Science and Astrology

'All sciences arise, ultimately, from everyday observations about natural events and about the relation men and women have to these events and to each other.' (Richard C. Lewontin in 'Biology in Human Affairs' – Voice of America, Forum).

Astrology is a study of the correlation of the positions of the stars and planets in the sky with earthly events, including birth of a baby and its life on this planet. It is as much a science as theories of genetics in the earlier period of their development, when critical observation of the surroundings was the mode of experimentation. Our ancient *rishis*, who were intellectual giants and who were keen observers of nature and natural phenomena, had come to some conclusions on the basis of their observations. The conclusions had some predictive values in the hands of the competent – one who had the ability to take into consideration all the parameters in their proper weightage. Presently, the conclusions may be regarded only as hypotheses; although the believers would consider that there is enough material evidence in their favour. Solid proof could come later; even as proofs for several of the biological postulates are coming by only now.

It might be of interest to note here that our *rishis* also made other observations after similar studies in other areas, for example, in biology. I would like to refer to three of the supreme postulates of the Hindu philosophy:

1. *Aham Brahmasmi. Atman* is universal. It is the same *Atman* present in each of us.
2. The doctrine of rebirth. We have had past lives and we will also have future. It is the same *Atman* moving from one life to the next. *Atman* would never perish.
3. The doctrine of *karma*. *Atman* when moving to the next life carries with it its own characteristics. And here its manifestations could be modified. Our present actions would be reflected in our next life.

One can see a parallelism of these in modern biological postulates:

1. The genetic material is universal. Each one of us has more or less the same genetic material.
2. The genetic material is transmitted to the progeny over generations. The genetic material has thus survived in the past and will also survive in the future. In fact, it would appear, that the living body is only a surviving mechanism of the genetic material. The latter would never perish.
3. The physical and the emotional characteristics of humans are carried forward to the next generation/s by the genes present in the genetic material. The genes, to start with, are at different threshold activities in each of us. The activities can change depending upon prolonged exposure to an environment. The genes are then manifested to a different extent in each of us.

It is mind-boggling that our *rishis* should have arrived at such astounding hypotheses just by observing human behaviour over generations. Presumably they had the ability to store large amount of information, recall them (quite often the information of even a previous generation, the memories of which were present in them) and correlate them.

The postulates of our *rishis* are indeed scientific, although later they got a religious hue; because the conclusions of their analysis of the information stored in their brain, when presented to the public, almost sounded as revelation.

I cannot but agonize at the thought that if only the Indian scientists had pondered in depth over the postulates of our *rishis*, they would have found that, many of the biological discoveries of the present are in the informations on the brain in Sanskrit literature.

Let us be open-minded. It is not improbable that all events in this universe are interrelated to a smaller or greater extent. Every cause has its effect, some perceptible, some not. In atmospheric sciences one talks of the butterfly effect (figuratively perhaps!). In medical sciences, one talks of the effect of the moon on the human brain. Who knows? The activities of our genes could be governed by the events in the sky and revealed in the lines in our palms!

Biology is on the move to momentous developments. Francis Crick in his book *The Astounding Hypothesis* states: 'You, your joy, your sorrow, your memories, your ambition, your personal identity and your free will are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules'. D. S. Wood in the book *Molecular Genetics in Diseases of Brain* states: 'The genetic material carries the instruction to grow, to divide, to mature and even probably to die!' Do not such statements sound as extracts from Indian traditional knowledge?

Let us be modest to draw from the experiences of our *rishis*, who were intellectual giants. We now have more information than our *rishis* had (but, perhaps, less ability to correlate them). Knowledge is always a modification of the one present earlier. There is scope for improvement on the postulates of even the *rishis*. But first, let us know what the postulates of our *rishis* are, in various areas of human activity. Astrology is one of them.

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Astrology, navratnas and gemmology

It was quite interesting to go through the editorial, 'The astrology fallout' (*Curr. Sci.*, 2001, **80**, 1085–1086) and the correspondence 'Astrology and science' (*Curr. Sci.*, 2001, **80**, 1088–1089). I had, however, ignored an earlier editorial (*Curr. Sci.*, 2001, **79**, 1139–1140) and the letter by K. N. Ganeshaiah (719–720). In this letter, I wish to give my opinion on the influence of astrology on the selling of precious stones. I had briefly discussed about Hindu astrology on assigning nine gems to the nine major planets (navratnas), as well as the birthstones listed by Retail Jewellers Association and American Gem Society in my book *Gems and Gem Industry in India* (2000, Mem. 45, Geological Society of India, Bangalore, p. 3 and p. 375 respectively). Although there is great progress in science and technology, it is surprising to note that there is a great demand for 'stones that bring luck' or 'stones that satisfy/pacify/tranquilize (fools?)' a planet positioned unfavourably in one's horoscope! Till mid-1980s there was only a meagre demand for 'yellow sapphire' – the *pushyaraga* or *pucraj* that governs the planet Jupiter, erroneously called topaz (misled by the ancient term 'oriental topaz'). The price of this not-so-attractive 'coloured stone', the yellow sapphire, has increased manifold in recent times, as the belief in astrology has increased. The *pucraj*, according to the astrology, is a 'safe stone' under any circumstances as it does not harass the wearer. What about other stones? If the stone assigned to Saturn (blue sapphire) or Sun (ruby) or Venus (diamond) does not suit the wearer, it brings bad luck to him/her! The beautiful stone has to tolerate abuses before being discarded or resold.

It is ridiculous to note that the navratnas are known better by their 'governors', the planets. Yellow sapphire (*pucraj*) is called the '*Guru stone*' (*Guru-ka-nung* or just *Guru*). Similarly, the *Sani* – blue sapphire – the most feared of all stones. The flawless 'Kashmiri Sani' is the most expensive (because it has the most appropriate lovely colour that Saturn demands?). Burmese or Ceylony Sanis are fine, but African or Australian Sanis are looked down upon as their colour tone is too dark, etc.

All the above statements appear strange, but this is the fact in the Indian gem market. In fact, the study of gemmology was never taken seriously as a science in India, in ancient times. Before the beginning of the Christian era, Kautilya described gemstones as objects of beauty and earners of revenue to the king's treasure (Murthy, S. R. N., *Gemmological Studies in Sanskrit Texts*, Rashtrothana Mudranalaya, Bangalore, 1990, p. 103). In later stages, however, astrologers and merchants took over the study of precious stones as objects of luck!

As P. Balaram rightly reproduced in the above mentioned editorial (p. 1086), 'if Vedic astrology is to be promoted as a subject relevant to our heritage, it could be included as a part of ancient Indian studies, rather than projecting it as science'. Gemmology, however, is a part of mineralogy (science), not a fable.

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Astrology – Hype, hope and future

The academia is divided into two groups, for and against introduction of Vedic astrology in Indian universities. For the common man, any subject that is taught in universities should be job-oriented, the inherent principle of Human Resource Development. Here we would like to place some points for consideration.

Almost 60% (roughly) of the Indian population prefer to go to an astrologer for many events, right from birth of a child to the death of an individual. Astrology has been a guiding principle for most of them in distressed and confused moments. In spite of the efforts by reformists, revolutionaries, atheists and anti-superstition campaigners, our people are still behind the local jyothir vigyaniks. This shows the belief people have in the subject, irrespective of cast, creed, race and region in India. Nowadays most of the dailies and magazines, irrespective of geographical area, publish astrology columns. Almost all the ISPs in the net offer astrology, tarot cards, numerology, etc. Most of the successful industrialists and politicians believe in astrology.

Some may argue that astrology ignores planets like Uranus, Neptune and Pluto. Astrology would not have warranted the necessity to include them in its predictions. Our epics tell us that most of the wars were won as a result of astrological calculations and most of the temples are built according to *vaasthu* and astrological principles. One may brush them aside as obsolete and useless in the present context and point to their recalcitrant nature to absorb the new inventions, as perceived by some scientists. It is our responsibility to praise the science of astrology for surviving over the years. The *Panchangams*, the astrological almanacs, could predict the day, date and time of eclipse traditionally, without the advanced gadgets available now. The Western scientific influence and advancements are only 300 to 400 years old. But the science of astrology has survived for centuries without the aid of any advancements and criticism. There has been loss of information and techniques because the practitioners did not divulge the information to strangers and also because there were no schools, colleges or institutions to sustain the subject through documentation.

Presently, there is a hype among most of the Indian population hailing the practice of traditional and ethnomedicine. Of

late, whether useful to the community or not, the ethno and traditional medicinal data-mining and compilation have been given top priority. They are seen preaching in the fora to cash in on the traditional/ethno value in the name of Intellectual Property Rights. If so, why cannot there be some consideration for astrology, as our traditional way of belief. With such an argument we are not blindly supporting the subject, but would like to point out that even with most of our advanced scientific efforts, we fail to predict correctly natural disasters like the cyclones, earthquakes, etc.

Accepting astrology as an Indian art/science of predicting nature, would result in development of quality astrologers, at least to satisfy the mass and to get rid of spurious practitioners and quacks from the arena. This would also pave the way for advancements in this discipline. If not successful, this would also die in due course.

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Research impact vs economic impact

The letter by E. Vivekanandan (*Curr. Sci.*, 2001, **80**, 118–119) makes a very important point about differentiating between research impact as reflected in journal impact factors, and the economic impact of particular research projects.

He points out that certain research reported in the *Indian Journal of Fisheries* has led to significant impact on the Indian economy. He does not provide the evidence that would be needed to demonstrate the long path from the research reported to the actual technological accomplishments in the Indian fishing industry.

In his letter he cites nine relevant publications but due to *Current Science*'s unfortunate policy of omitting the titles of cited papers, it is extremely difficult for the reader to determine exactly what discoveries are involved. One would need access to the original articles just to begin to determine the connection between the research cited and the activity in industry. Research impact (meaning impact on the scientific research community) is quite different from economic impact, a subject which is of great interest to the US advocacy organization called Research!America. This has played a significant role in gaining support for biomedical research from the US Congress. Edwin Manfield and other economists have demonstrated the economic impact of research[1,2]. This type of information ought to influence legislators in every country.

Vivekanandan refers to the 'philosophy of Garfield' – presumably an essay published in 1979. The citation's documentation is ambiguous. I believe he intended to cite my essay in *Current Contents*[3] (http://www.garfield.library.upenn.edu/essays/v4p313y1979-80.pdf). I think this further illustrates the potential confusion that arises from the archaic policy of omitting titles from cited references.

It is marvellous that your journal is now available on the web. Hopefully this means you can correct this inadvertent error – in the web version, at least.

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2. Salter, A. J. and Martin, B. R., *Res. Policy*, 2001, **30**, 509–532.
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Facts that are ignored in academic recognition-making

One would fully agree with the correspondence 'Recognition of contribution of a person should be one-time affair' (*Curr. Sci.*, 2001, **80**, 321) of Bharati Mittal and add that all is not well with the mechanism of recognition or award-making for academic excellence by different institutions. The exercise is not simple, but there is lot of scope for improvement in the mechanism by which the recognition is made. Since the number of areas in a subject in which research is being done in the country is very large, there is a likelihood that one or more committee members of recognition-making bodies may not be aware of the top workers in a particular field who may deserve to be recognized. The mechanism is subjective too because which area attracts the attention/interest of the award making or committee members, also matters. Thus many scientists escape (I emphasize 'escape') recognition because their areas of research are not appropriately recognized.

There is yet another aspect of the mechanism of recognition-making. Outstanding or extraordinary work is well known and people seldom fail to recognize it, but the quality and recognition of the work, which is good but second to top ranking, is always a matter of opinion. In such a case, if the person and his work have to be considered for recognition, at least one member of the committee has to know the person and be familiar with his work. This can happen only when the member works in the same area or belongs to the same department of the institution in which the person works. If one is permitted to stretch the point a little further, recogni-

tion depends on the quantum of publicity made about the person and his work.

Under such a situation the subjectivity in recognition-making is large. The quality of publications of a person has not been given due weightage in the mechanism in respect of the reputation of a journal in which the publication is made, because it is the journal which determines the quality of work. Incidentally, this could be one of the criteria for recognition even for a non-expert, provided the journals are categorized by a committee of experts with appropriate weightage in each category. By this one does not mean that this should be the sole criterion, but that this could be a foolproof criterion to some extent. Hence, attention with due weightage to the journals of publication should be given for making the recognition. The impact factor of a publication, which is given weightage presently for any consideration of recognition, is objective, but this also suffers from the prejudice of current popularity/demand or like/dislike of a subject rather than depending on the quality of work based on ingenuity, precision, critical analysis and thoroughness. The impact factor of a publication does not necessarily reflect the true quality of work. All that one can say is that it has credibility under the circumstances. Hence undue weightage to impact factor overplays the quality of work, so that one can say that if at present any consideration is being made for publication, it is not truly objective.

The number-factor has its role too in determining the quality of work. How is one going to make an assessment of the quality of work when the number of committee experts is fewer and the number of areas of research is much larger? It is then the quality or reputation of the journals and the number of publications in them that determine the quality of work. Several workers in Chemistry (I know of this subject only) with several good publications have been left out in comparison to those recognized with lesser publications. To elaborate the point further, persons with three/four publications in the journals of *American Chemical Society* or *Chemical Society, London* or equivalent journals, have been recognized in preference to or in absence of knowledge of persons with sixty/seventy publications in the same journals. Can difference in the area of work matter to such an extent for the quality of work?

Apart from research, one area which has so far been ignored for recognition, is scientific education. One who spends his life in spreading, propagating or creating an awareness of science in masses or in innovating science education at secondary/undergraduate level, should also be considered for recognition by the highest scientific body in the country. Bharati has rightly pointed out this fact in her letter. It is therefore necessary that all awards/recognition-making institutions or bodies should strike a balance amongst various areas of recognition in a subject, including that of scientific education and adopt some objective criteria, e.g. the quality of publication in terms of category of journals to compensate the subjectivity of the mechanism of recognition.

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Improving research in India

Y. K. Gupta (*Curr. Sci.*, 2001, **80**, 808) has given some suggestions for improving research in India through spiritual 'Karma'. His solution can prove to be helpful in a limited way, e.g. at the project level dissertation in a professional course. Peer review is always helpful for budding researchers. There is no substitute for general facilities and infrastructure for carrying out research at the international level. An up-to-date library, laboratory and workshop are necessary for experimental research. But the competence of the investigator-in-charge or the research supervisor cannot be ignored. What we need the most for promotion of research in Indian universities is networking of research groups with national laboratories where library, laboratory and other infrastructure facilities are available in abundance. DST and other funding agencies must evolve a strategy for networking the research centres. A lot of money can be saved in this way by joint collaborations. All major research projects should be sanctioned only after a thorough survey is made about the infrastructure facilities available with the principal investigator.

It is also pertinent that Indian journals should improve the standards of peer review as suggested by Gupta. I feel that there is a lot of personal bias which discourages young researchers to publish in Indian journals. There are no competent reviewers in some emerging areas of research. As a matter of fact, when an Indian reviewer rejects our paper, we publish it in a foreign journal of repute as its quality is improved in the review process.

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Need for popular science books

Popular science books play a crucial role in kindling the scientific attitude, outlook and perception towards pursuing a scientific career. I fully agree with Dilip Salwi's views (*Curr. Sci.*, 2001, **80**, 331–332) that in India popular science books have still not caught on among the young as well as the general readers. A lot is desirable in this front to popularize reading as well as publishing of quality popular science books.

In general, these books can be classified into two categories – one which caters to the young readers between 6 and 17 years and the other for general readers of any age. Scientists like Feynman, Paul Davies, Stephen Hawking, Penrose, Capra and many more have benefited millions by their books, as they had visions to popularize science among the laymen and understood the importance of populariza-

tion too. The success of the famous *A Brief History of Time* by Stephen Hawking points to the fact that scientists can reach millions not only by their inventions or patents, but by their popular science books which have a far-reaching consequence in the minds of people.

The meagre availability of popular science books in our country can be attributed to many reasons. Firstly, in India where different linguistic communities have their education in regional languages, it is desirable to have popular science books translated and also written in these languages. Regional languages like Bangla, Marathi, Tamil and Kannada have quite a large number of books for children but other languages, including Hindi do not have adequate numbers so as to reach the masses. National Book Trust and Children's Book Trust are publishing popular books for middle aged children. In English, journals like *Resonance* and *Science Reporter* (NISCOM) have grown in popularity immensely during the last few years.

Popular science books have tremendous book value in the real sense and NISCOM should actively engage in arranging science writers/scientists to publish more books for the general readers. Moreover, the pace of scientific and technological development cannot be maintained without a steady influx of bright young students. To nurture the scientific curiosity and temper among the students, it is imperative to reach them through the print medium. This would also create awareness and interest among intelligent laymen and also help youngsters in getting a broad-based knowledge about scientific frontiers. The CSIR golden jubilee series of books has been a very successful venture in this regard. Universities Press, Hyderabad has also published quite a number of titles of popular science topics by writers like John Gribbin, G. Venkataraman and many others.

By integrating scientific principles and applications with history, graphics and humour, a large number of very popular series are available in the West, e.g. *Know About Series* by Ranger Ricks Foundation, Washington DC, USA; *Tell Me Why?* series by Simon and Schuster and many others. The presentation of these books leaves an indelible impression on the minds of young readers. Unfortunately in India these books remain in the libraries of only a few select schools and institutes and are beyond the reach of common readers.

It is therefore suggested that, as is being done with computer books which have obtained copyrights for publishing in India, agreements can be entered into by Indian publishers with their Western counterparts for reprints of Indian editions of such books so that they can reach a large number of readers at an affordable price.

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Shrimping footprints in the sands of time

The mindless enthusiasm for unrestrained shrimp culture growth sensibly curbed an onrushing calamity – an environmental ill that if not utilized properly would spoil the entire industry. In 1993, India produced 62,000 mt of *Penaeus monodon*. A year later the number reduced to 44,000 mt because of the onslaught of virulent diseases. It is obvious that these diseases were the impact of total mismanagement of the ecosystem. The disaster should be considered a model lesson for aquatic farmers. This paper looks into several factors, which most likely precipitated the recent crisis.

The rapid growth of shrimp culture in India can be traced through several milestones starting from 1980. The period that followed saw the dissemination of culture practices throughout the coastal region of India. In 1985, formulated feeds entered the market, facilitating the culture on a commercial scale. The succeeding years (1990–1992) were characterized by a dramatic climb in production. Peak production figures were registered in the year 1993. Subsequently, the challenge that confronted the fisheries industry in the form of a killer disease cannot be ignored, as *P. monodon* is one of the country's most valuable aquacultural crops. The lofty expectations generated by the impressive track record left the industry initially unprepared to face the killer disease. It is unlikely that a single factor can be isolated as the main cause. Only a combination of factors seems to make sense, viz. seed-stock, over-intensified grow out practices, water pollution, pond deterioration and diseases[1].

Under the traditional polyculture and extensive culture systems no major problems were encountered, except for the occurrence of natural disasters and the presence of predators and competitors. As the culture systems shifted to semi-intensive and intensive styles, stocking densities were raised and formulated feeds were used. Intensive production was targeted on ponds with unsophisticated inlet/outlet systems, shallower depths unprepared to treat pond bottom, lesser aeration equipment/ha and insufficient water volumes. Intensive systems have greater needs for water treatment, chemicals and drugs for diseases, prophylaxis and treatment. Misuse of these had serious consequences. Water quality and the general culture environment became difficult to manage and culture species became more susceptible to various diseases. Eventually various types of infection such as protozoan epicommensals, entozoic algae, black gill disease, gill decay, telson damage, body cramp and red discoloration were reported to affect the prawn.

Single-phasic grow out system deteriorated the pond bottom. It seemed that infection with the virus might indeed be lethal, but most commonly some physiological or biochemical stress relating to poor husbandry, whether related to water quality, nutrition or handling gave the virus the opening it needed to become established in a population. This in turn led to debilitation and infection with a secondary *Vibrio* pathogen[2], which caused the high and rapid mortality[3], associated with white spot disease.

Import of broodstock from Sri Lanka and Thailand in the mid-boom phase could have led to vertical transmission of the virus. Import of used aquacultural tools

infested with *Barnacles* and *Lepas* also could be a causative factor. Diseased virus-positive mothers were not culled in the hatchery through proper means. Most unhealthy shrimp seeds not accepted by farmers were released into the creeks. Integrated effluent-treatment systems were absent in all the semi-intensive/intensive farms. With soaring breeder prices, possibly virus-positive mother prawn meat were then ignorantly fed as fresh biological feeds for broodstock.

As long as culture conditions were optimal, *P. monodon* appeared to be able to tolerate light-to-moderate infections. However, it is obvious that farms failed to maintain an ideal culture environment. In many cases, outbreaks have most likely been predisposed by stressors, such as poor water quality and deteriorating environmental conditions[2], poor nutrition, etc. Several pathogenic viruses have been identified, namely MBV, MBV + bacteria, SEMBV, WSV. When the disease struck, growers were often willing to try anything that might solve the problem.

Larvae failed to develop resistance to natural conditions due to the use of high temperature to accelerate larval growth (immersion heater instead of room thermostats). Collection of virus-latent wild seeds was an eco-terrorism favouring horizontal transmission of viruses. Increased production cycles/year leading to improper tilling and drying of bottom soil, deteriorated the ponds, further leading to immature aging. Unquestioned increase of stocking densities to unreasonably high levels, beyond the carrying capacity of the environment, led to it being abused or overloaded. The culture environment eventually became conducive to the outbreak of disease. Indiscriminate use of medicine and antibiotics and excessive application of antibiotics and chemicals to improve the prawn's resistance to disease, provided only temporary results. Once exposed to harsh or unfavourable natural conditions in the grow out phase, the prawn became susceptible to infection again.

Marketers who sold innumerable drugs to farmers (for trial) were themselves even less aware of the chemical implication in the animal's body and sometimes unavoidable use of polluted water, the culture water source gets contaminated with effluent discharged from aquaculture farm. Waste water which included diseased shrimp, fish and refuse was distributed along the coast in the vicinity of the water intake for the shrimp farms and pathogens were therefore transmitted rapidly from one shrimp farm to another.

Epizootic disease would seldom arise if husbandry and environment were perfect. Analysing the causes of the poor conditions, which frequently led to disease, it had been found that the fundamental factor was purely location. If sites were chosen for spurious reasons, failure would certainly result. A thorough study of climate, topography and local water conditions is to be made for site selection, apart from an economically viable price, suggesting that all the technical needs of the cultured animals could be adequately met. Failing to recognize this is the largest single cause of failure in aquaculture. The second cause was failure to recognize the limitations of the learning curve. Then, concentration on the hardware to the detriment of the software is a grave mistake. Design and engineering must be adequate and must provide resources in terms of water flow, space, oxygen and food distribution to meet the needs of planned stock and production[4].

The impressive performance of the flourishing *P. monodon* culture industry and the rising prosperity of those who had entered it, beckoned a large number of enthusiastic entrepreneurs. In their eagerness to put up their own farms and rake in a profit, many of them did not acquire a basic knowledge and proper training on the technical aspects of semi-intensive and intensive culture first, before embarking on a farming enterprise.

Absence of a reliable effective sanitation system has left hatchery facilities and grow out ponds highly vulnerable to contamination by harmful micro-organisms and has facilitated the spread of disease. Some farmers were plainly unaware, while others neglected the possible far-reaching consequences of poor sanitary practice.

The unwieldy competition for pumping estuarine water during high tides, which was already stained with industrial waste discharges resulted in a serious depression of the water quality profile. Lack of technical training of farmers is partly a contributing factor, nevertheless demanding urgent attention and action.

Consultants also were sometimes justifiably the subjects of suspicion, but when chosen carefully, they could become indispensable. Experimental consultants introduce technologies and methods perfected elsewhere.

Proper shut down or dry out between any two crops was lacking. Additional crop was imposed between narrowing fallow periods due to compulsion by the capitalistic corporate heads. Analysis of the fundamental causes of diseases revealed that most of the factors were man-made and could be averted. Absurdly encouraged shrimp seed brokerage system became a slow suicide. The Ministry of Environment did not monitor the ecological footprints from earlier periods of commercial shrimp farming.

Twenty years is a short time for a new industry to grow into a major one. But that was all it took. There is always a price to pay for development, especially one that proceeds to fast. The price was in the form of diseases and a damaged ecosystem. These problems crept in insidiously over the years, but were never grave enough to interrupt the smooth ascent. At least, this was a painful lesson to learn, for the industry. A perfect moulting should help a natural post-moulting growth.

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