Jellyfish exports

Bloom or bust?

Jellyfish is a new fish export industry in the south Indian State of Tamil Nadu, with effects on local fishing communities

Rumours of the destroyed huts were rife in the air as the businessmen hustled all morning, frantic to negotiate and strike a deal with village leaders in an attempt to stop the upsurge of violent protest against the jellyfish industry. Some villagers were angry, some were pleased; all were talking about the 'jellyfish men' and, in the background, a lady complained bitterly that despite yielding an ample prawn catch that morning, nobody was interested.

This is a description of the scene in Pulicat, a small fishing town at the southern border of Pulicat Lake, Tamil Nadu, India on 21 July 2003, the morning after fishermen from several villages destroyed the processing huts of the newly established jellyfish industry. These villages, like many throughout India, have existed for generations in their entirety upon the precious and fragile livelihood of fishing. Often neither much changed by India's economic advance nor touched by the political storms of the wider world, the villages in Pulicat remain, at a glance, very much as they have always been: colourful arrays of houses dotted amongst coconut palms, bordered by long rows of resting wooden *kattumaram*s. These traditional boats, long surviving the modernity of today's fishing fleet, remain lined up on beaches throughout the State, defiant against the onslaught of the Bay of Bengal, and calmly awaiting fishermen to again embrace the perilous sea for a daily wage.

To understand the impact of the jellyfish industry on the lives of fishermen and their families and on the structure of traditional fishing society, one must look back to the industry's arrival in the state of Tamil Nadu, less than a year before these disturbances occurred. The observant visitor to the Tamil Nadu coast may have noticed over the last year that, amongst these familiar clusters of village homes and temple squares, has arrived a new type of building, which can now be seen in almost all coastal villages from Pondicherry in the south up to the Andhra Pradesh border in the north and beyond. The large open-thatched structures that have appeared in coastal villages throughout Tamil Nadu are not the result of some new craze of housing style; they are, in fact, the now empty processing units of the rapidly spreading jellyfish industry, lying in wait for the season to begin again this spring.

Many have generally welcomed the industry as a thankful alternative to their dwindling fish and prawn catches. Others have been angered that, for numerous reasons, they have been unable to benefit from the new export and also by the pollution that processing units have sometimes been under suspicion of causing in local surroundings. Little is known about the jellyfish industry, although what can be sure is that the industry stirs up a storm of its own within communities and between villages, as trade agreements are set up, and seaworthy boat sales soar as access to the jellyfish becomes everyone's first priority. Perhaps the questions the fishermen must ask are "How can I benefit from the trade?" and, more importantly, "Is this new industry sustainable?", before rushing out to acquire a new boat and the subsequent debts.

Major export

According to Tamil fishermen, the summer of 2003 was the first time that the jellyfish industry significantly hit Tamil Nadu. Major export industries, based predominantly in the far east, with outlets in Pondicherry and Chennai, started the impressively quick and extensive appropriation of village space, boats and

fishermen and even entire fishing villages in the haste to make profit from last year's particularly large jellyfish swarms. The mass exodus of fishermen to benefit from this trade meant that, in some areas, the jellyfish export trade usurped even prawn exports, and became the number one exportable product for several months.

The industry did not only provide alternative income through buying jellyfish, but also through developing onsite jellyfish processing units, required due to the highly perishable nature of jellyfish, which needs treatment within only a few hours of capture. Jellyfish are landed directly at the processing huts, and immediately dehydrated using a traditional step-wise reduction of water content with a 10 per cent salt-and-alum mix, although, in some instances, more potent chemicals are involved, including bleach products, used to whiten the jellyfish and, in doing so, increasing its commercial value. This operation is low-cost, requiring little capital, but it is labour-intensive, and thus provides welcome extra income to workers in the processing huts, who are usually locally employed men and women.

In the case of Pulicat, discontent grew further over concerns about the potential for pollution from the jellyfish processing huts, creating a good case for village feuding, in an already fragile social and ecological environment.

This article attempts to answer some of the questions demanded by the upsurge of this new export interest in Tamil Nadu and India, by removing, in part, some of the mystery behind the jellyfish export industry. To begin, the global perspective of the industry is tackled: Will we all be eating jellyfish in the years to come, as fish becomes a rare delicacy, and if so, what do we understand about the jellyfish industry in terms of longer-term sustainability?

Fishing for edible jellyfish has been operational in countries like China and Japan for many centuries, providing a traditional and important component of Far Eastern cuisine, and even has its mention in writings from the Tsin Dynasty 300 AD. In spite of this, edible jellyfish became an important export commodity in Southeast Asia only in the 1970s, largely as a direct result of increased demand from the Japanese market.

Falling production

In the Japanese jellyfish industry, falling domestic production has been increasingly unable to meet rising consumer demand, partially fuelled by the introduction of shredded RTU (ready-to-use) jellyfish products. Such products have alleviated the traditional

but lengthy procedure of desalting jellyfish before cooking, a requirement that, for many, was inappropriate for today's modern busy lifestyle.

The jellyfish industry began its expansion to Southeast Asian countries such as Thailand, Indonesia and Malaysia, not only due to changes in demand and supply, but also due to the instability of production and price rises in the 1970s in China, Japan's main and traditional exporter. The result is that today, Japan's import market for jellyfish alone is valued at US$ 25.5 mn per annum.

The main global capture production of jellyfish (in metric tonnes as recorded by the FAO Fisheries Department Statistics and Monitoring since 1995), is dominated by the northwest Pacific (Area C-61), and seconded by the West- Central Pacific (C-71). Captures in the Eastern Indian Ocean, which includes the Bay of Bengal, in comparison, are small. The only other notable jellyfish capture is in the Mediterranean and Black Sea, which harvest small amounts annually.

The interaction of jellyfish with existing fish species within an ecosystem can be quite complex, and determined by many factors. Jellyfish can be detrimental to fish populations in two ways: firstly, by those species of jellyfish that directly predate on fish eggs and larvae; and, secondly, by those species that act in competition with other predatory fish for this food source, bearing in mind that usually the top predatory fish claim the highest commercial value.

Interactions can be positive to a fishery, in that jellyfish can also provide a source of food for adult and sub-adult fish. What is interesting, in terms of maintaining the balance of the fishery ecosystem, is the potential impact that *large* numbers of jellyfish, or 'jellyfish blooms' can have on fish populations and the wider-scale impact on a commercial fishery.

Diets of many species of jellyfish overlap with the diets of zooplanktivorous fish such as anchovies, herrings and sardines. When overfishing includes these species, there could be significant unconsumed zooplankton, and jellyfish populations might expand, because of the alleviated competition for food.

Additionally, the commercial removal of jellyfish predators, such as salmon, mackerel and butterfish, could further spur jellyfish population expansion.

However, this outcome is less clear as many jellyfish populations can be controlled by predation from other jellyfish and gelatinous species. One study points to a more sinister outlook for what jellyfish blooms might mean to a fishery.

Not only may jellyfish blooms indicate overfishing of larger top predator marine species, but also large jellyfish populations, once established, may suppress fish production in a recovering fishery, through competition and predation on fish larvae.

Once an ecological system has reached a point of stability as in this case, which is the jellyfish succeeding at the top of the food chain, the removal of its dominance may prove difficult, potentially preventing the recovery of the fishery, even if fishing effort of the fish was reduced: "The jellyfish state might be an alternative stable state which is difficult to revert," according to "Pelagic food web configurations at different levels of nutrient richness and their implications for the ratio fish production: primary production", by V. Sommer, H. Stibor, A. Katechakis, F. Sommer and T. Hanson, *Hydrobiologia* 484 (1-3), 2002.

Distributions of jellyfish populations are notoriously sporadic and unpredictable, and little is known about why or when they may occur in large numbers or 'jellyfish blooms'. Meteorological conditions, currents, water temperature, salinity and predation may play a significant role in determining the population size.

Seasonal life cycle

The life cycle of the jellyfish is seasonal in most species, which creates its seasonal appearance, although it is not yet understood what causes a jellyfish bloom to occur. In many areas, jellyfish can appear and disappear with great annual regularity, although, because populations commonly undergo inter-annual

fluctuations, some years bring much larger populations of jellyfish than others.

As a result, the fishing season for jellyfish is often restricted to only several months per year, the timing of which can vary with locality, and be influenced by fishing methods, freshwater outflow through river systems, and calm seas.

The typically high variation and fluctuation in annual catch highlight the potential instability of the fishery, and while a mass occurrence of jellyfish can bring in economic interests from outside, jellyfish, on other occasions, may suddenly disappear from fishing grounds altogether.

Jellyfish populations seem, in recent years, to have become unstable or show signs of decline in East Asian waters. Although the reasons for this are uncertain, pollution and overfishing are the most likely contenders for a cause, the effect being that Asian dealers are now exploring new sources of jellyfish.

The fishery for jellyfish has, until recently, remained predominantly in Southeast Asia, the annual catch for jellyfish for this region between the years of 1988 and 1999 being estimated at 169,000 tonnes wet weight, which is just over half of the worldwide estimated catch of 321,000 tonnes over the same period.

Jellyfish are also exported to Asia from the US and Canada, Australia and, recently, India, Mexico and Turkey, and a wide scope exists for other countries and other species to join the fishery. For example, there is a growing interest in creating an export market in Asia for the frequent swarms of the edible jellyfish *Stomolophusmelea gris L. Agassiz* (cannonball jellyfish) from the US: an investment, which has the potential to change a species—traditionally a pest to fishermen, which clogs up nets and crushes the shrimp catches—into a huge environmental and economic benefit for the region.

In addition to the expansion of jelly fishing in the oceans, pond culture technology, particularly in China, is widespread, selling for US$0.9 / kg, where large tent-like awnings are used to maintain a cultivated jellyfish production throughout the year. Although little has been written about this technology outside of the Far East, the fact that cultivation of jellyfish is not only possible, but already a well-established industry in some countries, may provide an alternative to dwindling global fish stocks.

Simple techniques

The cultivation and processing of jellyfish are simple techniques, and cost-effective. Could the increasing demand for jellyfish in the Far East provide alternatives for the

livelihoods of many fishermen around the globe, struggling to make ends meet and daily having to choose between knowingly overfishing their stocks or starvation? What terms could be put in place now, before the industry is taken over by only a few to soon become very rich?

One could and should perhaps ask the question: To what extent can the average fisherman benefit from this new industry? To answer this, one must first gain insight into how much they are already benefiting from the industry, and how much are they being exploited, simply because they lack the knowhow.

Sadly, it is not only the fishermen who lack sufficient knowledge about the jellyfish industry, but also the world of academia and even the industry itself, who do not know nearly enough about the jellyfish to claim whether it has or has not a future in fisheries in global terms. "In spite of their wide commercial availability, jellyfish processing and utilization are not sufficiently studied and reported in the literature," write P. Hsieh, F.M. Leong and J. Rudloe in "Jellyfish as food", *Hydrobiologia* 451 (1-3), 2001. Only little is known about the biology and fishery of the edible jellyfish, particularly so in Southeast Asia, where scientific studies cannot keep up with the rapid development of exploitation.

Surely, the potential for the sustainable utilization of jellyfish in the face of dwindling fish catches, as a contributor to global cuisine, and the substantiation of the many claims and beliefs of the medicinal properties of certain species, merits further interest and study by the fisheries community.

Jellyfish export is an established industry in several countries bordering the Bay of Bengal, including Myanmar, Thailand, Indonesia and Malaysia. In comparison to these countries, India's jellyfish fishery is still small-scale, although it is an industry that seems to be gaining momentum in terms of its development and import capacities.

Jellyfish blooms along the coast of Tamil Nadu are not uncommon, and many fishermen readily recollect how much of a nuisance it is to have hundreds of jellyfish entangling themselves in their nets from year to year. Some years, however, bring more jellyfish than others, and it is not only the Tamil fishermen who are inconvenienced by the jellyfish swarms. A study by Madras University found that the nearby atomic power station situated at Kalpakkam has suffered reduced production efficiency, and has, in the past, even been forced to stop production entirely, due to the jellyfish swarms clogging up the sea water intake piping. This can cost an estimated Rs. 5.5 mn (approx. US$122,000) per day on lost revenue.

Although only a year's data is not representative enough to predict the frequency of jellyfish blooms in this area, during the study that took place between January 1995 and December 1996, data showed that peaks in the jellyfish arrivals at the power station coincided with the reversal of the coastal water currents during the two monsoon seasons. These occur in early June (the southwest monsoon) and November (northeast monsoon) and anecdotally coincide with the activities of the jellyfish industry in Tamil Nadu in 2003.

The potential for local people to become more directly involved in the processing and export of jellyfish is largely limited by a lack of technological knowhow, although the benefits from such knowhow could be substantial. The cost of jellyfish when processed is increased nearly seven to eight times that of the raw commodity, but as the local fisherman do not have the technology to process and they get lots of jellyfish during the season, they cannot do processing and storing. However, as many fishermen get unexpected incomes, there are few complaints.

Extra income

One of the more alarming consequences of the jellyfish industry's operations is the adaptation of traditional fishermen to specialize in 'jelly fishing'. For example, in Pulicat Lake in northern Tamil Nadu, the traditional lake fishermen are naturally keen to also 'have a go' at jelly fishing to earn the substantial extra income they have watched their marine fishing

neighbours collecting on a daily basis. As a result, many fishermen are buying the expensive fibreglass boats that are necessary to venture into the sea. The traditional marine fishing villages are, of course, not at all happy about this, and the ability to repay the debts incurred by fishermen as a result of buying new boats is heavily dependent upon the continuation of the jellyfish industry in that area for several years at least.

If, however, the jellyfish industry leaves the area in a couple of years time, to follow periodic jelly blooms in other parts of the ocean, what fate awaits the lake fishermen, who are left with marine fishing boats, but no jellyfish market? Perhaps the lake fishermen will continue to fish in the ocean, but this transfer will not be straightforward; new nets and expertise would be needed. While, in the past, traditional disputes between villages at Pulicat have occurred over fishing rights in the lake, could it be that the jellyfish industry has shifted things so that future disputes may be over who can fish in the ocean?

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