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I N F O R M A T I O N B U L L E T I N



Editor: Neil Sims, Black Pearls Inc., P.O. Box 525, Holualoa, Hawaii 96725, USA. [Phone: +1 808 3311188; Fax: +1 808 3318689; e-mail: neil@blackpearlsinc.com]. **Production:** Information Section, Marine Resources Division, SPC, B.P. D5, 98848 Noumea Cedex, New Caledonia. [Fax: +687 263818; e-mail: cfpinfo@spc.int; www.spc.int/coastfish]. **Produced with financial assistance from France.**

From the Editor

We're back. We know it's been a while since we last wrote, and we wish that the old adage of 'no news is good news' held true. Unfortunately, it has been more of a case of 'no good news'. Our only possible excuse for the long lapse since POIB #14 — and it's a feeble one — is that we were waiting for some good news to include in the issue. Any glimmer of good fortune...

The situation has been pretty grim. Even before 11 September a steady downward slide in black pearl prices was forcing even perennial optimists to make a sour reassessment of the growth potential for the industry. Rumours of farms closing throughout French Polynesia were followed by massive layoffs and halting of seeding by Robert Wan. Buyers were reportedly staying away from Tahiti auctions, and there was a general sense of disarray, despondency and uncertainty. Wholesalers were reportedly unwilling to buy larger parcels, because they had no idea where the bottom of the market lay, and they didn't want to be left, in three months time, holding overpriced goods.

Then there were reports from the Cook Islands of oyster die-offs in Tongareva (Penrhyn) from algal blooms, and heavy farm mortalities in Manihiki lagoon. A *Vibrio* species was fingered as the culprit in the latter case, and the worst of it passed, but it reminded us all of the fickleness of nature and of the frailty of the animals we nurture. And stories of Cook Islands pearl farmers, urging their politicians to ban the import of Tahitian pearls, reminded us of the fickleness of human nature, and our more base, protectionist urges when the sands start to shift beneath our feet.

There has been sad news as well in the passing of John Latendresse and Ian Turner, each of them grand old fathers of

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pearling in their own way, and both highly respected and fondly remembered by those who knew them.

There is also increasing competition from cheap Chinese freshwater pearls (CFWP). Not the tiny rice pearls that we joked about for years, but round or near-round, and 8 mm and upwards. Sure, they look cheap, dyed, and over-polished, but the average pearl consumer apparently is not sufficiently discerning. I remember the Keynote Address at Pearls '94, when Fred Ward showed a slide of a 10 mm, perfectly round CFWP, and told the gaping gathering that this was where the future of pearling lay. Somewhere between POIB #14 and POIB #15, Fred's prognostication finally came to be.

There have been some small bits of positive news. French Polynesian authorities initiated some stricter quality control measures over pearl exports, and the market for better-quality black pearls took a positive turn in the wake of 11 September. There were new hatchery successes in Micronesia, new seeding technician training programmes in the Cooks and the Marshalls, and rumours (but no publishable stories) of ongoing expansion in Fiji and Tonga. There has also been a number of exciting pearl papers from the World Aquaculture Society meeting in Beijing. Wayne O'Connor has kindly provided us with a superbly detailed account of the pearl sessions from WAS. It is almost as good as having been there. We include many of these rosier bits and pieces in this issue, to try to counter the generally bleak tone.

In the past, we at POIB have studiously avoided wading too deeply into the waters of pearl politics, marketing and industry management, but perhaps it is time we did offer an opinion or two in this area. We heard a second-hand story (so don't quote me on this) of a highly-respected biologist who was asked, on an international radio programme, if the picture he was painting of pearl farms stretching across every lagoon from Papeete to Penang might not conflict with some basic economic laws — say, that one about supply and demand — 'Oh', came the reported reply 'that's not my problem. I'm a pearl biologist, not a pearl marketing expert!'

If it were only that easy. The truth is, these days you have to be both, or you can't really be either. When building a new farm, we must look for niche markets, or other competitive advantages that a lagoon can offer. When working to promote pearl culture in a country, we must be blunt in pointing

out the challenges and risks the industry faces. And when managing existing farms or working in established areas of the industry, we have to be aware of our responsibilities, and the regional context in which we work.

We don't want to tell people what to do — I'm an editor, not an edicter. However, there is finally a piece of good news that is both instructive and inspiring, and may give some cause for optimism. It motivated us to pull these pieces together into an issue, and bundle them off to our capable production crew in Noumea. This following story has great relevance to our region, and to our industry, and we ignore it at our peril.

Australian silver pearl prices have begun to show a softening trend over the last nine months or so, due somewhat in part to the events in the US, but also because of the looming threat of overproduction from Indonesia, where a number of large farm projects are apparently scheduled to come on line over the next few years. Silver South Sea pearl (SSP) prices were dropping, not because of current oversupply, but because of uncertainty about the future. People were wringing their hands, and pointing their fingers, but no one was doing anything of substance.

Then, in a bold, stunning stroke, a very large Australian SSP farming company stated that they would guarantee a specified reserve price for all pearls from Indonesian farms for the next two years. Almost instantly, the price for Australian SSPs firmed, turned around, and started to climb back towards its former levels.

There are lots of reasons why this could never happen in the Pacific Islands black pearl industry. But I thought it worthwhile to issue a POIB, with this as the best bit of news that we had. Perhaps, with time, something like this may come to pass.

Until then, all we can try to do is to grow better pearls. You could probably go broke very quickly if you just wanted to keep on growing more pearls. This industry is awash in average pearls. We need to distinguish ourselves, and our products. The mantra heard throughout the market is 'Quality... quality is always in demand...quality is always appreciated.' The world doesn't want more pearls...it wants more beautiful pearls.

Neil Anthony Sims



Layoffs in French Polynesia pearl industry caused by overproduction, industry leader says

Source: Oceania Flash/SPC – 19 December 2001

French Polynesia's largest black pearl company owner, Robert Wan, says his decision to temporarily lay off some 400 employees for the next six months was mainly caused by an excessive production of black pearls in the French territory. In an interview with the daily newspaper *La Dépêche de Tahiti*, Wan, who is regarded as one of the first local businessmen to have invested large amounts in the industry over twenty years ago, said the current crisis was mainly caused by excess production and a drop in quality, causing, in turn, a drop in prices. This translated into 400 employee layoffs within his Perles de Tahiti company, for six months, especially in the pearl farms of the Tuamotu and Gambier archipelagos. But during this period, Wan assured employees would continue to receive a tenth of their current salaries. 'Since last year, international buyers of Tahiti black pearls have not shown the interest they used to at auctions held in Papeete', Wan said. Wan recalls that prices have dropped by 70 per cent since 1994 and by 20 per cent in recent months. Another decision — linked to the personnel layoffs — was to stop grafting (the operation that involves implanting the kernel of a future pearl into the oyster) for stock that would be harvested in September 2002. Wan also predicts increasing competition from Pacific Island countries, such as the neighbouring

Cook Islands, but also Fiji (which produced its first batch of black pearls this year), Micronesia, the Marshall Islands, and Solomon Islands. Until recently, Wan was producing some five tonnes of black pearls per year. In March, French Polynesia's President Gaston Flosse personally took over the responsibility of the pearl industry portfolio and introduced drastic quality control measures, which included a tight control (including seizure and destruction) of low grade pearls. According to statistics, pearl farming and related industries currently employ some 7000 people locally, in over a thousand pearl farms throughout French Polynesia's far-flung archipelagos. The fastest growth in turnover occurred between 1998 and 1999, an euphoric time when the growth rate of the industry reached an unequalled 23 per cent. But business then slowed down in the year 2000 (only 14.4 per cent growth rate, a total turnover of 21.4 billion French Pacific Francs, over USD 160 million). On a global scale, Tahiti produces about a quarter of the world's black pearls. In 2000, the territory's two producer syndicates (Poe Rava Nui and Tahiti Pearls Producers) organised three auctions and sold overall 460,000 pearls, and a total of 5.8 million black pearls were exported.



Tahiti industry status

Source: *Perles de Tahiti bi-monthly Newsletter* 7(50) – March 2002

Tahiti's government has created a pearl industry follow-up committee to curb the current drop in Tahitian pearl prices. The committee was announced following the government's recent meeting with local pearl production and pearl dealer groups.

The committee's tasks will be to:

- Clearly distinguish between oyster and pearl producers; each type of producer will have its own regulations.
- Introduce quality control measures for pearls marketed locally.

For the first time since 1990, worldwide exports of loose Tahitian cultured pearls during 2001 were lower in volume than the preceding year. But that was expected ever since Tahiti's government applied a series of measures throughout last year aimed at improving the quality of exported pearls.

The goal of those measures is a lower overall volume but a higher overall quality as rejects and undesirable pearls are eliminated from the market. This will be the first full year that all of these government measures will be in effect.

After several years of record volumes at an average increase of 30 per cent a year, Tahitian pearl production has more than tripled since 1995. Last year's loose pearls weighed 10.5 t, or 900 kg less than the record 11.4 t exported during 2000. That was a drop of eight per cent, which means some 500,000 fewer loose Tahitian pearls reached world markets.

Overall, Tahitian pearl product exports last year totalled 10.7 t, an eight per cent drop from 11.6 t in 2001. That included about the same volume of worked pearls — 130 kg.

Indonesia: Rising star?

Is Indonesia's South Sea pearl a potential major competitor for Tahiti's pearl?

Exports of Indonesia's pearls skyrocketed between 1997 and 2000, tripling in value from USD 33 million to nearly USD 100 million, according to a study made by Alix based on worldwide pearl export data provided by the French Overseas Trade Center.

President Flosse calls for production discipline

The annual volume of Tahitian pearl production must end up 15–20 per cent lower in order to refocus on the quality of Tahiti's gems, according to Government President Gaston Flosse, who is also pearl industry minister.

Speaking to the local media during a visit to the Robert Wan Pearl Museum, President Flosse talked about the range of different measures already undertaken or under study. His comments came a few days before the government's creation of a pearl industry follow-up committee.

'I think that a year or two from now we can stabilise prices and (Tahiti's) pearl will have regained the ranking it deserves,' he said. President Flosse said he based his prediction on export controls favouring good quality pearls by making inferior quality pearls disappear along with the concern for such an increased presence in all markets.

As for production, President Flosse called for taking into consideration the views of the smallest producers, whose representatives will also be consulted on the government's follow-up committee. 'Things must be done little by little and not brutally,' he said. 'This committee is an informal committee whose goal is to collect the opinions of pearl industry professionals, pearl oysters producers, pearl producers, pearl dealers — all those who know this sector very well.'

And he added that a professional accreditation card for pearl producers and pearl oyster producers would help to regulate production just as it has done for pearl dealers. 'We know that some of the maritime concessions are not exploited and that, on the other hand, the vast majority of them exceed the areas granted,' President Flosse continued. And there are critics who raise the question, he said, of how quality pearls can be produced when pearl farming densities exceed standards. 'We must limit ourselves to a specific volume of oysters per square meter in order to improve pearl quality and also to avoid oyster illnesses and polluting the lagoons.'

That solidified Indonesia's ranking as the world's N° 3 loose, cultured pearl exporting country in 2000, the latest year of available statistics. Those exports gave Indonesia nearly 21 per cent of the world market, up from 18 per cent in 1999. More importantly, Indonesia's growth is coming at the expense of other exporting countries, particularly Tahiti.

Hong Kong: New star

Some 94 per cent of all Tahiti's worldwide exports of loose, cultured pearls go to five countries, with Japan and Hong Kong accounting for 85 per cent of those exports.

But Hong Kong is clearly the new star among Tahitian pearl export destinations. This Chinese business capital increased its market share of Tahitian pearl exports by 46 per cent last year, while Japan's share dropped 16 per cent.

There is no big secret to Hong Kong's success. It simply has become the major re-exporting market for Tahitian pearls. Its major clients are in the USA, but Hong Kong also re-exports to Japan, Germany, the United Kingdom, Switzerland, Italy and France.



Penrhyn oyster killer not a disease, say scientists

Source: *Cook Islands News* – 19 December 2001

Fears that the pearl harvest in Penrhyn could be obliterated by a mystery disease have receded. The Ministry of Marine Resources has investigated what was killing the oysters in the lagoon and now believes it was a natural phenomenon rather than a virus.

Aquaculture expert Ian Bertram arrived back from Penrhyn yesterday (Tuesday) to report on the mystery plague that has been affecting pearl farmers on the atoll. He had been flown to the lagoon on Saturday to find out what was causing the deaths of hundreds of oysters and pipi.

The department acted after reports that many of the molluscs on the islands were being killed by an unknown bug that left the shells gaping and the nacre bleached. But after visiting many of the farms at the lagoon Bertram told Navy Epati that the symptoms do not resemble those of a disease.'

The Secretary of Marine Resources said that a recent mass spawning of shellfish, an algal bloom and murky conditions in the lagoon could all have

contributed to a 'bizarre combination' of circumstances that had caused the deaths. 'It doesn't really look as bad as we first thought,' said Epati. 'We said it was serious because we didn't know what it was that was killing them. We have a better idea now. Our initial assessment is that it doesn't look anything like a virus or a disease — and that is very, very good news. It looks more like a natural phenomenon that we will now attempt to identify.'

He added that shells no longer appeared to be dying and that conditions in the lagoon had changed over the weekend. 'Some of the shells that were affected even appear to be recovering,' he added.

Epati said that the scare could lead to beacons being installed in the sea at Penrhyn and other pearl producing lagoons. 'I think we could have maybe avoided this if we had been able to monitor the situation in the lagoon.' He said that the beacons could forewarn farmers and the government of any changes in sea conditions and help prevent panics like this one.



Disease outbreak costs Manihiki pearl farms millions

Source: *Radio Australia* – 27 February 2001

The disease outbreak that caused the deaths of young oysters at the Manihiki pearl farms in the outer Cook Islands in 2000 is expected to cost the industry USD 34 million dollars in lost revenue over the next five years.

Ben Ponia, an aquaculture specialist with the Secretariat of the Pacific Community in Noumea, said it will take five years before the industry

recovers to normal production levels. He proposed a grid system last year for Manihiki lagoon to allow better regulation and monitoring of pearl farms.

Under this system, growers would be able to farm as many as four million pearls, which is far more than the current level.



Cook Islands asked to ban Tahitian black pearl imports

Source: Radio Australia – 17 July 2001

The Cook Islands government has been asked to ban the importation of Tahitian black pearls. The Manihiki Island Council says the government should ban the pearls or impose duty of 100 per cent. The council says it is concerned that over the past 12 months the average price for black pearls on the international market has declined by up to 40 per cent. It blames the drop on an increase in production by French Polynesian farmers.

Local retailers and wholesalers in Rarotonga are buying cheap pearls in Tahiti and selling them to tourists in Rarotonga. Deputy Prime Minister Norman George supports the council's view. He says that too many expatriate business people in the Cook Islands have no interest in the long-term survival of the country.



Cook Islands to train local pearl technicians

Source: Radio Australia – 17 September 2001

After years of paying foreign pearl technicians exorbitant fees for their expertise in seeding shells, Cook Islanders recently announced plans to use Chinese pearl experts to train local farmers, according to a story published in the *Cook Islands News*.

Foreign technicians currently charge as much as 50 per cent of all shells seeded, making it hard for local farmers to develop their farms and repay

their bank loans, according to the article. The training initiative, which is being spearheaded by the Development Investment Board (DIB), seeks to identify experts — through the Chinese Embassy in Wellington, New Zealand, and the South Pacific Trade Commission in Auckland, New Zealand — who can travel to Manihiki and Penrhyn, the two low-lying atolls where cultured pearl production takes place.



Promising advances for Marshall Islands pearl industry

Source: Radio Australia – 17 October 2001

A private pearl operation in the Marshall Islands says 2001 pearl harvest showed a hint of economic potential for the Marshall Islands. Robert Reimers Enterprises says the harvest for 2001 was estimated to be worth about USD 50,000, compared with the multi-million dollar industries in Tahiti (USD 200 million a year) and the Cook Islands (USD 40 million). But the company said the government's

inability to focus resources on pearl farming was hindering development of what could become the main industry for the Marshall Islands. The company said there is such a worldwide demand for pearls that there could be half a dozen farms operating in the Marshall Islands and there would still be plenty of business for everyone.



Black pearl seeding secrets being shared in Marshall Islands

Source: *The Marshall Islands Journal* – 22 March 2002

To produce pearls in commercially viable numbers, oysters must be 'seeded' manually by specially trained 'seeding technicians'. This essential component of the pearl oyster industry is, for the most part, a closely held trade secret by a small number of seeding technicians who ply their trade worldwide.

The local Black Pearls of Micronesia (BPOM) pearl farm on Bikirin in Majuro, however, has discovered one foreign technician who not only isn't paranoid about islanders looking over her shoulder while she seeds oysters, she's actively training a crew of Marshallese employees to do the job themselves.

After working with four different, but equally secretive, seeding technicians over the past several years, BPOM was delighted with the arrival of Berni Aquilina, a New Zealand-based pearl technician.

Aquilina has wrapped up three weeks at the Bikirin farm where she seeded thousands of pearl oysters and ran a comprehensive training programme for the entire crew of ten workers (four of whom work at BPOM's Arno farm), with a focus on developing the seeding skills of three senior workers.

Farm manager Virgil Alfred said that the change in work attitude among the ten Marshallese employees has been noticeable as a result of the growth of their knowledge of pearl oyster growing since Aquilina started the training.

Why is Aquilina breaking with the tradition of secrecy surrounding her trade? She said that when she started learning pearl seeding skills, she experienced difficulty in gaining training from those skilled in the trade. As a consequence, she said she appreciates the difficulty that people in small islands have in gaining access to these skills and wants to help pass them along. In addition, by passing along skills to people locally, they can then participate more fully in their own businesses and economic development, she indicated.

Sowing the seeds of knowledge

Source: *The Marshall Islands Journal* – 22 March 2002

Black Pearls of Micronesia pearl farm is receiving support for training Marshallese pearl farm staff in pearl seeding skills from two U.S. federally-funded programmes.

Both the Saltonstall-Kennedy programme of the U.S. National Marine Fisheries Service (NMFS), and the Workforce Investment Act (WIA) are providing support for the training of Marshallese

To appreciate her contribution at the Bikirin farm in just three weeks, one has to understand how other seeding technicians cloak their work in secrecy. 'One worked behind a curtain and wouldn't allow anyone near him when he was seeding the oysters,' said Bobby Muller. Another turned a high-backed worktable around so that the six-foot-high back blocked any curious local workers from seeing what he was doing.

With Aquilina on the island, it was the first time that the worktables were turned so that the Marshallese workers could see her work — and begin learning how to do the seeding themselves.

Aquilina said that it's not a skill that's learned overnight. BPOM has already made plans to bring her back later this year to conduct another seeding and continue training the local staff. In addition to working here, she's also working with two pearl growing farms in the Cook Islands, providing similar seeding services and training.

Is she worried that by passing on her skills, she'll put herself out of a job? On the contrary Aquilina believes there's plenty of work for pearl seeding technicians in the region, and that because of the difficulty in developing a proficiency level, there's plenty of work for the foreseeable future.



pearl farm workers. The training programme involves all aspects of farm operations, from setting lines, caring for oysters, seeding both round and half pearls, and harvesting.

The NMFS-supported project will continue into 2003, with another formal seeding training later this year.



Developing a pearl oyster industry in Micronesia.

Excerpted from an article by Robert Jackson in: *Micronesia Land Grant Update*, March 2002

Development of economically viable industries in Micronesia to support the fledgling economy is at the top of development priorities. A research and extension project on developing a pearl aquaculture industry and developing local expertise in Micronesia has been initiated. A pearl hatchery expert from Australia has been hired and a hatchery was built at Nett Point, Pohnpei for training local

people who will eventually gain the knowledge and skills necessary in establishing, managing and maintaining their own farms. There is an insufficient number of juvenile pearl oysters (spat) in the waters around Micronesia. The project will provide an alternative method of providing a constant and high quality supply of spat, and will immediately begin the transfer of technical know-how from the

pearl expert to the local people. In the future the hatchery project will be managed by COM-FSM and it will be extended to the rest of Micronesia.

Nukuoro plans local sale of first pearl harvest

The Nukuoro Municipal Pearl Farm is planning a sale of its first pearl harvest on the island of Pohnpei in May 2002. The initial harvest of 900 pearls has been graded and will be sold 'loose' at a

locally organised sale over a two-day period. Remaining pearls will be sent to a jeweller in Malaysia for setting into pendants, earrings and bracelets in time for sale at the upcoming Micronesian games in July of this year.

The Nukuoro farm is also preparing for a visit by a seeding technician in June 2002 to harvest 4400 seeded oysters and to seed up to 10,000 new oysters.



PATS demonstrates successful pearl oyster hatchery technology

Source: *Island Aquaculture Newsletter* from College of Micronesia Land Grant and CTSA – Spring 2002 issue

In a separate but related project to the Land Grant project described on this page, the Ponape Agriculture and Trade School (PATS) embarked on a pearl oyster hatchery and farming demonstration project in August 2001 for students and rural communities in Pohnpei.

From August 2001 to February 2002, a small hatchery and algae room was installed at PATS. Pearl oysters were successfully spawned in February and the school now has approximately 60,000, 4–5 mm spat in their rearing system. Spat will soon be transferred to a submerged farm in Pohnpei lagoon.



CTSA requests funds to support hatcheries in RMI

Source: *Island Aquaculture Newsletter* from College of Micronesia Land Grant and CTSA – Spring 2002 issue

In an effort to overcome the shortage of spat on RMI farms, the Center for Tropical and Subtropical Aquaculture (CTSA) has submitted a request to USDA to re-budget funds designated for snail predation mitigation research into hatchery opera-

tions. Spat supply for Marshallese farms ran dry in March 2001 with the closure of the RMI's only hatchery, operated by BPOM. Without a renewed supply of spat, the pearl industry in RMI faces possible collapse.



Growth in West Australian black pearl industry

Source: Michael Zekulich in the *West Australian* – 2 October 1999

The issuing of 10 new black pearl farming licenses will bring the state's total to 28, prompting the State Government to forecast a AUD 10–20 million industry within a year and, in the Shark Bay area alone, a forecast of AUD 200 million within

10 years. Peter Morgan, one of the first black pearl farmers in Shark Bay, believes Western Australia could rival the South Pacific pearl industry in the near future.



WA black pearl industry

Source: Michael Zekulich in *The Age* – 23 June 2000

Western Australia cultured pearl farmer, Peter Morgan, believes the black pearl industry in WA could be worth AUD 200 million a year within a few years. Principal of Blue Lagoon Pearls, Mr Morgan, said it has taken over seven years and AUD 2 million to produce the first fully-grown black pearls in the region. Most black pearls are

produced in Tahiti and then sold internationally. Top-quality black pearls can fetch more than AUD 5000 on the international market, more than three times the price of the biggest cultured albino pearls. Mr Morgan hopes to produce 60,000 pearls a year by 2003.





Pearl research laboratory being built in Tahiti

Source: *Tahiti presse* – 20 February 2002

During a recent ceremony, Jacques Calvas, head of the IFREMER Oceanologic Center of the Pacific, laid the first brick of a new laboratory that will be devoted to pearl oyster research. IFREMER is the key French sea exploitation research institute, and its Tahiti center is based in Vairao.

A team of 10 people in the new laboratory will undertake studies on viruses and bacteria specific to pearl oysters. The research center is due to open in November 2002.



Pearl oysters in Busuanga, Palawan

Adapted from: *SEAFDEC Asian Aquaculture* XXIII(3-4) – May–August 2001

Philippines hatchery update

People from Southern Marine Corporation (SOMMACO) and Hikari South Sea Pearl Corporation in Busuanga in the Calamian Group, Palawan, sum up hatchery technology for pearl oysters in the Philippines as still in the experimental stage. Different factors pose a limitation to the large-scale production of pearl oyster larvae.

Hikari resident manager Augustin Badon said that in general, only 70 per cent of the hatchery part of pearl farming are technically mastered. The remaining 30 per cent are 'an art'.

'It is not like the tiger shrimp industry where everything is already in place, so we know what problems to expect and the proper adjustments to make. In the pearl oyster hatchery, we cannot say which technique is effective and which is not. We simply look for solutions each time we encounter problems. If we can establish definite hatchery techniques for pearl oysters, we can produce five

to six times a year.' Presently, they are able to produce twice a year.

SOMMACO consultant Malou Sanchez, on the other hand, said that SOMMACO has seen some improvements in the years they have spent culturing pearl oysters. Survival rates have increased to 90 per cent and SOMMACO has been able to improve the quality of the shells they produce.

'There are only about seven of us (corporations involved in pearl farming) here, so we are willing to share whatever resources we have. But the intricate process and the cost of technology involved allow us to produce pearl oyster larvae mainly for our own use.'

She also said that SOMMACO is aiming for higher survival rates and very good genetic stock at low production costs.

SOMMACO has a building facility that's been constructed to facilitate the flow of work. It requires

the least number of people and the least number of movements. The water pump and filter systems are juxtaposed with the algal production facility where natural food is grown. Next to it is the larval rearing area which then flows into the nursery where the larvae are prepared for deployment.

John Hamiter, another SOMMACO consultant, said that with this design, they have no need to go out of the building at all, especially during typhoons.

On the other hand, Hikari hatchery technician Redentor Diaz said that there are important factors to consider in the larvae culture of pearl oysters.

There are *Vibrio* bacteria that destroy spat. Contamination is prevented by filtration and disinfection using chemicals (such as hydrochloride). Abrupt changes in water salinity and temperature also affect the distribution of plankton, which provide nutrients to the larvae.

‘We have to ensure the quality or condition of spawners or parent shells from the wild. We have to be careful about food contamination. Failure to detect contamination in feeds (usually due to the wrong culture of phytoplankton) can result in mortality.’

And this is just in the hatchery stage. Mr Badon said that at most, they have a 20 per cent survival rate of the 500,000 mother of pearls deployed in long lines.

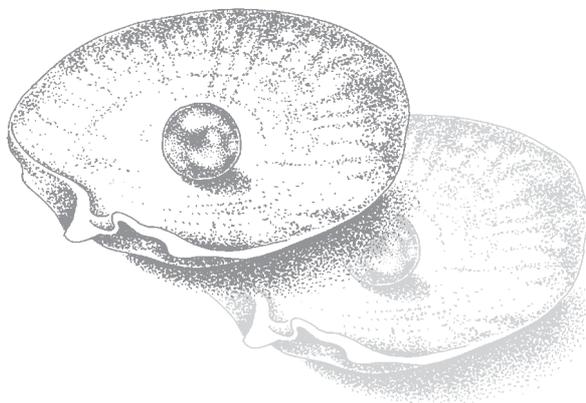
At present, most pearl farmers use 20 per cent wild and 80 per cent hatchery-bred parent shells because they do not want to deplete the sources from the wild. They prefer to use hatchery-bred parent stock because they are able to determine its condition.

Pearl farming has also created some controversies in Busuanga. Local fisherfolk complain that pearl farms have displaced them from their traditional fishing grounds and that long lines obstruct navigational routes, especially at night.

Mr Badon estimated that pearl farms cover about 10–15 per cent of Busuanga’s sea waters.

‘But they can’t discount the benefits that the pearl farms have given back,’ Ms Sanchez said.

Jonathan Sacamay, a cultivation technician of Hikari, expressed that pearl farms have provided a permanent source of income to workers both in and outside the locality — many Hikari workers come from Iioilo and other parts of the Visayas. They help preserve the marine ecosystem and enhance the fishery stock as long lines also serve as aggregating devices that attract marine animals to spawn. Pearl farms discourage the practice of dynamite and cyanide fishing as this can be destructive to the mother of pearls being cultured underwater. Prohibition is possible with the cooperation of the local government, which derives income from the rent paid by pearl farm operators.



Pearl culture in Hainan, China

Wayne O'Connor¹ and Aimin Wang²

Attending a World Aquaculture Society conference provides an opportunity to gain an insight into much of the host countries' aquaculture activities; however, in China the sheer size of the industry seems only to be matched by the diversity of species cultured. Here, two days is insufficient to see all that is cultured in a single province, but if it's all the time you have, and you also have an interest in pearl culture, Hainan is worth the visit.

Hainan is a large island (34,000 km²) in the South China Sea off the southern Chinese coast. Most of the 7.1 million people live in the two largest cities, Haikou, the capital, and Sanya, a resort town on the southern coast. The island is tropical and particularly popular with Chinese tourists who visit the area to enjoy the mild winters. Temperatures average a little over 25°C and rarely drop below 18°C. Aquaculture is the island's most important industry, which until recently was dominated by fish culture. Now, thanks to the introduction of white shrimp, *Litopenaeus vannamei*, shrimp culture leads production. Regardless, Hainan is home to a wide variety of cultured species and has populations of *Pinctada martensii*, *Pinctada maxima*, *Pinctada margaritifera* and *Pteria penguin* at its disposal.

Pearl oyster culture in China occurs in the southern provinces of Guangxi, Guangdong and Hainan, although production from Hainan is comparatively very small. As in the other provinces, pearl culture has focused largely on *Pinctada martensii* and, to a much lesser extent, *P. maxima*. Both species are readily available from fisherman and have been produced in hatcheries run by staff of the Fisheries Department, Hainan University (FDHU).

While *P. martensii* can be spawned throughout the year, hatchery production generally occurs from February to May and from September to December. The techniques used are simple, reliable and inexpensive. Broodstock are gathered from the wild and from farms and can be spawned using temperature induction techniques or, in the case of *P. martensii*, simply sacrificed

and the gametes collected. Larvae are cultured in tile-lined concrete tanks and fed algae (*Dicrateria zhanjiangensis*, *Chaetoceros muelleri* and *Tetraselmis (Platymonas) subcordiformis*). Bakers yeast, *Saccaromyces cervisiae*, is also used as a feed supplement during early larval culture. The larvae remain in the same tank until settlement and water is exchanged daily using a mesh covered siphon hose.

After approximately 24 days, larvae develop to pediveliger stage and settlement collectors are introduced to the larval culture tank. Each collector comprises ten 20 cm x 20 cm sheets of thin plastic suspended one above the other at intervals of approximately 10 cm. When spat have reached an average size of about 1–2 mm they are gently removed from the plates and the walls of the tank using a sponge. The spat are then grown in the field in fine mesh bags until they reach 5–8 mm when they are transferred to cages.

P. martensii are held on the farm for a period of 15 months until they reach 70 mm. The oysters are then commonly seeded with two nuclei of between 4.5 and 7.5 mm diameter. Following operation, the oysters are returned to the farm for a further 11 months before they are sacrificed and the pearls are collected. Survival rates from spat to 70 mm and from seeding to harvest were reported to be approximately 35 per cent and 60 per cent, respectively.

The experimental farm maintained by Hainan University can be found in Linshui Bay and is constructed of concrete pylons that are driven into the seabed. Timber poles are placed between the pylons to produce a lattice from which mesh cages holding the oysters are suspended. A hut has been constructed above the farm to house students and workers, and to permit operations and maintain security.

When initially set up in 1978, the farm at Linshui Bay produced pearls from both *P. martensii* and *P. maxima* although in the interim, attempts to produce *P. maxima* were halted and have only recently

1. NSW Fisheries, Port Stephens Fisheries Centre, Taylors Beach, NSW, Australia.
2. Fisheries Department, Hainan University, Haikou, Hainan, P.R. China.

been revived by Professor Wang. The current farm site is small, approximately 1 mu (15 mu = 1 ha) in an area of particularly intense fishing and aquaculture activity. Nearby farms include seaweed culture, fish farms and spiny lobster growout. These additional activities were blamed for the demise of nearby edible oyster farming and were thought to be affecting the viability of pearl farming. Thus, moves were underway to select alternative, more remote sites for pearl culture.

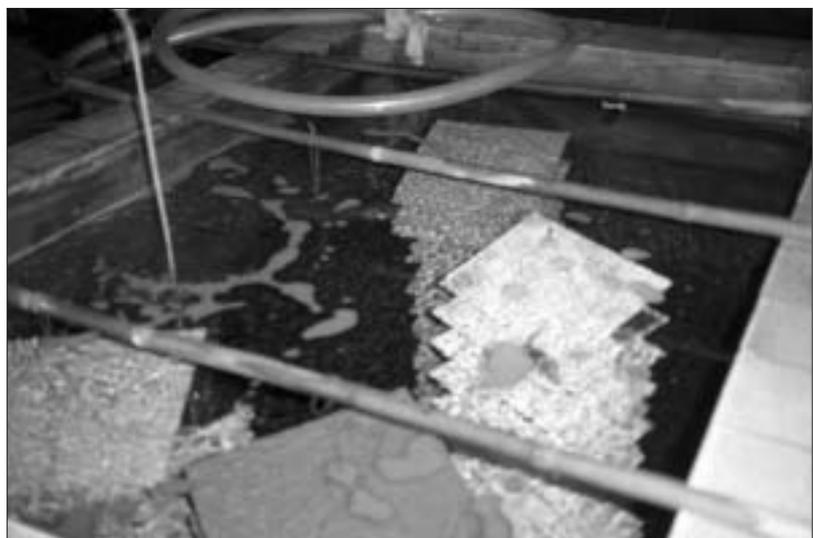
Nearby, in Sanya City, Professor Wang is establishing a Pearl Oyster Research Institute, which boasts a hatchery facility to produce both *P. martensii* and *P. maxima* spat, and a farm site for the cultivation of *P. maxima*. The institute will permit furthering development of techniques for the production of polyploid *P. martensii*. In addition, Professor Wang, in conjunction with Dr Fang Xuan Jun of the Hainan Institute of Tropical Agricultural Resources, is also investigating two other approaches to improve pearl quality.

Stemming from earlier work in Guangxi Province, a coated nucleus has been developed that reportedly increases post operative survival and reduces rejection rates. The coating is said to contain both an antibiotic and a constituent that accelerates the proliferation of epithelial cells from donor mantle tissue. Equipment has been purchased to begin small-scale treatment of nuclei to permit further evaluations. When treated, the nuclei are a lemon-yellow; however the colour is said to dissipate rapidly after implantation. The treated nuclei are expected to have a shelf life of at least 12 months when stored correctly.

Slow growth rates and the high prevalence of mudworm (*Polydora ciliata*) infestation have hampered *P. martensii* farming in Hainan. Fortunately, the succession of agriculture to aquaculture, in terms of economic importance in Hainan, has Dr Fang turning some of his attention from crop genetics to pearl oysters. Using oyster stocks gathered from Sanya (Hainan), Beihai (Guangxi) and



Algal culture room at the Pearl Oyster Research Institute, Sanya.



*Plastic collectors used to settle *P. martensii* and *P. maxima* spat.*

Daya Bay (Guangdong), each strain and its hybrids are being assessed for parameters of importance in pearl culture (growth, survival and nacre colour). First- and second-generation oysters have been produced and have shown significant variation in growth and survival. Using random amplified polymorphic DNA (RAPD) techniques, Dr Fang is attempting to find markers for these characteristics

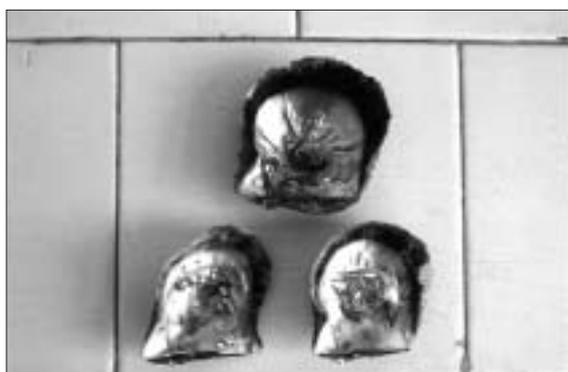
to accelerate selection. Innovative techniques are also being assessed whereby digital images of the nacre layers are used to quantify colour characteristics so that further selection on this basis might take place.



Hainan University pearl farm at Linshui Bay, Hainan, with a small fish farm in the foreground.



Pearl Oyster Research Institute hatchery at Sanya, Hainan.



Pinctada martensii shells showing blistering caused by Polydora infestation.



Tahiti pearl producers snubbed by international buyers

Source: Oceania Flash/SPC – 1 March 2001.

The first black pearl auction of 2001 in French Polynesia was deemed a disappointment due to low attendance by international buyers, the daily newspaper *La Dépêche de Tahiti* reports.

Tahiti Pearl Producers (TPP) President Franck Tehaamatai said that of 169 lots auctioned earlier this week, only 132 were sold. He also said the lots were sold at lower than expected prices.

The two-day sale at Papeete's Sheraton Hotel netted 608 million French Pacific Francs (USD 4,735,619). Producers had anticipated netting 750 million CFP (USD 5,841,636).

International buyers attending the auction came from Japan, Hong Kong, France, Spain, Australia and Hawai'i.

TPP embarked on a 'clean-up' operation last year aimed at preserving high quality standards to

deter the sale of cheaper, lower quality pearls. Producers are now wondering whether they should lower their prices.

'Maybe we are wrong after all. Maybe we should bring our prices down. But, if it were to happen, I think it's not even worth cultivating pearls. There is a bottom price below which you cannot go,' Tehaamatai said.

In light of this setback, TPP is currently considering forming a centralised buying syndicate that would ensure minimum prices and lure smaller producers who are discounting their pearls.

'At the moment, they are panicking and selling their production at very low prices. Our move would give the black pearl its value back. This is in the interest of the pearl industry and the whole economy that revolves around it', a TPP spokesman said.



Hong Kong pearl auctions: Blacks, whites and plenty of grey

The pearl world's two biggest producers — Nick Paspaley of Australia and Robert Wan of Tahiti — followed different strategies for selling their cultured goods at the recent auctions in Hong Kong, but both walked away from their respective sales with what insiders described as good results. And yet, the future of prices seems as uncertain as ever.

The Paspaley Pearls Auction held 25–27 February, — during the 19th Hong Kong International

Jewellery Show — sold about 80 per cent of the pearls on offer, with most falling in the commercial quality range.

South Sea pearls have seen a significant price drop in the past year, with some dealers reporting falloffs as steep as 25 to 30 per cent. The question on everybody's lips is: 'Has the industry hit bottom?' Many say yes.

'Prices are firming up but are still modest,' said Alex Vock of ProVockative Gems, a South Sea pearl specialist in New York.

Prices on goods in the commercial quality range are up about 20 per cent from last November's auctions, while fine quality goods are still pricing below last year at this time, Vock said. He suggested that a new spurt of production out of Indonesia has created an excess of fine quality supply.

The Tahitian pearl picture is slightly cloudier. Wan, the kingpin of the Tahitian industry, sold nearly 50,000 pearls — roughly 40 per cent of the lots on offer — for a total of USD 3.5 million at the 10th Robert Wan/Tahiti Perles Auction, held 28 February to 1 March.

Instead of allowing pearls to sell below their reserve price, the mega-producer opted to hold on to the goods, doing his best to stabilise the volatile Tahitian market, which has seen such a glut of commercial quality pearls in the recent past that prices have tumbled — and continue to tumble. To stop the free fall, Wan announced a reduction in his 2002 production schedule, a move that was

designed to complement the supply controls instituted by the Tahitian government last year.

'To continue pearl production at the same pace in view of the economic situation both worldwide and in French Polynesia would only force the price of Tahitian pearls even lower,' he said in a prepared statement.

After the auctions, the optimists of the industry said the measures show signs of paying off, pointing to unconfirmed reports of large numbers of Tahitian farmers going out of business. The subsequent decrease in production, they say, indicates that six to eight months from now, pearl buyers will start to see prices climb. But pearl realists complain that they've heard that refrain one too many times.

'What we hear, and what we see, are different,' ProVockative Gems' Vock said. 'There is so much product in the [Tahitian] pipeline, so no one I know is buying or pricing in a way that is gambling the supply will come down. The only way to sell Tahitian pearls is to sell them cheap.'



Perles de Tahiti's new ad campaign: Latest effort to stabilise black pearl market

by Greg Andrews

Source: *National Jeweler* – 16 January 2002

In its ongoing effort to maintain the value, quality and reputation of Tahitian black pearls, the Perles de Tahiti trade association recently launched a new consumer marketing campaign that positions black pearls as a 'must-have' luxury accessory for the sophisticated female shopper.

Perles de Tahiti — an association of pearl farmers that supports the marketing of black pearls worldwide — hired Miami-based DJS Marketing Group last fall to launch the campaign. The multi-layered marketing initiative includes print and direct-mail advertising as well as events promoting Tahitian black pearls.

Evoking images of 'sophistication, timeless beauty and value,' the campaign's intent is to emphasise the appeal and stature of wearing Tahitian black pearls, according to DJS Marketing.

'Women desire jewellery that's striking and unique', said Deborah J. Scarpa, president of Miami-based DJS Marketing. 'Our campaign will

position Tahitian black pearl as a classic addition to any woman's wardrobe.'

The new campaign comes on the heels of numerous initiatives implemented in 2001 by the French Polynesian government, in concert with Perles de Tahiti, to rid the market of inferior-quality Tahitian pearls, lessen the surging volume of exports coming out of the territory over the last 15 years, raise falling prices for the pearls, and restore industry confidence in the product.

According to Perles de Tahiti, Tahitian pearl exports increased from 104.1 kg in 1996 to 11.4 t in 2000. During that same period, however, prices plummeted from a record high of USD 76 per gram to just USD 13 per gram. This overproduction, coupled with a flood of poor-quality pearls entering the market, drove prices downward and hurt the product's overall reputation, industry experts said.

The new government initiatives intended to help stabilise the market include: setting the minimum

nacre thickness requirement for all exported Tahitian pearls to 0.6 mm (to be raised to 0.8 mm in July 2002); closing all French Polynesia lagoons to new maritime concessions; requiring that seeded oysters remain in lagoons for at least 18 months to achieve minimum nacre thickness; enlarging the 'rejects' category so that fewer, but better-quality pearls reach consumers; tightening customs controls at airports to prevent rejected pearls from

being smuggled out of the country; and requiring all would-be pearl exporters to receive a stamp of approval from the Tahitian Pearl Department.

The government has also levied a tax against all exported Tahitian pearls of about USD 150 per gram, a 25 per cent increase intended to help finance the new controls imposed on local pearl farmers.



The current status of Chinese freshwater cultured pearls

By Shigeru Akamatsu, Li Tajima Zansheng, Thomas M. Moses and Kenneth Scarratt

Source: *Gems and Gemology* 37(2):96–113

Chinese freshwater cultured pearls (FWCPs) are assuming a growing role at major gem and jewellery fairs, and in the market at large. Yet, it is difficult to obtain hard information on such topics as the amount produced, type of quality, and the culturing techniques used because pearl culturing in China covers such a broad area, with thousands of individual farms, and a variety of culturing techniques are used. This article reports on recent visits by two of the authors (Shigeru Akamatsu and Li Tajima Zansheng) to Chinese pearl farms in Hanzhou Province to investigate the latest pearl-culturing techniques being used there, both in tissue nucleation and, much less commonly, bead (typically shell but also wax) nucleation. With improved techniques, and by using younger *Hyriopsis cumingi* mussels, pearl culturers are producing freshwater cultured pearls in a variety of attractive colours that are larger, rounder, and with better lustre. Tissue-nucleated FWCPs can be separated from natural and bead-nucleated cultured pearls with X-radiography.

The popularity of Chinese freshwater cultured pearls (FWCPs) has risen dramatically on the world market. The unique characteristics of the Chinese FWCP — in terms of size, shape, and colour — have been key to this popularity. Chinese FWCPs are available in sizes ranging from 2 mm to over 10 mm; in an interesting variety of shapes such as round, oval, drop, button, and baroque; and in rich colours such as orange and purple, often with a metallic lustre. The vast majority of these Chinese FWCPs are nucleated by mantle tissue only, although some nucleation with spherical beads has taken place (Bosshart et al. 1993; 'China producing nucleated rounds' 1995; Matlins 1999; 'China starts...' 2000; Scarratt et al. 2000). This makes them distinct from the overwhelming majority of cultured pearls from other localities, which are bead nucleated. Despite the growing popularity of Chinese FWCPs, details concerning

their history, culturing areas, production figures, culturing techniques, and the characteristics of the pearls themselves are not widely known. In response to the growing demand for information, two of the authors visited six FWCP farms and one nucleus manufacturer in China's Zhejiang district; they also examined hundreds of Chinese FWCPs. The trip was made from 25 to 29 July 2000; information in this article has been confirmed and updated since then, based on the second author's monthly trips to the pearl-farming areas to visit his pearl factory in Zhuji City, as well as to purchase fresh water cultured pearls for export. In addition, the first author has visited Chinese freshwater pearl-culturing areas several times during the past two years. This article reports on the current status of the Chinese freshwater cultured pearl, both the various culturing techniques used and the cultured pearls themselves, updating (and superseding) the pearl-culturing information in Scarratt et al. (2000).

Conclusion

Annual production of freshwater cultured pearls in China is estimated at about 1000 tonnes, with approximately 650 tonnes usable in the jewellery trade. However, the present expansion of cultivation indicates a substantial increase within the next two or three years. Although more high-quality FWCPs are being produced as cultivation methods improve, most of the Chinese FWCPs are still of moderate to low quality.

The improvements in size, shape, surface condition, lustre, and colour seen in recent years are the result of many advances in the culturing materials and techniques used. These include changing mussel species from *Cristaria plicata* to *H. cumingi*, nucleation of younger (one-year-old) mussels, improvement in the tissue nucleation (rolling a thinner piece of mantle into a round shape and inserting fewer pieces into the host mussel), a rela-

tively longer culturing period, and a frequent change of culturing farms.

Bead-nucleation techniques also are being developed, but our experience indicates that bead-nucleated FWCPs continue to represent a very small percentage of the total production in China. This appears to be due to the technical difficulties and culturing costs involved. For example, bead nucleation doubles the labour required because both a bead *and* a piece of tissue must be inserted into the pocket, whereas tissue nucleation requires only a single action to insert the piece of tissue. In any event, the separation of bead-nucleated from tissue-nucleated cultured pearls, and of the tissue-nucleated product from its natural counterparts, is readily accomplished with contemporary X-radiography techniques.

While this information represents the study of several pearl operations and hundreds of FWCPs, the fact that China has many thousands of pearl farms and produces tonnes of cultured pearls annually

makes it impossible to provide a complete story. We believe, however, that the information we have provided is representative of the Chinese product seen in the market today and that the new nucleation and culturing techniques promise an even better product in the future.

About the authors

- Mr Akamatsu is former manager of the Pearl Research Laboratory and currently general manager of the Sales Promotion Department, K. Mikimoto & Co. Ltd., Tokyo, Japan.
- Mr Li, who started his Chinese freshwater cultured pearl business in 1985, is president of Stream Co., Tokyo and Hong Kong; in 1998, he established a pearl-processing operation in Zhuji City, China.
- Mr Scarratt is laboratory director at the AGTA Gemological Testing Center, New York.
- Mr. Moses is vice president of Identification Services at the GIA Gem Trade Laboratory, New York.



Excerpts from *Pearl World – The International Pearling Journal*

The following five articles were selected by Richard D. Torrey, publisher of *Pearl World: The International Pearling Journal* to present an overview of the cultured pearl industry situation in French Polynesia.

The Tahitian mess... and efforts to clean it up

In an article entitled 'Tahitians ban all inferior quality pearls from export' National Jeweler reported in the 1 May issue as follows:

In an effort to safeguard the worldwide reputation of Tahitian pearls threatened recently by a glut in the marketplace, the French Polynesia Assembly has adopted a measure revising the classification of the black gems, prohibiting all inferior-quality goods from being exported.

The legislation, which is scheduled to take effect on 1 May, comes on the heels of French Polynesia President Gaston Flosse's 14 March announcement that his government would be streamlining pearl production and export policies so that the Tahitian cultured pearl, could maintain its position in the world market. Over the last three years, over-supplies have dragged down prices on the once-exclusive gems, forcing the government to respond to criticism that it has allowed production to run amok.

'We were concerned there was too much on the market,' said Kevin Lane, vice president of retail marketing for Mikimoto. 'We even approached the government about it. Apparently, they've put some measures in place.'

Indeed, they have. According to the new classification measures, rejected pearls will be subject to stricter definitions, particularly those that hover around the D category, the lowest quality pearls that may be sold locally and exported overseas. The Assembly voted to increase the number of criteria used to determine what constitutes a reject pearl from three to five. The two new criteria specify that a rejected pearl has a 'milky loss of normal pigmentation marks over more than 20 per cent of its surface,' and it has no lustre.

The measure also made slight changes to the definitions of B, C and D category pearls, sometimes as little as one word. For example, B-quality pearls are now defined as those that have imperfections 'concentrated' over less than a third of their surface, C-quality pearls are those with 'light' concentrations' of imperfections over less than two-thirds of their surface, and D-quality pearls are those with 'light' imperfections over more than two-thirds of their surface and 'no deep imperfections'.

The A category, which refers to pearls with no more than one imperfection or a group of localised

imperfections concentrated over less than 10 per cent of a pearl's surface, remains unchanged.

Suggested changes in the marketing of Tahitian SSPs

'Many in the black pearl trade attribute falling Tahitian pearl prices with overproduction' began an article in a recent Jewellery News Asia. In the article, Francois Duval-Arnould, President of Midnight Pearls International (Hong Kong) presented a different point of view.

The Tahitian pearl is a beautiful gem. But given the way it is currently sold, the market value of Tahitian pearls can only decline.

My belief is that raising production is not the main cause of declining Tahitian pearl prices. Markets such as India and China still present immense potential. World demand for Tahitian pearls is strong and ever increasing. A production of 11 tonnes of Tahitian pearls is relatively small compared to the potential of the world pearl market.

The problem lies in how effectively producers sell their pearls. Why are 11mm Chinese freshwater pearls higher in price than 11mm Tahitian pearls when production of Tahitian pearls in these sizes is lower than that of Chinese freshwater pearls? Everything depends on how the pearls are sold and distributed.

In French Polynesia, owing to the low cost of setting up a pearl farm, many of the population can afford to start a pearling business. But among the numerous Tahitian pearl farmers, how many actually understand the various aspects of developing a business? Many do not know how to price their pearls.

A more organised channel for sales is through auction. In addition to the auctions organised by individual producers in Hong Kong, three auctions are organised annually by GIE Pearl Producers and GIE Poe Rava Nui in Tahiti. All producers are welcome to sell their pearls at these auctions.

One suggestion is that the government could set up a buying centre to sell pearls on behalf of individual producers. The buying centre would provide a basic partial payment to individual producers. With their cash flow needs taken care of, these producers would not need to sell their crops quickly at erratic prices.

I am confident that better organised selling at the producers level would bring an instant rise in Tahitian pearl prices of at least 20 per cent.

A lot of work needs to be done in the area of information to help producers understand that selling

through proper channels is to their benefit.

It is a pity that many producers sell at erratic prices to wholesalers, and that these wholesalers dump the goods at the first possible opportunity out of fear of stock depreciation.

When wholesalers buy from producers, who have little understanding of the international pearl business, they negotiate for the lowest prices, sell at a 10 per cent markup, and go for a fast turnover.

This practice allows wholesalers to make fast profits and minimise risk. But in such a practice, neither producers nor wholesalers take a long-term view of the Tahitian pearl industry.

Pearl farms are spread out over the archipelagos in French Polynesia. Communication among farmers is inadequate. GIE Perles de Tahiti and the various associations of pearl producers have done a great job in terms of promotion, and in organising the three auctions in Tahiti, but a lot remains to be done.

Given the effective worldwide promotion and the strong demand for black pearls, Tahitian pearls should command a much higher value at farm level than they do at present. They are currently selling at huge markup at the retail level, because while Tahitian pearls have a high perceived value, they are being sold at an unreasonably low value at farm level.

Why cannot people take a long-term view of this industry when GIE Perles de Tahiti is spending the largest sum any pearl association has ever spent to promote Tahitian pearls?

Why cannot people take a long-term view of this industry when French Polynesia produces such pearls of unique beauty?

Sorting out the blacklip debacle

The following article from the 1 August issue of National Jeweler gives a pretty succinct overview of what's gone wrong with the Tahitian cultured pearl industry.

French Polynesia includes five archipelagos and 2589 square miles of Pacific Ocean.

'The amount of real estate is immense,' said Armand Asher of the Albert Asher South Sea Pearl Company in New York. 'There are quite a few places to grow oysters.'

To be exact, there are 1076.

That's how many farms span this vast ocean network, according to numbers compiled by Perles de Tahiti, a trade association that promotes Tahitian pearls worldwide. What's more, 753 of them total less than 12 acres, mostly mom-and-pop farms churning out goods to pay for their daily needs.

This is one way to explain the recent plunge in prices on low- to medium-quality Tahitian cultured pearls. Simply put, there are more farmers growing more pearls in more places than the current market can absorb. As the US economy softens, many people are finding that pearl purchases they made not more than a few months ago have already depreciated, in some cases by as much as half.

Even more startling, strands that would have been worth USD 100,000 twenty years ago are now going for as little as one-tenth of that price, said Alex Vock of ProVockative Gems, New York.

Decent quality strands from 9 to 11 mm have felt the brunt of the price blow. They are fetching any-

where from USD 3500–5000 wholesale, a 30–50 per cent drop from a year ago, dealers said. But many pearl industry insiders continue to speculate about when or if the market will hit bottom. Some think it already has.

'I don't think prices will go any lower,' said Devin Macnow of the Cultured Pearl Information Center in New York. 'According to my sources in Tahiti, they can't go any lower. Farmers just can't sustain it.' Leonard Federer of New York-based Tri-Gem Industries, a big supplier of Tahitian pearls, concurred.

But price volatility hasn't touched the market for fine-quality pearls in sizes above 13 mm or 14 mm, Federer insisted. Apparently, the cream of the crop is hard to find and even harder to match. 'We are constantly looking for those goods, and they are fetching a premium,' Federer said. Everyone seems to agree, however, that smaller, spotted goods in the C and D quality ranges are pricing lower than dealers have ever seen.

'We still have to see how the year goes, but, right now, supply is strong and demand is weak,' said Anil Sethi of Tara & Sons in New York. 'We're already at the point where the cost of production is more than the market is willing to give.'

Meanwhile, 77 per cent of US jewelers responding to a recent Perles de Tahiti-sponsored survey indicated they expected Tahitian pearl sales to increase by the end of 2001.

Controlling production

To continue on this subject, we pick up from an article in the 1 August issue of Jewellery News Asia which reports on the additional measures that Tahiti has drafted to eliminate low quality pearls.

To stop the expansion in production, the government has started suspending the issue of new leases for farming in several islands. To upgrade the size of pearls produced, the government may impose a new import tax on shell nuclei below 7 mm.

In addition, it plans to restrict the number of employment visas issued for pearl technicians from overseas. A total of 242 overseas pearl technicians are currently working at 60 pearl farms in French Polynesia: 190 from China and

52 from Japan, in addition to a further 22 independent technicians.

'By reducing the number of employment visas and reducing the number of technicians we will automatically reduce production,' Mr Coeroli said.

The use of Chinese technicians was cited among the trade as one reason for the decrease in pearl size. 'It is true that Chinese technicians are specialists in small sizes and are usually not skilled at grafting larger sizes. Many producers are turn-

ing to Chinese technicians because the wages are much lower compared with those for technicians from Japan.

'It is a vicious circle. Pearl dealers put pressure on prices; producers cannot make a profit at the price offered, so they reduce production costs by

employing Chinese rather than Japanese technicians and they thereby produce smaller pearls, reducing the average price and size of pearls. We hope the new measures will break this cycle and help increase size and quality of the Tahitian pearl production,' Mr Coeroli said.

Dealers news – Tahitian SSPs

Strange times are still afoot in French Polynesia

In mid-December it was reported that Robert Wan's Tahiti Perles were 'restructuring their organisation' by putting 520 staff and workers 'on ice' for six months at 10 per cent of their normal salaries, and that only skeleton crews would remain on all farms (including Marutea, Nego Nego, Fakawara and Gambier) for care taking and maintenance. Sales would be maintained by administrative staff.

To date this hiatus in production has not seemed to have had a major impact on the quantity of goods flowing through the pipeline.

At the Tucson Show, we found out that there is still great, widespread unease about the Tahitian product.

One US dealer told us: 'Tahitian SSPs are a big problem. As you can see, I don't stock a lot of Tahitians. Why? Because I'm really very critical of the people in Tahiti. Basically, the bottom line is that pure greed is rampant. It's a jungle out there. And the authorities promised to take control of the situation. An official came to me and said: "Oh, we're doing this and we're doing that to improve matters." And nothing has changed. They're still flooding the market. And retail jewellers continue to lose confidence in the product because they don't know from day what's going on. I just don't see the light at the end of the tunnel with Tahitian goods. Producers are too hungry for money, and it seems to me that every little guy — whoever wants to do it — can easily put oysters into the water and keep them there and hope that they can get some pearls out of them.'

A recent update from Andy Muller reports that black pearl woes continue abroad: 'With Tahitian blacks, an unstable price situation remains and confidence really needs to be restored in the product.'

'The (temporary?) halt in production from Tahiti's largest farmer still shows little effect on the market. Even though no oysters are to be grafted for at least six months (January to June), there are still lots of goods in the market and the undercutting and under-selling continues. Only prices for special goods that are scarce, are very firm, or even on the increase; this means large sizes in good colours that are clean, very fancy colours in all sizes, large clean drops, or fine clean goods in all sizes with peacock coloration. Standard goods are in oversupply and price cutting and discounting prevails. It is again obvious that the old pearling law still prevails: In an uncontrolled downward market, there are only losers, no winners. Winners are only found in a controlled, stable market,' he concluded.





Ian Robert Turner

16 September 1946 – 3 April 2002

It is with great sadness that I write of the passing of Ian Turner who drowned tragically at Penrhyn, Cook Islands, on 3 April 2002.

Ian was Australia's first local pearl technician. When I began working in the Australian pearling industry in the early 1980s, Ian had already established his reputation as a technician. Even six years later, when I began seeding round pearls, technical knowledge was not readily forthcoming. It is easy then to imagine the difficulties Ian must have faced in acquiring his seeding skills, and the dedication it must have taken for him to master his craft. He moved to Broome from Melbourne in 1975 with a mechanical engineering degree and lured by the warmth as well as by work on pearling luggers. He worked with Broome Pearls for some years and was introduced to pearl-seeding in 1979 by a technician named Hyuga, and later he honed his skills with Mizuno, a business partner.

Ian had a quiet nature, yet he was always enthusiastic about his work and always willing to share his knowledge. I remember, as a new freelance technician, tentatively phoning him one day when we were both in Broome between respective jobs. He immediately invited me around and spent an intensive hour talking operating technique with me, sketching diagrams to illustrate his points, and being generally encouraging. It was a surprising and welcome change from the customary technicians' reticence.

Over the years Ian worked in many remote places away from Australia, including Kish Island in Iran, Dongonab Bay in the Sudanese Red Sea, several atolls in French Polynesia as well as Manihiki and Penrhyn Atolls in the Cook Islands. Ian always thought deeply about his work, took pleasure in making big pearls, and liked to experiment to improve his technique. His past career as mechanical engineer remained useful too, as he made many of his own operating instruments.

In recent years I also began working in the Cook Islands so Ian and I saw each other from time to time. He taught his daughter Zoe to seed and demonstrated his work to interested locals. Once I visited the seeding house on a small *kaoa* in Manihiki lagoon, where Ian worked and preferred to live. On the wall behind his operating table were many pearl-oyster shells with different characteristics upon which Ian had written interpretive notes in felt-pen as a guide to the farm workers. I was reminded of my Broome visit years before and could see that he was still sharing his knowledge.

We grieve with Ian's family. At the time of his death, Ian was soon to become a grandfather so we also mourn that he will not see his first grandchild. Yet, in another sense, Ian will always be remembered and respected as one of the grandfathers of Australian pearling. Rest in peace, grandfather.

Berni Aquilina



PHD student in India seeks correspondents

I am working as a research fellow at the Centre of Advanced Study in Marine Biology. My field of interest is biology and culture aspect of the Indian pearl oyster *Pinctada fucata*. My PhD title is, 'Some aspects of the biology and physiology of Indian pearl oyster *P. fucata* (Gould)'. I would appreciate receiving advice and suggestions, or

reprints of any work you may have relating to this species.

Joe Austin
54, IInd Street Millerpuram, Tuticorin
628 008, Tamil Nadu, India
E-mail: joeaustin@rediffmail.com



Alabama nuclei producer seeks pearl farmers contacts

I was very interested to discover your publication. I found it to be some of the most informative information on pearl farming that I have come across. I have long been a student on the subject. I exported mussel shells to Asia for many years. I have recently started producing nuclei and have experimental pearl farming operation under way using native American Mussels. I am looking for a complete list

of pearl farmers in Australia, the Cook Islands and French Polynesia.

Greg Howard
Southern Aquatics L.L.C., 249 Byaless Ave.
Florence, AL 35630, USA
Tel.: +1 256 767 7658, Fax: +1 256 767 7358
E-mail: southermintl@cs.com



Black-dyed faceted cultured pearl

Source: *GIA INSIDER* 3(11) – 8 June 2001. Reprinted with permission from the Gemological Institute of America; copyright 2001 GIA, www.gia.edu.

Recently, the West Coast GIA Gem Trade Laboratory received an eight millimetre black faceted pearl submitted for an identification report. The client noticed unusual 'colour spots' that made him question whether it was indeed a natural-colour Tahitian cultured pearl. Although we cannot determine a pearl's provenance, we can determine its identity, whether it is natural or cultured, and whether or not it has been treated.

The item had an attractive black body colour with strong purplish pink overtones. Most of the polygonal facets had been well placed and polished. X-radiography revealed a fairly large bead nucleus, which confirmed that this was a cultured pearl. Using 10x magnification with strong overhead illumination, we observed that the nacre was actually dark brown. This colour was unevenly distributed, and concentrations in some areas gave the surface a slightly spotted appearance. Magnification also revealed that on some facets the top nacre layer had been removed, exposing an almost colourless layer of nacre. Along the rims of those exposed areas was an opaque, light brown deposit of unknown identity.

The reaction to long-wave UV radiation was quite peculiar. The exposed near colourless nacre layer

fluoresced chalky yellowish white, similar in appearance to natural-colour light nacre shell layers. The black nacre surface, however, did not show any fluorescence. Natural-colour black nacre fluoresces either reddish brown or red to long-wave UV. The absence of this type of fluorescence in the top nacre layer proved that it had been treated. EDXRF chemical analysis revealed the presence of silver, which further substantiated our conclusion that the cultured pearl had been treated to attain its black colour. As for the brown deposit around the rims of exposed areas, we could only speculate that it was a by-product of the faceting and treatment process.

Gem Trade Lab Notes contributing editor Karin Hurwit, senior research gemologist at the GIA Gem Trade Laboratory in Carlsbad, provided this report.

For more reports from the GIA Gem Trade Laboratory, see the Lab Notes section of the Summer 2001 issue of *Gems & Gemology*. To obtain this issue or to subscribe, visit www.gia.edu/gandg, or contact subscriptions manager Debbie Ortiz at dortiz@gia.edu. Call toll-free 800 421 7250, ext. 7142. Outside the US and Canada, call 760 603 4000, ext. 7142.





World Aquaculture Society's WAS 2002, Beijing

by Wayne O'Connor

NSW Fisheries, Port Stephens Fisheries Centre, Taylors Beach, NSW, Australia.

The annual meeting of the World Aquaculture Society is one of the few truly international opportunities for those involved in pearls to gather and discuss trends and developments in pearl culture. This year the conference was held in Beijing, China, and, as in past years, it attracted a wide variety of participants from many regions.

As has been the case since 1994, a session devoted to pearl culture was chaired by Richard Fassler of the State of Hawaii Department of Business, Economic Development and Tourism, and this year was co-chaired by Yu Xiang-yong from Zhanjiang Ocean University, China. Talks and posters addressed a number of topics and because there was so much interest, many talks were forced into other compatible sessions. Several themes pervaded the conference; however, concerns of downturns in sales, particularly in black pearls, and the need to increase pearl quality dominated discussions. Student interest in pearl culture was high and both Anne-Michelle Lee and Josiah Pit from James Cook University are to be congratulated for receiving World Aquaculture Society student awards for the quality of their work. It is pleasing to see that their talents have been devoted to aspects of pearl culture.

China

Information on pearl culture in the host country was provided by a number of speakers. Yu Xiang-yong presented a brief history of marine pearl culture in China, describing some of the chal-

lenges facing the industry and outlining developments in Chinese research. Marine pearl culture began following the pioneering work of Professor Dalen Xiong in Zhanjiang, southern China. The first round cultured pearls were produced in 1958 and the industry has grown to an annual output of 25–30 t. Despite its successes, the industry also faces considerable challenges. There has been overfishing of wild stocks and little attention has been paid to the maintenance of genetic diversity in farmed stocks. Water quality is falling, farms are overstocked and mortality rates are high. When pearls are produced, nuclei rejection rates are high, pearl yields are low and pearl quality is frequently poor.

To address the problems facing the industry, Yu suggested that greater government involvement was needed to support research, monitor pollution and to regulate and educate its participants. Some research is underway. Studies are assessing genetic diversity and the potential for hybridisation in akoya oyster (*Pinctada martensii*) stocks using RAPD, isozymic and morphological measures. Other work has demonstrated the advantages of triploidy in *P. martensii*, such as accelerated growth, and attempts have been made to produce tetraploids for triploid production. Researchers are also attempting to diversify the industry by increasing the use of other Pteriids such as the silverlip pearl oyster, *P. maxima*, the blacklip pearl oyster, *P. margaritifera*, and the winged pearl oyster, *Pteria penguin*, which are all found in Chinese waters.

Professor Yu outlined the progress of nucleated pearl culture in the freshwater wrinkle comb mussel, *Cristaria plicata*. The technique is reportedly similar to that used in marine pearl oysters. A single nucleus, commonly 7–9 mm in diameter, is inserted in each mussel along with a piece of mantle tissue. The pearl is then cultured for between one and two years. Production of nucleated freshwater pearls in China is increasing and was just above four tonnes in 2001. Hua Dan, in a later presentation, elaborated on the developments across the industry. The increasing use of an alternate species, the triangle sail mussel *Hyriopsis cumingii*, was noted, and the techniques used to produce non-nucleated pearls were described. Hua reported that China now dominates the freshwater pearl market, producing between 800 and 1000 t of pearls annually. Of these, 400–500 t are exported to Asia, Europe, Africa and America.

As highlighted by Professor Yu, considerable effort has been made to improve growth rates in *P. martensii*. Professor Aimin Wang, formerly with Guangxi Institute of Oceanography and now with Hainan Ocean University, documented attempts to achieve faster growth through the production of tetraploid oysters, which would then be used to provide triploids for farming. Three techniques were described: 1) the inhibition of first polar body release from fertilised triploid eggs, 2) the inhibition of first and second polar body release from diploid eggs, and 3) the inhibition of first cleavage of diploid zygotes. Each of these techniques was capable of producing tetraploid trocophores; however, in all cases, subsequent larval survival was poor. In these trials, only the inhibition of both polar bodies was successful in producing tetraploid juveniles, although the percentage of tetraploid oysters was very low, 0.0625%. In addition, Professor Wang informally discussed his research using microsatellites to select oysters for faster growth and his attempts to revive *P. maxima* culture in Hainan, southern China.

Black pearls

Richard Fassler described the proliferation of black pearl culture through the Pacific and highlighted the benefits this might have for many island nations. However, Fassler noted the importance of the French Polynesian industry and its ability to dominate this section of the market. Here, production has increased rapidly, so much so that it has outpaced marketing efforts. As a result, Fassler and others reported substantial falls in black pearl prices. Anecdotal reports of large-scale layoffs in Tahiti's industry were also made.

Fassler also noted that falls in Tahitian pearl prices will assuredly dictate the prices achieved by other

producers and that to avoid this, attempts must be made to differentiate their products. Emphasis needs to be placed on creating a unique product, perhaps through selecting for different colours or uniqueness in design, but above all quality not quantity must be paramount. He felt that some Tahitian lagoons had been overexploited and that this should serve as a cautionary tale for other emerging producers. Fassler's address was not meant as a requiem for the industry, but there may well be significant changes to the structure of the industry in coming years.

Bernard Poirine fleshed out the maladies of the Tahitian industry by providing an historical perspective on black pearl production and prices. Central to the problems experienced was the over-exploitation of the available lagoon area. In 1972, 1.5 kg of pearls was produced. Since then, production has increased at a rate of 29 per cent a year to achieve a total harvest of 11,764 kg in 2000. This increase has had its corollary in falling prices, and now production is beginning to fall with indicators such as nuclei imports suggesting the fall will continue. This was described as a special case of 'the tragedy of the commons'.

Poirine described theoretical models of pearl production in which the dichotomy between the economic and the biological optima for pearl production was highlighted. In particular, he emphasised that the economic optimum for pearl production is achieved at stocking densities well below the maximum sustainable oyster density. Poirine discussed the merits of various regulatory frameworks in addressing the problems of overexploitation and made reference to quota systems in Australia, and fisheries cooperative management in Japan. Some discussion ensued, with contributions from Terii Seaman and Ben Ponia. A working group has been formed in French Polynesia, which will address issues such as export control, tighter control of pearl concessions, the maintenance of minimum standards for pearl quality, and the regulation of oyster stocking densities.

Consistent with increasing interest in pearl culture, in particular *P. margaritifera*, Ajai Sonkar spoke of the potential for culturing the species in the Andaman and Nicobar Islands. Falling within Indian's exclusive economic zone, this archipelago has a number of sites that have been identified as suitable for culturing *P. margaritifera*. Wild stocks of the oysters at most of these sites are low and thus hatchery production may be necessary.

In attempts to improve techniques for culturing of *P. margaritifera*, researchers at James Cook University, Queensland, Australia, have investigated several aspects of the oyster's production.

Josiah Pit has been evaluating tropical algal species as substitutes for more temperate species, which are commonly used in the diet of *P. margaritifera*. In particular, the inclusion of *Pavlova salina* in the larval diet was found to be of benefit to larvae. Hector Acosta-Salmon reported on a nondestructive technique for the collection of gonadal tissue from *P. margaritifera*. Using the relaxant propylene phenoxetol, a biopsy needle was inserted through a 10 mm notch in the oyster's shell to remove gametes from the antero-dorsal surface of the gonad. These samples could then be used to assess the reproductive condition of the oysters.

Pinctada maxima culture in Irian Jaya

In the past, details of on-farm research and development for *P. maxima* have been scant, however, this year marked what some hoped might be a watershed for future meetings. Joseph Taylor, Jens Knauer and Anne-Michelle Lee (Atlas Pacific Pty Ltd, Perth, Western Australia) presented several talks and a poster detailing attempts to improve the quality of South Sea pearls produced in Irian Jaya, Indonesia. Joseph Taylor reported that in Australia, recent sales of golden pearls have achieved prices well in excess of silver pearls and their talks documented the relative merits of attempts to increase the percentages of this colour variant. Taylor said the percentages of golden pearls in each harvest are higher in Indonesia than in Australia, and that selection for gold saibo (mantle tissue) donors was successful in increasing the percentage of gold pearls to 8.6%. However, he questioned the merits of this selection, as the proportion of cream-yellow pearls was correspondingly high (78.8%). In contrast, selecting for silver-nacred saibo reportedly produced over 98% silver-white pearls and that larger numbers of these pearls were in the preferred shape categories of round, drop and button.

In the past, one of the major impediments to the use of silver saibo in Indonesia has been a shortage of suitable donors. Jens Knauer noted that the percentage of silver-nacred stocks at various sites ranged between 0.3% and 8.9% and discussed strategies for increasing the pool of suitable saibo donors. This was achieved in the first instance by producing larvae from broodstock selected for their silver nacre. These stocks were then supplemented by additional silver-nacred stocks selected after examining 20–24-month-old oysters from routine production runs. Interestingly, both Taylor and Knauer reported differences in growth between silver and gold-nacred stocks with the latter growing faster.

To increase the efficiency of operations, Taylor and Knauer provided information on attempts to pre-

operatively condition oysters and to develop methods to more accurately predict nuclei requirements. Comparisons of operative condition, post operative survival and nuclei retention were made between oysters placed on the seafloor or held in 1 mm mesh socks or rice sacks. Oysters from the seafloor had the highest proportions of operable stock; however, higher survival and nuclei retention has encouraged the use of mesh socks to condition stock. With respect to nuclei requirements, Knauer indicated that at AUD 88–165 per kg, nuclei were a significant cost, which tied up capital that might otherwise be used for farm development. Previously, nuclei purchases had been made on the basis of predictions from past experience and were approximately 60 per cent accurate. Studies have been undertaken to look at the relationship between the morphological characteristics of *P. maxima* (wet weight, shell height, width and length) and the size of nuclei that would ultimately be used. Knauer reported that oyster wet weight was the best predictor of nuclei size, but that the use of a single morphological characteristic did significantly increase predictive accuracy beyond the 60 per cent already achieved.

Atlas Pacific is continuing a programme of evaluating sites, and depths within sites, for growth of different size classes of pearl oysters. Anne-Michelle Lee has been monitoring various environmental parameters and relating these to oyster growth. While depth has not been found to be a significant factor, a picture of locational and seasonal changes in growth is emerging.

Akoya culture in Australia

The success of pearl culture over the past 15 years has encouraged a number of new entrants to pearl production. This year several talks were given concerning aspects of research aimed at producing akoya pearls in Queensland and New South Wales (NSW). Josiah Pit described results from two separate trials investigating the growth rates of *P. imbricata*. The first, Pit's own work at James Cook University, Orpheus Island Research Station and the second, my own research at NSW Fisheries, Port Stephens Fisheries Centre. Larval growth rates have been similar (approximately 20 days to settlement) at both locations, but the growth of oysters during the nursery and growout phases were faster in the warmer Queensland waters. In spite of the differences, oysters can be grown to a size of 50 mm or more within 12 months in both states.

Despite the growth rates achieved in Queensland, slow-growing oyster 'runts' were noted among the batches of *P. imbricata* produced. This raised the question of the efficacy of maintaining these oys-

ters. Pit reported the results of trials in which the runts were separated and their individual growth rates compared with their larger siblings. Under these circumstances the runts grew at the same rate as their siblings, suggesting their initial poor growth was a result of environmental rather than genetic factors.

Simultaneous with our investigations into the farming potential of *P. imbricata* in NSW, we began to follow the reproductive condition of the oyster. These studies found that oyster reproductive activity was greatest from late spring to early autumn with oysters in poor reproductive condition during winter. Two annual peaks in condition were observed, the first in November and the second in March–April; however, microscopic examination of the gonad indicated differences between the two peaks. Gonad samples collected following the peak in November showed a high proportion were empty, consistent with spawning, while those taken in April–May suggested the oysters were resorbing the gonad rather than spawning. The number of spat settling has varied significantly between years but has been restricted to the summer months, December to February. This is consistent with November spawnings and further suggests that the second, autumnal peak in reproductive activity does not contribute to oyster settlement.

While to date, predators have not been a great problem in the culturing of *P. imbricata* in NSW, the occurrence of the flatworm, *Imogine mcgrathi*, in spat bags and cages was a cause for some concern. This flatworm was shown to eat pearl oysters at rate of approximately one per month and has been found sporadically in high numbers in other types of mollusc culture in NSW, such as mussel and edible oyster farming. If higher numbers of flatworms were found in pearl oyster culture, the efficacy of several treatments for flat worm control was evaluated. Salting oysters or dipping them in hyper- or hyposaline baths were all effective means of control. Currently, caged oysters are dipped in freshwater baths for 30 minutes to kill the flatworms, with care taken to ensure the salinity does not rise above 2.5 ppt.

Progress in Mexico

On several occasions during the discussions, Richard Fassler expressed his admiration for work undertaken in the Mexican pearl industry. It was, therefore, pleasing to have Carlos Rangel-Davalos and several of his colleagues give presentations at

the meeting to provide further information on developments in Mexico. The industry is based on *Pteria sterna* and *Pinctada mazatlanica*, both of which can be hatchery produced. Rangel-Davalos described culture methods that have been evaluated in which the oysters are grown in 3.6 x 3.6 m plastic mesh enclosures. When they reach 70 mm, the oysters can be seeded and placed in 'folded' pocket nets. These nets are then placed on an iron framework on the seabed. The maintenance of this system was said to require three technicians for a period of 90 days for each 10,000 oysters. From spat to pearl harvest took three years.

In conjunction with their research into pearl culture, Rangel-Davalos et al. also described attempts to reseed wild oyster beds with hatchery produced juveniles. Mexican oyster beds have been heavily exploited in the past, which led to a fishery closure. A poster was presented at the meeting describing the successful re-establishment of a population at La Gaviota Island in La Paz Bay. The keys to this success were the use of mesh enclosures to protect oysters until they reached a size of 98 mm. Survival rates of between 8.3 and 21.2 per cent after 11 months were reported.

Abstracts¹

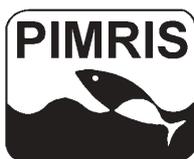
- Acosta-Salmon, H. and P.C. Southgate. Use of biopsy technique to obtain gonad tissue from the black lip pearl oyster, *Pinctada margaritifera*.
- Du, X. and L. Lu. Comparison of proteins in extrapallial fluid of six species of mollusc.
- Fassler, R.C. Recent developments in selected Pacific and Indian Ocean black pearl projects.
- Hua, D. Freshwater pearl culture in China.
- Knauer, J. and J.J.U. Taylor. Production of silver naced 'saibo oysters' of the silver- or gold-lip pearl oysters *Pinctada maxima* in Indonesia.
- Knauer, J. and J.J.U. Taylor. Assessment for external growth parameters of the silver- or gold-lip pearl oyster *Pinctada maxima* as indicators of the required nucleus size.
- Lee, A.M., J. Taylor and P. Southgate. Comparative growth and mortality of silver-lip pearl oyster *Pinctada maxima* (Jameson) cultured at two sites in Irian Jaya, Indonesia.

1. Some of these abstracts appear on pages 29–35 of this issue.

- O'Connor, W.A. and N.F. Lawler. Reproductive condition of the pearl oyster *Pinctada imbricata* in Port Stephens, NSW, Australia.
- O'Connor, W.A. and L.J. Newman. Predation of *Pinctada imbricata* and *Mytilus galloprovincialis* by the Stylochid flatworm, *Imogine mcgrathi*.
- Pit, J.H. and P.C. Southgate. Should slow growing pearl oyster spat ('runts') be discarded.
- Pit, J.H. and W.A. O'Connor. Culture of akoya pearl oysters in Australia.
- Pit, J.H. The use of tropical microalgae *Pavlova* spp. for pearl oyster *Pinctada margaritifera* larvae.
- Poirine, B. Managing a common resource: Regulation of pearl farm industry in French Polynesia.
- Rangel-Davalos, C., H. Acosta-Salmon, E. Martinez-Fernandez, A. Olivera, A. Romo-Pinera and H. Ruiz-Robio. Modelling pearl oyster culture in Northwest Mexico.
- Rangel-Davalos, C., H. Acosta-Salmon, L. Hernandez-Moreno, E. Martinez-Fernandez, A. Olivera, A. Romo-Pinera and H. Ruiz-Robio. Further information on pearl oyster 'concha nacar' *Pteria sterna* repopulation in La Paz Bay, Baja California Sur, Mexico.
- Sonkar, A.K. Potential of pearl culture in Andaman and Nicobar Islands.
- Taylor, J.J.U. Production of golden and silver South Sea pearls from Indonesian hatchery reared *Pinctada maxima*.
- Taylor, J.J.U. and J. Knauer. Inducing preoperative condition in silver- or gold-lip pearl oysters *Pinctada maxima* for pearl grafting.
- Wang, A., Y. Bing, L. Ye and G. Lan. Comparative studies of three methods in the induction of tetraploidy of pearl oyster (*Pinctada martensii* D).
- Yu, X. Pearl culturing in China present problem, countermeasure and new development.

Acknowledgements

My thanks to Richard Fassler and Xiang-Yong Yu for the time and effort put into coordinating and chairing the pearl session and my apologies to anyone whose presentation or abstract was related to pearls, that I have over looked. For those who have not had the chance to attend a WAS conference, WAS 2003 will be held in May in Salvador Brazil, followed by WAS 2004 in Hawaii. Details can be obtained from the World Aquaculture Society web site www.was.org.



Recent development in selected Pacific and Indian Ocean black pearl projects

Presented at the Pearl Session, World Aquaculture Society's Annual Meeting, Beijing, People's Republic of China, 24 April 2002.

Black pearl farming: a brief overview

By C. Richard Fassler

Economic Development Specialist, State of Hawaii Department of Business, Economic Development & Tourism, PO Box 2359, Honolulu, Hawaii 96804. rfassler@dbedt.hawaii.gov

The good news

There is considerable good news in the farming of the black pearl oyster, *P. margaritifera*. Ten years ago, black pearl farming was almost exclusively in the domain of French Polynesia and the Cook Islands. Now, however, research projects are sprouting up throughout the Pacific Ocean and even into the Indian Ocean in Western Australia. Such places as the Solomon Islands, Tonga and the Federated States of Micronesia are pushing ahead with commercial farming and witnessing some successes.

And why not? Pearls have been identified by many economists as the ideal crop for small island nations, whose major economic activity has been traditional agriculture — copra or a variety of vegetables. As this paper will reveal, funding for pearl projects involving basic research for such necessities as a hatchery, and the training of the indigenous people, appears to be plentiful. Both American and Australian agencies are now heavily involved in this activity in the Pacific. Whereas pearl farming was once confined to those nations with the ability to capture spat in lagoons, French Polynesia being the prime example, the development of hatchery techniques has opened the door to pearl farming almost anywhere where there is clean water and a minimum of turbidity.

The bad news

But there is considerable bad news, too. For the most part, 'a black pearl, is a black pearl, is a black pearl.' Some experts might be able to tell the difference between a pearl that has been produced in the Cook Islands and a pearl that has been produced in Tahiti, but the buying public can not tell one from the other, and doesn't particularly concern itself with the origin of the pearl. This presents a dangerous marketing situation for a beginning nation, as prices will be dominated by the major player, and that major player is French Polynesia — the proverbial '500-pound gorilla in the middle of the living room.'

The Tahiti experience

By all accounts, the black pearl industry in Tahiti is in turmoil, due to vast production from 'industrialised' farms, many with an attitude that: 'The more we produce, the more quality we will produce.' There appears to have been little concern for the effects of one's production on the market as a whole. The bright spot has been a highly effective government marketing campaign, which has most fortunately resulted in the absorption of much product. But, unfortunately, high production has outpaced marketing efforts, resulting in too much product on the market and a consequent lowering

of prices. The timing couldn't have been worse: at the moment when the industry was managing to convince the world that black pearls were a rare treasure, they suddenly emerged with such plentitude that swapmeet sellers and television hawkers were selling a low-priced product that even the most modest income could afford.

Fortunately, the very quality product seems to be holding its own, and this is the way the industry now appears to be turning. French Polynesia has taken steps to put more 'quality' than 'quantity' in its future by imposing quotas, encouraging farmers to leave pearls in the water longer, and so forth.

Lessons learned

What does this mean for the many incipient black pearl farmers scattered across the vast ocean? The first lesson will be that they must be extremely mindful of events in Tahiti (and, at present, it is the author's belief that not many of these new farmers are aware of that situation). Tahiti's low prices will most assuredly mean low prices for everyone.

The second lesson will be that all attempts must be made to make their product unique — through the development of colours, for example, and, above all, an emphasis on quality.

Oddly enough, as Tahiti turns back to small farms to cut costs, it may find itself in the position the industry was in some two decades ago: dominated by family members who are able to devote more

care to each harvest. This is precisely where the beginning farms in other nations are: using family members, devoting much care to product.

And where Tahiti has been careless about the environment, pushing the limits of many lagoons, the new black pearl farmers must be aware that too much product could be disastrous. A major advantage that they have is clean waters. This is an advantage that must not be squandered.

The future

So, what is the future of black pearl farming in the Pacific? At the moment, it is very much in a transition stage. The 'old player', Tahiti, is falling, and the new players are wondering what is going on. It may be some years before things are sorted out. Above all, one thing will remain true: any attempts at rapid pearl farming development will result in an even further lowering of prices, possible pollution, a severe image problem for black pearls and, perhaps worst of all, a dampening of enthusiasm for an industry that could still make a strong contribution to the economies of small Pacific nations.

The following abstracts present some detail on black pearl projects in the Pacific/Indian Ocean region. Perhaps most useful are the contact numbers of the principal researchers and farm managers. The author would like to encourage a dialogue that will, hopefully, involve both conference participants and these farmers and researchers.

Abstracts

Production of silver-nacred 'saibo-oysters' of the silver- or goldlip pearl oyster *Pinctada maxima* in Indonesia

Jens Knauer and Joseph J.U. Taylor

Atlas Pacific Limited, PO Box 291, North Fremantle, WA 6159, Australia. atlas@atlasocean.com.au

The production of highly valued silver-coloured South Sea pearls is achieved by inserting a spherical nucleus and a piece of mantle tissue, the 'saibo' from a silver-nacred silver- or goldlip pearl oyster (*Pinctada maxima*), into the gonad of a recipient pearl oyster. Silver pearl production thus depends on a regular supply of silver-nacred *P. maxima*. In Indonesia, however, *P. maxima* predominantly have a yellow to gold-coloured nacre, and silver-nacred specimens are extremely rare. A sufficient supply of silver saibo to produce silver pearls therefore presents a continuous problem to *P. maxima* farms in Indonesia.

Consequently, at our Indonesian pearl oyster farm at Waigeo Island in Irian Jaya, we have implemented a strategy to ensure a regular and sufficient supply of silver saibo-oysters. There are two aspects to the strategy. First, we produce larvae using wild and hatchery broodstock specifically selected for their silver-nacre. Up to two such runs are attempted per hatchery season. Secondly, oysters resulting from other hatchery runs are examined after approximately 20 to 24 months of age and, if found to be silver-nacred, are put aside for use as a saibo-oyster. Data on the silver-hatchery runs and incidence of silver nacre in wild and hatchery-produced *P. maxima* are presented, and the implications for pearl oyster culture in Indonesia are discussed.

Producing golden and silver South Sea pearls from Indonesian hatchery reared *Pinctada maxima*

Joseph J.U. Taylor

Atlas Pacific Limited, PO Box 291, North Fremantle, WA 6159, Australia. atlas@atlasPacific.com.au

Cultured South Sea pearls result from the surgical implantation of a shell bead nucleus with a section of mantle tissue (saibo) from a sacrificed donor *Pinctada maxima* into the gonad of a healthy host. The selection of saibo tissue is integral to the success of the operation and the quality of the resulting pearl. Pearl colour greatly influences value, golden South Sea pearls are the most valuable followed by silver-white pearls. Cream and yellow is regarded as an inferior colour and these pearls sell at greatly reduced prices. To determine the degree saibo affects the value of South Sea Pearls, two experiments were conducted using donor saibo tissue selected on the basis of observed nacre coloration.

In the first experiment, pearl colour and quality were compared between oysters seeded using saibo tissue cut from donor pearl oysters exhibiting either silver-white (silver saibo) or golden (gold saibo) nacre colour. The differences in pearl colour were highly significant ($P < 0.01$) for the two treatments. Oysters seeded with silver saibo produced 98.2% silver-white pearls, no golden pearls and small numbers of cream/yellow pearls. By contrast, gold saibo produced 12.7% silver-white pearls, 8.4% golden pearls and 78.8% cream/yellow pearls. In addition, a significantly greater ($P < 0.01$) proportion of pearls from silver saibo were in the better (more valuable) shape categories (round, drop and button) than for gold saibo.

The obviously large variation in colour from gold saibo prompted a second experiment using seven individual donor oysters (G1 - G7) exhibiting gold characteristics. The variation in colour was highly significant ($P < 0.01$) between treatments. In pearls produced using saibo from four of the donor oysters (G2, G4, G5 and G6), more than 50% exhibited gold colour. One hundred per cent of the pearls produced by G5 were golden while G1 produced no golden pearls but did produce 43.8% silver-white pearls and 56.3% cream/yellow pearls.

The results indicate that it is easier, providing the appropriate oysters are available, to select donor saibo tissue for producing silver-white pearls than for the more valuable golden pearls. Furthermore, using tissue derived from pearl oysters with gold colour characteristics can lead to the production of large numbers of comparatively low value cream/yellow pearls lowering the overall value of the crop. Very careful selection of goldlip pearl oysters can, however, yield good numbers of golden pearls. In order to maximise pearl value, careful consideration must be given to saibo selection.

Inducing pre-operative condition in silver- or goldlip pearl oysters *Pinctada maxima* for pearl grafting

Joseph J.U. Taylor and Jens Knauer

Atlas Pacific Limited, PO Box 291, North Fremantle, WA 6159, Australia. atlas@atlasPacific.com.au

The success of pearl oyster surgery is largely dependent on the pre-operative condition of the gonad in which the nucleus and donor mantle tissue (saibo) is implanted. Ideally, the gonad should be void of gametes that may limit space for pearl nuclei and obscure a technician's view during operation. Low metabolic activity also assists by reducing the strength of the adductor and foot muscles that can cause expulsion of pearl nuclei through the gonad wall. In Australian waters, this is achieved in silver- or goldlip pearl oysters (*Pinctada maxima*) naturally by choosing to operate only during the cooler winter months (June–August) when the pearl oysters are in a non-reproductive state. In equatorial regions such as Indonesia, which have little annual variation in water temperature, pre-operative condition must be induced.

On our Indonesian farm, three methods were assessed for inducing the pre-operative condition in 2.5 year-old hatchery-reared *P. maxima*. Oysters were either held in paired eight-pocket panels and covered with commercially available 50 kg capacity rice sacks (RS) or 1 mm nylon mesh socks (MS), or they were laid flat on the sea floor (SF). The covered oysters were suspended to a depth of 15 m from surface long-lines. Those in the SF treatment were held at a depth of 8–10 m on a natural coral rubble bed. After 30 days the oysters were assessed for condition and either operated on or rejected. Significantly more of the

SF pearl oysters ($P<0.05$) were in operable condition (96.7%) than in either the RS (90.3%) or MS (85%) treatments, which did not differ significantly ($P>0.05$).

Six months post-operation, survival of MS conditioned pearl oysters was significantly higher ($P<0.01$) at 98.8% than in either the SF or RS treatments with pearl oyster survival rates of 97.8% and 96.1%, respectively. Surviving oysters were examined using x-ray equipment to determine whether or not they contained a growing pearl. There was no significant difference ($P>0.05$) in pearl retention between MS and RS with 66.4% and 66.5%, respectively; however, both had significantly higher pearl retention than SF (64.4%). Due to the high value of *P. maxima* (USD 1.00/cm DVL), using 1 mm mesh socks is favoured as this treatment resulted in the highest survival rates and pearl retention was not significantly different to pearl oysters conditioned using rice sacks.

Assessment of external growth parameters of the silver- or goldlip pearl oyster *Pinctada maxima* as indicators of the required pearl nucleus size

Jens Knauer and Joseph J.U. Taylor

Atlas Pacific Limited, PO Box 291, North Fremantle, WA 6159 Australia. atlas@atlasocean.com.au

Cultured pearls are produced by grafting a spherical nucleus and a piece of mantle tissue, the 'saibo' from a sacrificial pearl oyster, into the gonad of a recipient pearl oyster. Nuclei, which are crafted from a variety of freshwater mussel shells, constitute a major material cost in pearl culturing. It is therefore desirable to accurately order nuclei of the appropriate size, ahead of the operating season. However, the size of a nucleus that can be implanted into a particular pearl oyster can only be known at the time of operation, when the technician can get a measure of the available space within the pearl oyster's gonad.

In this study, we assessed whether easily measured growth parameters of the silver- or goldlip pearl oyster, *Pinctada maxima*, are suitable as indicators of the required pearl nucleus size. The experiment was done at Atlas Pacific P/L's Indonesian pearling project at Waigeo Island, Irian Jaya. The relationships between wet weight (WW), antero-posterior shell length (SL), dorso-ventral shell height (SH) and shell width (SW) of *P. maxima*, and pearl nucleus size required during implantation of pearl nuclei was studied by regression analysis ($n = 847$). The highest coefficient of determination was found for WW ($r^2 = 0.62$), followed by SH ($r^2 = 0.49$), SL ($r^2 = 0.48$) and SW ($r^2 = 0.24$). The relationships between each of the growth parameters and pearl nucleus size were significant ($P<0.05$). The results of this study indicate that up to 62% of pearl nuclei sizes required for pearl operations can be correctly predicted based on WW measurements of *P. maxima*. The suitability of the growth parameters as indicators to accurately predict nuclei requirements ahead of the operating season is discussed.

Recent developments in selected Pacific and Indian Ocean black pearl projects

C. Richard Fassler

State of Hawaii Department of Business, Economic Development & Tourism, PO Box 2359, Honolulu, Hawaii 96804. rfassler@dbedt.hawaii.gov

For the past 20 years, black pearl farming has centred on French Polynesia, and to a lesser extent, the Cook Islands. Within the past five years, advances in technology have enabled black pearl farmers to increase production dramatically, to the point where black pearls have entered the mainstream global pearl marketplace at reasonable prices. Other improvements, such as the utilisation of pearl grafters from nations other than Japan, have decreased production costs and opened up the industry to new areas in the Pacific and Indian Oceans. Indeed, black pearl farming is no longer confined to one species of oyster: *Pinctada margaritifera*.

The goal of this paper is to present a number of new black pearl projects, briefly discuss production and marketing techniques, and offer comments on the challenges and successes of the ventures. These projects will include those located in the Marshall Islands, the Solomon Islands, Kiribati, Fiji, the Abrolhos Islands (Australia), the Andaman Islands (India) and Mexico. A discussion of the similarities and differences among the projects will be provided, together with observations on marketing strategies in light of the serious downturn in pearl sales following the tragic events of 11 September 2001.

Should slow growing pearl oyster spat ('runts') be discarded?

Josiah H. Pit and Paul C. Southgate

School of Marine Biology and Aquaculture, James Cook University, Townsville, Queensland 4811, Australia.

Josiah.Pit@jcu.edu.au

Growth of cultured bivalve molluscs is highly variable during both hatchery and nursery culture and variation can occur among individuals of the same age reared under identical conditions. In this laboratory, pearl oyster spat are generally graded at 3.5 months of age when fast-growers (>10 mm shell height) are separated from normal growers (5–10 mm) and runts (<5 mm). Runts are often discarded because it is believed that they will remain slow growers for life. This study reports on two experiments that assessed the growth rates of different size classes of blacklip pearl oyster (*Pinctada margaritifera*) and Akoya pearl oyster (*P. fucata*) spat in northern Australia. Spat of the same age from three size classes (<5 mm, 5–10 mm and >10 mm) were individually glued into replicate plastic mesh trays (55 x 30 x 10 cm) and positioned on a surface long line at 6 m for four months.

At the end of the first experiment there were significant differences between mean dorso-ventral shell height (DVH) of *Pinctada margaritifera* spat from the different size classes ($F_{2,87} = 167.67$, $P < 0.01$). Mean (\pm SE) DVH was 24.6 ± 0.4 mm, 32.2 ± 0.4 mm and 35.6 ± 0.4 mm, for spat with initial DVH size classes of <5 mm, 5–10 mm and >10 mm respectively. Spat in the 5–10 and >10 mm size classes showed significantly greater growth during the experiment than those in the small size class ($F_{2,87} = 15.99$, $P < 0.010$). However, a number of individuals in the <5 mm size class grew very rapidly and were as large as some oysters in the larger two size classes at the end of the experiment.

At the end of the second experiment there were significant differences between mean DVH of *P. fucata* from the different size classes ($F_{2,267} = 140.39$, $P < 0.001$). Mean (\pm SE) DVH was 36.2 ± 0.3 mm, 42.3 ± 0.4 mm and 46.9 ± 0.4 mm, for spat in the initial size classes of <5 mm, 5–10 mm and >10 mm, respectively. Incremental growth in DVH was 30.0 ± 0.5 mm, 32.1 ± 0.4 mm and 30.3 ± 0.4 mm for spat in the initial size classes of <5 mm, 5–10 mm and >10 mm, respectively. Growth during the experiment was significantly greater in individuals from the 5–10 mm size class ($F_{2,267} = 7.05$, $P = 0.001$) whereas those from the <5 mm and >10 mm size classes did not differ significantly ($P = 0.903$).

Results from these experiments show that small spat do not catch up to larger individuals within a cohort within four months from grading. However, the results also show that spat classed as runts are capable of similar growth rates to larger pearl oysters when provided with appropriate conditions. On this basis, it may be premature to discard runts at first grading.

Use of a biopsy technique to obtain gonad tissue from the blacklip pearl oyster *Pinctada margaritifera*

Hector Acosta-Salmon and Paul C. Southgate

School of Marine Biology and Aquaculture, James Cook University, Townsville, Queensland 4811, Australia.

Hector.Acostasalmon@jcu.edu.au

Aquaculture research often requires samples of different animal tissues to be obtained for various analyses. An example of this is sampling gonad tissue to assess reproductive seasonality or the effectiveness of broodstock conditioning protocols. In many cases this process is destructive and involves sacrificing experimental animals. While this is not such a problem with lower value aquaculture animals such as rock oysters and mussels, it is often prohibitive with higher value animals such as pearl oysters, which have the potential to produce pearls worth many hundreds of thousands of dollars.

In order to carry out research into the reproductive biology of the blacklip pearl oyster, *Pinctada margaritifera*, a non-destructive method of obtaining gonad tissue using biopsy was assessed. Prior to biopsy, oysters were anaesthetised with 2 mL/L of propylene phenoxetol. Three different 9-cm-long biopsy needles (16, 18 and 20 gauge) with a 10 mm sample notch, were compared as a means of obtaining gonad tissue from 20 oysters. Samples were removed from each oyster using each of the three biopsy needles. Biopsy samples were taken from an antero-dorsal portion of the gonad. Following the biopsy procedure, each oyster was killed and the gonad sectioned for standard histological preparation. All samples were preserved with the formaldehyde-

acetic acid-calcium carbonate gonad fixative (FAACC), dehydrated in an alcohol series dilution, embedded in paraffin, sectioned and stained with H-E. Samples were observed microscopically to assess gonad condition and to compare samples taken using biopsy with those taken using destructive sampling.

The impact of the biopsy sampling technique on oyster mortality was determined using a second batch of 48 oysters. Three groups of 12 oysters were sampled with each of the 16 gauge, 18 gauge and 20 gauge biopsy needles; the remaining 12 oysters were kept as controls. Oysters were maintained under culture conditions to assess survival.

Preliminary results showed 100% recovery from the anaesthetic and biopsy procedure after two weeks. Results of longer-term survival and histological analysis will be presented. This study indicates that non-destructive biopsy sampling could be a valuable means of assessing gonad condition in pearl oysters.

Reproductive condition of the pearl oyster, *Pinctada imbricata*, in Port Stephens, NSW, Australia

Wayne A. O'Connor, Norman F. Lawler

NSW Fisheries, Port Stephens Fisheries Centre, Taylors Beach, NSW 2316, Australia. occonnorw@fisheries.nsw.gov.au

Pearl oysters form the basis of Australia's most valuable aquaculture industry and are the subject of considerable commercial interest. Largely the focus has been upon the silverlip pearl oyster *Pinctada maxima*, although increasingly interest is diversifying to include other endemic pteriids. Among these, *Pinctada imbricata* (Röding) is attracting particular attention, however, there is a paucity of information regarding the species in Australian waters.

Central to the development of a pearl industry is an understanding of the reproductive biology of the target species. This assists in timing various aspects of farming including the collection of wild spat, hatchery production and the timing of nuclei implantation. Regrettably, reproductive studies to date indicate that the behaviour of *P. imbricata* varies significantly according to location. Therefore, simultaneous with initial investigations into the farming potential of *P. imbricata*, studies also began to follow the reproductive condition of the oyster in New South Wales.

Beginning in May 1998 and continuing until August 2000, oysters were collected monthly from natural populations off Wanda Head, Port Stephens. These oysters were returned to the laboratory where both macroscopic and histological observations of reproductive condition were made. Oyster reproductive activity was greatest from late spring to early autumn with oysters in poor reproductive condition during winter. Two annual peaks in macroscopic condition occurred, the first in November and the second in March–April; however, histological examination of gonadal tissue indicated differences between the two peaks. Gonad samples collected following the peak in November showed a high proportion of voided follicles consistent with spawning, while those taken in March–April suggested gamete resorption.

In addition to reproductive monitoring, spat collector bags were deployed monthly to monitor natural recruitment. Spatfall has varied significantly between years but has been restricted the summer months December–February. This is consistent with November spawnings and further suggests that the second autumnal peak in reproduction does not contribute to recruitment.

Managing a common resource: Regulation of the pearl farm industry in French Polynesia

Bernard Poirine

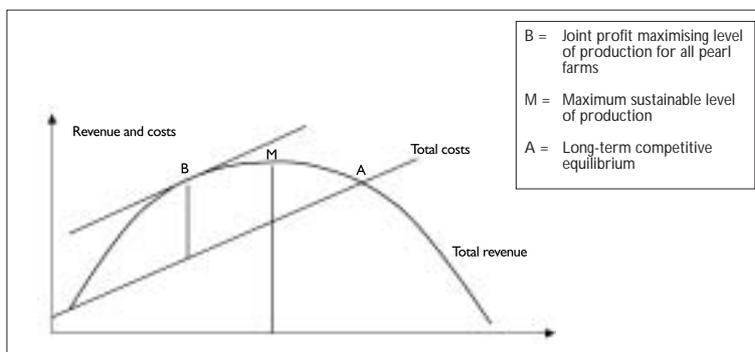
IRIDIP, Université de la Polynésie française, BP 6570 FAAA, French Polynesia. bernard.poirine@upf.pf

The first part of the paper presents the pearl farming industry in French Polynesia and its recent growth. The second part discusses the danger of overexploitation of the lagoons in some atolls, how the problem has been addressed (or not addressed), some examples of dystrophic crisis in French Polynesia and, recently, in Manihiki in the Cook Islands.

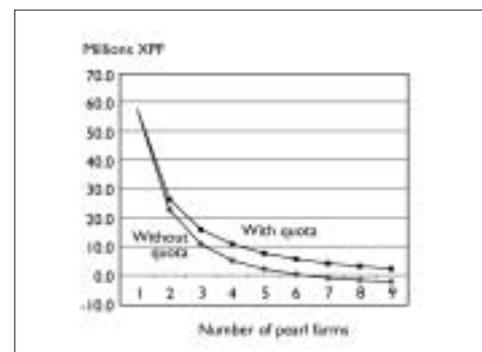
The third part reveals that the problem comes from the negative externalities in production relating to the use of a 'free' (almost free) use of a common resource, the lagoon. It is a special case of the 'tragedy of the commons'.

The fourth part presents a theoretical model of a lagoon with 'n' pearl farms, each maximising profits, with negative production externalities in the production function for each pearl farm. The model shows how the competitive equilibrium is above the optimal level of production maximising joint profits for all pearl farms, and also above the maximum sustainable yield of the lagoon, the former being lower than the latter. The model also shows that profit per farm is higher if a quota system limits the number of shells in stock in the lagoon.

Finally the fifth part reviews the different regulation policies addressing the problem: the Japanese policy (decentralised regulation through village cooperatives), the Australian policy (quotas on grafted shells), and a 19th Century policy of 'oyster banks auctions' in Holland.



Revenue, cost and optimum level of production in a pearl farming lagoon



Profit per farm with or without quotas on grafted shells

Potential of pearl culture in the Andaman and Nicobar Islands

Ajai K. Sonkar

Chairman, Biotech Research Institute, 557/470, Old Katra, Allahabad 211 002 India

The Andaman and Nicobar Islands form an archipelago consisting of more than 550 islands, islets and rocky outcrops in the Bay of Bengal, lying between 6°45'N and 13°41'N latitude and between 92°12'E and 93°57'E longitude. There is a limited land area of only 8293 sq km, but the islands have a total coastline of 1962 km, which is about one-fourth of the total coastline of India. Of the two million sq km of India exclusive economic zone, 0.6 million sq. km or 30% lies around the Andaman and Nicobar Islands.

The continental shelf around these oceanic islands is limited to about 16,000 sq km, as compared to the total shelf area of about 452,000 sq km for the entire country. With practically no continental slope, the land drops steeply to great depths not far from the coastline.

The blacklip pearl oyster *Pinctada margaritifera* is an important resource in the Andaman and Nicobar Islands. Havelock Island, Mayabunder, North Bay, Wandoor, Chiriatapu, Diglipur and several other spots have been identified for *P. margaritifera*. The background colours of *P. margaritifera* shells in the collections from several locations are dark green, bronze, brown or black. The shells show variation in form and outline. *P. margaritifera* generally occupies the intertidal reef flat and was observed up to a depth of about 10 m.

Although it is observed that the population of *P. margaritifera* at most of the places identified for the availability of the oysters is not very high, a hatchery could fulfil the requirements of a commercial venture.

Several other aspects of the potential of pearl culture in the Andaman and Nicobar Islands will be discussed in the paper.

Freshwater pearl culture in China

Hua Dan

Freshwater Fisheries Research Center, CAFS, Jiangsu Wuxi 214081, China. huad@ffrc.wx.net.cn

Freshwater pearl culture started in China 2000 years ago and the bead-nucleated freshwater cultured pearls were produced at least as early as 1900. Commercial freshwater pearl culture, however, dates back only to the late 1960s and early 1970s, after the key technology had been developed, and when tremendous quantities of small, irregularly shaped rice-like freshwater cultured pearls from pearly mussel (wrinkle comb mussel, *Cristaria plicata*) entered the market. Although, these rice-like cultured pearls dominated Chinese production during the 1980s, in 1984 the importance of quality as well as quantity was realised. Pearl culture scientists made changes in technology and, most importantly, in the mussel used, which resulted in the production of greater quantities of larger and more lustrous round, near-round, and baroque cultured pearls having a variety of colours. The pearly mussel most used in pearl culture is the triangle sail mussel (*Hyriopsis cumingii*). Today, Chinese cultured pearls are in great demand throughout the world; 95% of the freshwater pearls in the world market come from China. China is producing an estimated 800 to 1000 t of freshwater cultured pearls annually, of which 400 to 500 t are exported to different countries in Asia, Europe, Africa, and America, such as Japan, Korea, India, Thailand, Britain, Germany, USA, Canada, Australia and South Africa. These exports include pearls larger than 8 mm.

This monograph includes the principles and techniques of freshwater pearl culture in China, viz Principles of Pearl Formation, pearl culture operation procedure and operated mussel culture.

Comparative effects of temperature on suspension feeding and energy budgets of the pearl oysters *Pinctada margaritifera* and *P. maxima*

H. Yukihiro¹, J.S. Lucas² and D.W. Klumpp³

1. Department of Zoology and Tropical Ecology, School of Biological Sciences, James Cook University, Townsville, Queensland 4811, Australia

2. School of Marine Biology and Aquaculture, James Cook University, Townsville, Queensland 4811, Australia

3. Australian Institute of Marine Science, PMB 3, Townsville MC, Queensland 4810, Australia

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This study assessed the effects of seasonal temperatures on suspension feeding, related physiological parameters and energy budgets in two pearl oysters, *Pinctada margaritifera* and *P. maxima*. Pearl oysters that were acclimatised at approximately 19, 23, 28 and 32°C in the field were tested in the laboratory at these temperatures. Clearance rate (CR), absorption efficiency (ae), absorbed energy (AE), respired energy (RE), excreted energy (EE) and the value of (AE – RE) were significantly affected by temperature, usually increasing with increasing temperature. ae, RE, EE and the value of (AE – RE) differed significantly between the pearl oyster species. *P. margaritifera* had a significantly higher CR than *P. maxima* at 19°C. *P. maxima* had higher ae than *P. margaritifera* at 28 and 32°C. As a result, *P. margaritifera* had greater AE than *P. maxima* at 19°C, but the latter species had greater AE at 32°C. Temperature significantly affected the RE of *P. margaritifera* over a wider temperature range (19 to 32°C) than *P. maxima* (19 to 23°C). However, interspecific differences in RE were only significant at 32°C. *P. maxima* had significantly higher EE at 32°C than *P. margaritifera*, although this energy accounted for a very small portion of AE (<5%). *P. maxima* exceeded *P. margaritifera* in scope for growth [SFG = (AE – RE) – EE] at 32°C, but the latter species had greater SFG at 19°C. These results agree with observations of the occurrence of *P. margaritifera* at higher latitudes and lower temperature habitats. The temperature effects on suspension feeding, related physiological parameters and SFG indicate that there will be marked seasonal variations in growth in both species in environments where water temperatures vary seasonally. In bioenergetic terms, the optimum temperature ranges for these pearl oysters are approximately 23 to 28 and 23 to 32°C for *P. margaritifera* and *P. maxima*, respectively.

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E-mail:

Past seeding experience:

| Species | Country/Region | No. years |
|---------|----------------|-----------|
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I hereby request that my name, contact information and other professional details shown above be placed on **POIB's Pacific Pearl Seeding Technician Registry**. I understand that this information will be provided to people who represent themselves as bona fide pearl farmers, for the purposes of increasing my professional contacts. I do not hold SPC or BPI, or any of their employees liable for any misuse or abuse of this information.

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This registry is designed to facilitate links between newly developing farms and seeding technicians. This basic information will be provided to bona fide Pacific pearl farmers who request it. It is then up to the individuals to pursue the matter further. Copies of this registry will be held both by the Editor of this bulletin in Hawaii and by the SPC Fisheries Information Section in New Caledonia. Please fill this out yourself, if you are a seeding technician, or pass it along to someone who is, and send it back to one of the addresses indicated on the form. Thank you.