made, all

# potential of krill



**Dimitri Sclabos, marketing director,  
Top Ocean**

*Ocean* who worked on the Chilean project. For one season he travelled to the fishing grounds with the Japanese fleet.

Later, employed by a private company, he worked with six vessels in the Ukrainian fleet, which were producing up to 8m cans of krill meat on each trip.

The Ukrainians stopped going to Antarctica when the former USSR collapsed. Despite strong krill markets in Japan, Korea and Taiwan, the faltering Asian economy and the increase in fuel costs made the product too costly to manufacture, says Mr Toro.

'Our (Chile's) work was mostly on animal and aquaculture products,' Mr Toro says. 'This process is aimed at human consumption, so it's very challenging.'

'Krill is difficult as a raw material, so it's necessary to have a very clear process for handling and processing. I think our experience is necessary for this new concept.'

*Top Ocean's* president, David Rogers, is an American who lived in Alaska for 18 years where he worked as head of R&D for International Seafoods.

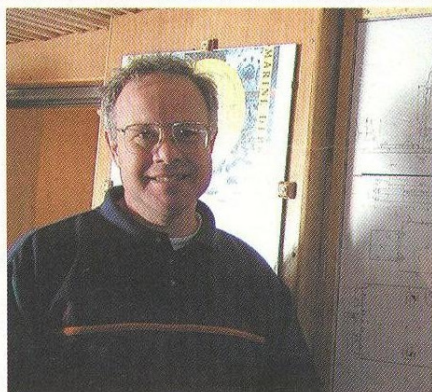
The captain, Mitch Hull, is also an American, as is the company's purchasing officer, Ross Grange. There's an American chief engineer - Steve Dorn - but he has a Ukrainian counterpart.

The company is American, but the investors are Korean, connected to the Unification Church lead by the Reverend Sun Myung Moon.

The boat crew hails mainly from St Petersburg, in Russia, 'because they grew up with these vessels' as sailors in the former USSR fleet, Mr Rogers says. However, they are not all Russians, but include Ukrainians, Latvians and Belarussians.

The fishermen are mostly from Poland 'because the Poles have the most recent experience with fishing for krill,' Mr Rogers explains. The nets are from Poland, Japan, Norway and other countries. The net gear is Norwegian; the technology East German.

'Working with all these people from other places has changed us all,' says Mr Hull.



**Top: Discussing the project, left to right, Dimitri Sclabos (Top Ocean marketing director); Alejandro Torres (former Top Ocean head of quality control, now a consultant); Luis Rodriguez (Top Ocean laboratory chief); and Jim Ostergard, consultant**

**Above: David Rogers, president, Top Ocean**

**Left: Dimitri Sclabos (left) discussing krill dishes prepared by Chef David Lillo**

the equipment is stainless steel and suitable for processing human-grade products.

For meal production, the krill are pressed, then flash dried using equipment that achieves the result in one minute that 'most driers take at least 45 minutes to accomplish'.

## A FLOATING UN

The *Top Ocean* is a floating United Nations, which employs the technology of every country that ever fished for krill in Antarctica and some of the personnel. A technical crew from

Russia, the Ukraine and Belarus mans the Russian-built vessel. The fishing crew is Polish, because the Poles have the most recent krill-fishing experience.

The technicians on the processing side are all Chileans who worked on a recent four-year-long project sponsored by Chile to catch, process and study the quality of krill processing. They have the most up-to-date scientific knowledge of the proper handling of krill.

Raul Toro, director of quality control, is one of several Chileans employed by *Top*



Photo: Mitch Hull

## FISHING FOR KRILL

In the early 1970s, just less than 7,000t of krill were caught in the Southern Ocean. By 1981, the landings reached 600,000t and remained around that level until the former USSR collapsed in 1992. In 1998, only 100,000t were harvested.

The Japanese were harvesting all along, and still are. Their catches have been stable since the 1980s and nearly 80% of their catch is frozen raw and cut into blocks for recreational fishing bait. The other 20% is marketed as meat for human consumption in Japan.

All Antarctic fisheries are carefully controlled by the international organization, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), based in Hobart, Australia, which carefully assesses the stocks (now estimated at in excess of 300m tonnes) and sets the quota (now 4m tonnes).

Mr Rogers points out that the harvest has never yet exceeded even 1% of the quota.

Many things set *Top Ocean* apart from the other ventures that have tackled the krill fishery. The personnel involved are not from a single country and there is no government support or financial backing to keep the venture going if it does not turn a profit.

Also, *Top Ocean* does not rely on one type of technology, unlike the Japanese operations that use only Japanese technology, while the Russians only used Russian technology.

'That's what they know, so they would just upgrade within their own technology,' says Mr Rogers. 'We practically had fistfights about which technology to use.'

'How do you select who has the best idea of what to do?' Mr Rogers asks. 'We're American wannabes. All these other countries developed the technology. It's a real challenge.'

'But *Top Ocean* is willing to try new techniques,' says Mr Sclabos. 'We're not afraid to take from different countries and David

(Rogers) is positive enough to try anything.'

The Norwegians, the Germans, the Indians, the Koreans and now the Brazilians have also tried, or are now trying to fish for krill under government-subsidized programmes.

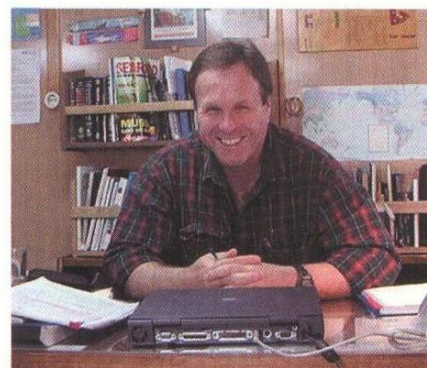
Not much is known about krill. During Antarctica's winter, the only food krill eat is the flora under the ice. But if there is no food, they can shrink to larval size, grow again and repeat the process.

Research shows the crustaceans will live for up to 11 years in seawater tanks, but may live for only a couple of years in the wild, where their age is difficult to assess.

'We are the first US fishing trawler to fish in Antarctica,' says Mr Hull. The US dictum requiring American-made hulls does not apply since *Top Ocean* does not fish in US waters.



Polish crew members mending nets on the *Top Ocean*



Captain Mitch Hull

'In the 1960s we thought that fish protein concentrate (FPC) could feed the world,' says Mr Rogers, who was then involved in a project to develop FPC. 'And krill is the biggest single-species resource on earth short of phytoplankton.'

Of the 80 species of krill, *Top Ocean* targets just one – *Euphausia superba*. There is no bycatch.

## PRODUCTS

The krill meat has been well received. 'It's the best product ever delivered to the marketplace,' says Mr Sclabos.

So has the aquaculture-grade krill meal. 'It's great for salmon because it contains the natural colouring salmon needs and the protein in krill goes a lot farther than other proteins.'

The meal from the last trip was snapped up by the Australians and the Japanese. The meat will first be sold in Spain and Japan and then, the *Top Ocean* staff hope, the USA.

'Krill meat is a new product. We have defined its main marketing attributes as a "disruptive product" which will foster new products and services with a market impact that cannot be easily predicted today,' says Mr Sclabos.

'Krill meat customers will be sophisticated and demanding ones, with needs that cannot be served with just another round of standard products.'

At the International Boston Seafood Show earlier this year, several people suggested the company call krill by another name to enhance sales opportunities. 'We were tempted,' Mr Sclabos says. 'But then we thought, "no".'

'We're in the middle of a special resource. We won't call it by a funny name. We'd rather be featured in the medical journals than the seafood magazines, frankly, if we can convey krill's nutritional value.'

As proof of krill's versatility, in September *Top Ocean* invited local business people to a luncheon in Punta Arenas, prepared by Chef David Lillo of the Hotel Finis Terrae. Mr Lillo prepared 29 different dishes with krill – everything from cold salad to hot sauces with rice, including a variety of dips, mousse, soup and seiche.

'Our aim is to position our meats in the US market, plus other relevant world markets,' Mr Sclabos says. 'We want to support our introductory work through direct cooking activities at fairs and customer presentations,

simultaneously creating awareness though new and challenging recipes.

'Our first season was a test, with only a small catch. In 2001, we made a trip with a 56t production result,' he says. 'It sold out almost right away.'

Besides their versatility, krill meats have a tremendous power based on their medical properties.

The tiny crustacean is rich in omega-3s, and has 'a perfect EPA/DHA relationship', Mr Sclabos says. 'It has proved to be a sophisticated product which helps to clean arteries, prevent heart attacks plus other medical benefits.'

'It takes 250g of corn to fulfil the nutritional needs of a teenager,' Mr Sclabos added. 'It takes 30g of krill.'

The high concentration of omega-3 fatty acids makes krill a heart-healthy food, but a doctor in Uruguay believes it is much more. The heart specialist has the krill meat dried and powdered in the UK, and then he gives his patients capsules containing krill powder, because he believes its properties actually restore the tissue of the heart.

The animal-grade meal is perfect for salmon feed, explains Mr Sclabos, since krill not only packs more protein per ounce than other feed ingredients, but contains natural asthaxanthin, a substance often added to feed to impart colour to salmon flesh.

'This meal has no parallel for content, colour, or quality,' Mr Sclabos says.

In Asia, buyers for the meal include Nissui, Marubeni, Toshoku Yamaha-Nutreco and other Japanese companies, as well as Grobest from China and Hong Kong, and Harinas Co from Taiwan. Meal is also sold to European buyers, while Nissui, True World Foods and Pescanova are buying krill meal.

'We are starting to work on the nutraceutical side with our krill oils and krill shell - chitin and chitosan,' Mr Sclabos says. 'We won't fight with shrimp's low price structure, nor its associated products, nor with surimi analogues.'

Krill begins to digest itself within 15 minutes, so processing must be rapid. All the research, the international expertise and *Top Ocean's* current experience has shown that to achieve high quality, the meat must be slightly cooked by the heating process.

'We have developed a marketing plan focused on the high-end market, supporting our work through medical publications with an upgrade migration compared to other alternative products,' says Mr Sclabos. 'We target the "ready-to-eat" segment with our slightly cooked meat.'

He expects the meat to sell at more than \$2 per lb. 'Europe should be a natural market for us because they're used to high-priced products and to eating seafood.'

*Top Ocean* is contracting with the Culinary Institute of America in Hyde Park, New York, to develop additional krill recipes. A few recipes are available on the website ([www.kingkrill.com](http://www.kingkrill.com)).

'Once we make the market understand what krill is,' Mr Sclabos says. 'Demand will be great.'

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## FEEDING THE HUNGRY

The interest of the Unification Church in krill began with the Korean War, explains Mr Rogers, when the Koreans' 'common experience was not having any food'. So 22 years ago, Rev Sun Myung Moon, head of the Unification Church, began developing fish-based business throughout the world with the intent of having profitable businesses in order to also develop a source of protein for the future so countries would not go hungry.



Once the concept was adopted, Mr Rogers studied fisheries throughout the world with an eye to finding one that fits the right profile for the high-protein meal.

'We (the Unification Church) looked at Arrowtooth flounder in Alaska. We saw dried protein concentrate being made in Uruguay. We went to a bycatch conference in Alaska in 1990... We looked at making paste from the rejects from a surimi line... We thought we could make a dried powder out of a frozen paste... We flew to France to look at a "flavours" company that was using recovered wash water...'

When it was determined that processing krill offered the best chance to make a high-quality meal, the church faced another reality: there is no market for the product, even though non-governmental organizations (NGOs) that work with Top Ocean on the humanitarian aspect of the project are screaming for the dry concentrate to take to Africa, where they hope to feed the hungry populations of four or more countries.

'We tested the meal for two weeks in Kosovo and people loved it,' says Mr Rogers. He is working hard to get the Antarctic krill venture onto a solid footing so he can get to the part that interests him most - the humanitarian part.

'It was different from the Russians, who only wanted to feed their people behind the Iron Curtain,' Mr Rogers says. 'Our project was aimed at relieving suffering for humankind.'

'It is far-reaching and based on human principles, so it continued to develop over years. The intent here was to see if food-grade products could be made from krill to benefit people.'

Only three of the top company people - all Americans - belong to the church, but the international employees of Top Ocean seem to share the company's vision and values for their own reasons.

'I spent seven years working for US companies where everything was focused on making money,' says Mr Sclabos. 'Now I'm here trying to balance profit with humanitarian principles.'

'We need to make money so the company will be stable, but it takes a different mindset to also consider the humanitarian side. It applies to all of us.'

'The focus now has turned entirely to market-driven products,' says Mr Rogers. 'We haven't relinquished our intent or goal, but the reality is we're not a government, we're a private business that first has to maintain itself.'

Mr Rogers points out that when Top Ocean achieves regular production of human-grade meal, it and the NGOs don't plan to give it away, but perhaps launch or assist small businesses that can sell the meal at reasonable costs.

'It's a harsh historical reality - we're ahead of our time, even if we're behind in the intentions of our own organization,' he says.

'Not for long', adds Mr Sclabos. 'We're behind in making a profit, but not behind in technology.'

'We can make the food-grade product down below in this vessel. No other krill-fishing vessel can do that. If all we wanted was profit, we could have bought cheaper equipment (to produce animal-grade meal). There's a big concept behind this.'



Photo: Mitch Hall