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EDITORIAL

There are several causes for loss of marine biodiversity, especially in the coastal waters of industrialized countries. Among the most important are:1). direct habitat destruction through the erection of engineering and drainage works that disturb the physical integrity of coastal and marine systems; 2) poor fisheries management; 3). the uncontrolled exploitation of corals and mollusks; 4). the "by-catch" of large numbers of non-target species in fisheries; 5). the introduction of alien species; and 6). the overall lack of an integrated approach to coastal zone management.

In addition, as technology and international trade have intensified, their impact has extended even to the remote oceans, which bear the "fingerprints" of humanity. The species and ecosystems suffering most, however, are in the coastal waters closes to humankind. Many marine organisms release their eggs into the surface waters of the sea. Planktonic larvae can disperse hundreds, even thousands, of kilometers, and because of this widespread dispersal, marine fishes, invertebrates, and plants might seem to be at a low risk of extinction. Several categories of marine species are particularly vulnerable to threats caused by human activities: a). Surface-dwellers (including larvae of many commercial fishes) are vulnerable to oil and other floating pollutants and increased ultraviolet radiation. b) Species requiring more than one habitat during development (such as Pacific salmon populations) are threatened by activities in any one of them. c). Species that mature slowly and produce few young (such as sea turtles, seabirds, and sharks) are vulnerable to over-exploitation. Maintaining the integrity of the sea and, hence, its sustained production of resources and services requires attention to whole ecosystems as well as to their component species.

CONTENTS

- Estuaries and salt marshes, mangrove forests, and sea-grass beds near cities and towns are severely degraded worldwide. And, because ships carry millions of larvae in their ballast tanks, alien species are common in the busiest harbors, where more than half of the species can be interlopers. Many estuaries draining rural watersheds are contaminated with agricultural chemicals and choked with silt eroded from farming and forestry.
- The increasingly observed worldwide bleaching of corals could portend massive ecological changes for coral reefs and other marine ecosystems.
- Global atmospheric change will touch even the remotest areas.

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INVITED ARTICLES

MARINE BIOACTIVE COMPOUNDS AND THEIR APPLICATIONS IN MARICULTURE

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Introduction

Marine bioactive compounds or Marine natural products (MNPs) are organic compounds produced by microbes, sponges, seaweeds, and other marine organisms. The host organism synthesizes these compounds as non-primary or secondary metabolites to protect themselves and to maintain homeostasis in their environment. Between 1977 and 1987, around 2500 new metabolites (MNPs) were reported from marine organisms ranging from microbes to fish, which accounts for less than 1.0% of the total marine organisms. Review of literature reveals that even the seawater has bactericidal properties. This could be attributed to the production of antibiotics by planktonic algae and bacteria respectively.

In the case of aquaculture or Mariculture activities, diseases are frequently encountered in all the stages (from the egg stage onwards). Disease control using antibiotic substances has inherent limitations. Recently, the Marine Products Export Development Authority (MPEDA) of India has restricted the usage of many antibiotics in aquaculture, particularly in shrimp farming. The common problems of antibiotic use include: development of drug resistant bacteria, environmental contamination and possible residues in the tissues of fish/shellfish. Disease management using vaccines has limitation as they are specific. If the causative agent is different, the vaccine will not work. Considering the potential of marine bioactive substances, and the avenues for developing potent new drugs and other useful products, a holistic approach is required to develop fish/ shellfish therapeutics, immunostimulants and other feed additives.

Marine bacteria

Rosenfeld and Zobell (1947) demonstrated that marine bacteria produce anti-microbial substances. The first documented identification of a bioactive marine bacterial metabolite was the highly brominated pyrrole antibiotic, isolated by Burkholder and co-workers from a bacterium obtained from the surface of the Caribbean Sea grass *Thalassia* (Burkholder *et al*., 1966). Subsequently, this unique metabolite was identified by x-ray crystallographic methods, which composed of more than 70% bromine by weight (Lovell, 1966). The metabolite exhibited impressive *in vitro* antibiotic properties against Gram-positive bacteria, with minimum inhibitory concentration (MIC) ranging from 0.0063 to 0.2 μg/ml. However, it was inactive for Gram-negative bacteria and animal assays. As more evidence is obtained, it is becoming abundantly clear that bacteria form highly specific, symbiotic relationships with marine plants and animals. Experience in this area arose from a study of the pathogen resistance of the estuarine shrimp *Palaemon macrodactylus*. Gil-Turnes *et al*., (1989) observed that the eggs of *P. dactylus* possess significant bacterial epibionts, which, when removed by treatment with antibiotics, leads to the rapid infestation of the eggs by pathogenic fungi, especially of *Lagenidium callinectes.* It could be due to the anti-fungal agents produced by bacteria. Studies on marine bacterial products in Mariculture are therefore essential.

Marine fungi

Although terrestrial fungi have represented a major biomedicinal resource (penicillin from *Penicillium*, for example), studies to develop the biomedicinal potential of marine fungi were less The isolation of a small lactone, leptosphaerin from *Leptosphaeria oraemaris* by Schiehser (1980) demonstrated that marine fungi may form important resource for unique metabolites. Later, the useful chemical, Gliovictin was isolated from marine fungus, *Asteromyces cruciatus* (Shin and

Fenical, 1987). Since then more than twenty useful bioactive compounds have been derived from marine fungi.

Marine Microalgae

Microalgae are significant resource for bioactive metabolites, particularly cytotoxic agents with applications in cancer chemotherapy (Moore et al., 1988). From the marine microalgae such as from the blooms of *Phaeocystis sp*., antibiotic substances were listed. *Phaeocystis pouchetii* is reported to produce chemicals such as Acrylic acid, which constitutes about 7.0% of the dry weight. The antibiotic substances thus produced are transferred throughout the food chain and found in the digestive tract of Antartic penguins (Sieburth, 1961). Production of ß carotene and vitamins by the halotolerant alga *Dunaliella sp.,* is documented. These compounds have much importance for the Mariculture activities.

Marine Macroalgae

Of the total marine algae so far evaluated, about 25.0% showed one or the other biological activity. The metabolites of green algae were reported to contain 1,4 –diacetoxic butadiene moiety, which exhibited icthyotoxic property. Among the red algae, halogenated lipids have been isolated, particularly from the *Laurencia sp.* The rare chemical prostaglandin was also reported to occur in *Gracilaria pichenoids*. *Ulva* meal supplementation was found to provide disease resistance to red sea bream in Japan (Satoh *et al*, 1986). Similar results were also reported from Japan on the use of *Ulva* meal supplementation towards disease resistance and high growth rate in black sea bream (Nakagawa *et al*, 1987). The polysaccharide fractions from marine algae, *Porphyra yezoensis* (PASF) was found to stimulate the *in vivo* and *in vitro* murine phagocytic function. The purified fractions of PASF gave stronger phagocytic activity (Yoshizawa *et al*. 1995). Some of the macro algal crude extracts indicated their potential therapeutic nature when challenged with potential pathogens among fish and shellfish. The cellular and humoral responses of the fish/shellfish towards the algal metabolites were investigated (Lipton, 2001).

Marine Sponges

The wider biosynthetic capability of sponges could be attributed to their biological association with other symbionts. According to Bertrand and Vacelet (1971), about 38% of the sponge body comprises of microorganisms. A wide variety of secondary metabolites were isolated from sponges and these have been associated with antibacterial, antimicrobial, antiviral, antifouling, HIV-protease inhibitory, HIV reverse transcriptase inhibitory, immuno- suppressent and cytotoxic activities. In addition to potential anticancer applications, the MNPs of sponges have a myriad of activities ranging from antibiotic activity including anticoagulant, antithrombin, anti-inflammatory, as well as imunomodulatory activities.

Presence of specific symbiont morphologies of bacteria within specific sponges has been reported. These specific bacteria, which live symbiotically with sponges, passed through their feeding chambers without being digested. This suggested some sort of encapsulation or recognition process. In the demosponge, *Halichondria panicea,* an association with the microbe *Pseudomonas insolita* was suggested to be lectin-based (Müller *et al.,* 1981). Wilkinson found an immunological basis for symbiosis in some sponges, which he claimed as evidence of a Precambrian origin for many symbioses (Wilkinson, 1984).

A major problem with the early studies on sponge-microbe symbiosis was that most microorganisms were uncultured or unculturable. The application of molecular biology to sponge-microbe symbiosis is now yielding results that could not have been obtained by classical microbiological methods. The discovery of a member of the Archaea living specifically within a sponge similar to *Axinella mexicana* was particularly worth to mention (Preston *et al.,* 1997).

Avenues for further research and development in relevance to Mariculture:

Perusal of literature indicates that during the last three decades number of diverse biologically active compounds has been isolated from marine organisms, but the number of compounds taken-up for the field trial/clinical use are scanty. Some of the future requirements are listed below:

1. Microbial Isolation/screening and culture techniques: required as new symbiotic microbes are difficult to culture under laboratory conditions. Basic Research in Marine Microbiology is essential. Without considerable attention to developing the basic biology of marine microorganisms, explorations for new bioactive metabolites would be limited to those few classes of microorganisms, which are readily isolated and grown under "standard" conditions. Unfortunately, little is known about the specific nutrients and growth factors required by most of the marine microbes. For example, the common media components such as peptone, sugars etc., are unrealistic marine nutrients as complex carbon sources such as chitin, sulphated polysaccharides, marine protein etc., are found in the marine habitat. In addition, information is lacking on some of the uncommon inorganic elements such as lithium, silicon etc., abundant in the marine sediments. As a result of these difficulties, it is seen that less than 5% of the available microbial population is only culturable under the standard laboratory conditions. Presently, this condition, certainly limits the scope and ability to isolate and culture majority of the interesting and new microbes.
2. Preparation of crude extracts for bioactivity: as the goal is to obtain the widest possible screening for each crude extract so that no useful compound is over looked. Solvents such as methanol, chloroform or ether as independent solvents or as combinations can be used depending upon the nature of the MNPs. As soon as the crude extracts are obtained, there is need for immediate and simple in vitro assays such as: i. Antimicrobial and ii. Enzyme inhibition assay (very low quantity of sample only is required). This in turn helps in the `bioassay – guided fractionation and purification' process.
3. Purifucation: Once bioactivity is detected in the crude extract, the next step is to purify the same. It is important to employ non-destructive method such as spectroscopic method, which conserves the materials for further bioassays. In addition, techniques such as: TLC, MS/IR/uv and H nMR – (for structural elucidations) are to be adopted for purification of the crude extract and for determining the structure.
4. Pharmacological screening: The next step after purification and structural elucidation is pharmacological screening. Studies such as determining the LD50 of the extracts in mice, in addition to brine shrimp assay, fertilized sea urchin assay and starfish assay are to be carried out in established laboratories. Further tests such as: antiviral (AIDS/anti-HIV), cytotoxic, anti-inflammatory, anti-tumor, tumor promoter (protein kinase), analgesic, anti-coagulant / anti-thrombic (ex: heparin), anti-ulcer, anti-cholesterol / anti-lipemic, wound dressing, anti-parasitic, anti-protozoa are to be conducted.
5. Commercial development of bioactive (MNP) products: The `co-operative drug development programme' as suggested by Dr. Faulkner is the best method, which will solve the problems arising on issues such as: patent rights, academic freedom and industrial secrecy.
6. Conservational aspects of source organisms: Eco-friendly collection of the source organism and required supply of them in bulk for scaling-up process.
7. The role of Industry and Academia: Considering the less microbiological and intensive pharmacological training to the industrial personnel, relevant microbiological training has to be imparted to the industrial pharmacologists. New isolation methods, media development etc., are to be included in the curricula of academic/research institutes. Collaborative programmes which combine biomedical and microbiological expertise of the pharmaceutical industry with the marine microbiological resources available in the marine R&D Institutes will in the long run help in the better utilization of the marine resources for biotechnological aspects.

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Pressures on Marine Biodiversity

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Overview

An estimated 60 percent of the global population lives within roughly 100 kilometers of the shore. This means that about 3.4 billion people rely heavily on marine habitats and resources for food, building materials, building sites, and agricultural and recreational areas and use coastal areas as a dumping ground for sewage, garbage, and toxic wastes. Moreover, much of the remaining non-coastal population is concentrated along rivers and other waterways. Pollution and poor land use practices within these watersheds affect downstream marine habitats because sediments and pollutants are ultimately washed into coastal waters.

Pressures on marine ecosystems include coastal population density and continued population growth, which are accompanied by increased consumer demand for marine products, increased waste disposal, rapid alteration of coastal habitats, uncontrolled industrial pollution, inadequate institutional structures for managing marine resources, lack of property rights and management regimes within international waters, and lack of understanding and awareness of marine ecosystem processes and the effects of human actions on marine biodiversity.

Most of the world's marine ecosystems--particularly near-shore habitats are stressed by a combination of these factors. Land-based pollution in the form of industrial wastes, sewage, and runoff of pesticides and fertilizers, combined with oil and other wastes from ship traffic, have contaminated the entire basin.

The direct factors (pressures) leading to the loss of marine biodiversity can be broken into five categories:

- habitat loss,
- intense overexploitation,
- pollution and sedimentation,
- species introductions, and
- climate change.

Habitat Loss

Habitat conversion and degradation are generally thought to be the most significant threats to terrestrial life. Within marine ecosystems, they rank along with overexploitation and pollution as major causes of biodiversity loss.

Coastal development contributes to habitat loss in a number of ways. These include conversion of mangroves and other wetlands as a result of urbanization and agricultural expansion, the building of shoreline stabilization structures such as breakwaters, mining, oil drilling, dredging and filling. These result both in the destruction of wetlands and other habitats and in the degradation of nearby areas (through siltation and changes in water temperature and flow, salinity, and other physical factors).

Damming of rivers and water diversion projects lead to changes in downstream estuarine and marine communities, because interruption of freshwater flow changes the physical environment of such areas and the amount of nutrients that they receive. In addition, dams can cut off species access to spawning areas - this includes not only species that live in saltwater and reproduce in rivers (such as salmon) but also freshwater species that breed at sea (such as freshwater eels).

Intense exploitation of marine resources may indirectly lead to loss of habitat. For e.g, trawling disturbs bottom-dwelling communities - both adjacent to shorelines and in deeper coastal waters - as nets scour sea-beds and smother burrowing creatures and other species with sediments. Fishing with dynamite and harvesting of corals have been major threats to coral reef areas.

Intense Overexploitation

More than one fourth of all production occur within ocean upwelling and tropical marine shelf areas and is consumed by humans; in temperate shelf regions, it is about 35 percent. Continued exploitation at such levels is leading to changes in species composition, loss of biodiversity, and shifts in dominance and survivability.

Much of the global fishing effort is targeted at a few species, located primarily near the top of the food chain. Overexploitation of these species has three effects, viz.,

- Loss of genetic diversity as fish populations decline.
- Affects the relative abundance of individual species or the mix of different species within an ecosystem. Often, populations of both the target species and the predators that feed on these species decline and are replaced by stocks of lesser commercial value and
- Depleted fisheries have direct economic impacts, including reduced income (and unemployment) and higher consumer prices.

Overfishing affects other marine species, not just fish stocks. Over-hunting has decimated many marine mammal populations. Poor management practices, subsidization of the fishing industry, uncontrolled harvests within international waters, and destructive and wasteful capture methods are to blame for the overexploitation of most marine species.

Pollution and Sedimentation

Dumping and discharging of pollutants into the sea, oil spills, nutrient- and silt-laden runoff from land and rivers, fallout of chemicals carried by the wind from land-based sources, and noise from ships and other machinery (which disrupts communication among whales and other species) are some of the major contaminants affecting marine species and ecosystems

Contaminants affect marine biodiversity in a number of ways. Untreated sewage, oil, heavy metals, and other wastes may be directly toxic to some marine organisms. Their effects may be instantaneous or cumulative.

Other contaminants such as radioactive waste, pesticides, and other chemicals have cumulative effects, building up within individuals over time, especially within species high on the food chain. Moreover, various contaminants and physical degradation can act together in a cumulative or synergistic fashion.

Other contaminants can trigger ecosystem-wide changes, resulting in conditions that are inimical to a range of species. Runoff of sewage from cities and of fertilizer and pesticide desidues from agricultural areas elevates the levels of nutrients within near-shore waters. Certain algal species capitalize on these conditions, undergoing massive population explosions (known as blooms), which, by lowering water clarity and oxygen content, effectively crowd out other taxa in the community. Many bloom species produce toxins. So-called killer blooms have been linked to die-offs of fish, shellfish, and other species that consume or come into contact with toxic algae or that ingest other consumers of those algae.

Widespread effects are often noted as a result of sedimentation. Soils eroded from deforested areas and poorly managed agricultural lands often end up at sea, reducing light penetration to seagrass bed, coral, and other communities dependent on the productivity of photosynthesizers living on the sea floor. As sediments settle out, they smother bottom-dwelling organisms and affect filter-feeding species.

Nontoxic solid wastes and marine debris cause significant mortality among marine species. For example, plastic bags, fishing lines, and other debris can entangle seals, seabirds, and other organisms, causing slow but sure deaths. Bits of plastic and other man-made materials are regularly ingested by sea turtles and other species, often with fatal consequences. Abandoned fishing nets, lobster pots, and other equipment continue to catch fish and other marine creatures years after the gear is discarded or lost.

Species Introductions

For centuries, ships have served as a means by which organisms can hitchhike to new waters. Until recently, such transport was limited mainly to animals that attached themselves to or burrowed into the hulls of ocean-going vessels. Now, however, ships carry an enormous variety of exotic species, including both plankton and larger species in larval form, within their ballast water.

Accidental introduction of exotic species may be one factor in the apparent spread of toxic blooms; it is also the suspected cause of a disease affecting. By feeding on or overrunning dominant native species, exotic species can trigger changes in the species mix within ecosystems.

Although there are no documented marine extinctions caused by exotic species, introduced species have played a major role in threatening or leading to the extinction of numerous inland species. Even though a species may not be exotic, transfer from one area to another may cause the mixing of genetic stocks and the transmission of disease.

Climate Change

Global warming could be a significant threat to marine biodiversity. Among other effects, rising waters (as a result of melting ice caps) could drown coastal mangrove and other wetland habitats. Even if global warming were to proceed at a pace slow enough to permit species to colonize new coastline boundaries, the presence of existing agricultural and urban development with protective bulkheads and dikes would, in many cases, prevent the establishment of new wetland areas.

Projected climate change could have other effects, including changes in ocean currents, salinity (due to changes in river flow), and surface temperatures. These would alter the species compositions found within individual ecosystems today, perhaps triggering local and global extinctions in the process.

BOOKS

Coastal Urban Environment/edited by R. Ramesh and S. Ramachandran**.** 2003. New Delhi, Capital Pub., 232 p.

The primary objective of the book is to discuss the state-of-the-art coastal urban environment and its status with regard to recent developments and future planning. Evaluation of coastal issues, policies, management, case studies, and sustainable use of coastal waters in an urban environment have been addressed. Special emphasis has been given to coastal environments such as mangroves and coral reef ecosystems that are highly fragile and are constantly exposed to anthropogenic stress.

The Empty Ocean by Richard Ellis. 2003. 367 p. Island Press, USA

Acclaimed author and artist Richard Ellis tells the story of our continued assault on life in the sea and weighs the chances for its recovery. Through his own drawings, he introduces us to the many forms of sea life that humans have fished, hunted, and collected over the centuries, from charismatic whales and dolphins to the lowly menhaden, from sea turtles to cod, tuna, and coral. He brings to life the natural history of the various species, the threats they face, and the losses they have suffered. Although killing has occurred on a huge scale, with extinction all too often the result, Ellis also finds instances of hope and resilience, of species that have begun to make remarkable comebacks when given the opportunity.

The Jade Coast: *Ecology of the North Pacific Ocean* by Rob Butler 2003. 176 p. Firefly Books, Canada

Over 80 stunning colour photographs depict the fascinating coastline from northern California to southeast Alaska which supports over 400 species of fish, 161 species of marine birds, 29 marine mammals, and over 6500 species of invertebrates.

Responsible Fisheries in the Marine Ecosystem Edited by G Valdimarsson and M Sinclair. 2003. 448 p. CABI.

Addresses ecological and environmental issues associated with responsible and sustainable marine fisheries. It includes 20 chapters developed from an international conference and concurrent symposium held in Iceland in October 2001. Contributors include leading international authorities from around the world.

Marine Bioinvasions: Patterns, Processes and Perspectives Edited by Judith Pederson. 2003. 143 p. Kluwer, Netherlands

Collection of papers presented at the Second International Conference on Marine Bioinvasions. The complexity of marine ecosystems challenges easy solutions to prevention, management, and control of introduced species. This book highlights issues of timely importance in marine bioinvasion science, including potential evolutionary consequences and the feasibility of biological control.

The Economics of Marine Resources and Conservation Policy *The Pacific Halibut Case Study with Commentary*. Edited by James A Crutchfield and Arnold Zellner. 2003. 240 p. Chicago UP, USA

How can we manage a so-called renewable natural resource such as a fishery when we don't know how renewable it really is? Crutchfield and Zellner developed a dynamic and highly successful economic approach to this problem, drawing on extensive data from the Pacific halibut industry. Long out-of-print, this book presents a complete reprint of Crutchfield and Zellner's pioneering study, together with a new introduction by the authors and four new papers by other scholars. These new studies cover the history of the Pacific halibut industry as well as the general and specific contributions of the original work to the fields of resource economics and management.

Red Tides Edited by Tomotoshi Okaichi. 2003. 432 p. Kluwer, Netherlands

Discusses the red tide phenomena throughout the world, which includes biological research results on taxonomy of cyst and vegetative cells of red tide organisms and ecological and physiological studies using ecological modeling.

Coastal and Marine Environmental Site Guide by M Budd, S John, J Simm and M Wilkinson. 2003. 164 p. CIRIA

This guide provides practical and accessible information on appreciating, avoiding and mitigating the effects of poor environmental practice on coastal and marine construction projects.

NEWS BRIEFS

Spurt in smuggling of marine life causes concern, *The Hindu* Sep 12, 2003.

A spurt in the smuggling of marine life, using the city as a major transit point, is causing concern among researchers and wildlife authorities. The authorities detected 10 major cases of wildlife smuggling over the last two years, of which half involved marine life. Sea cucumbers, organ pipe corals, sea horses, pipe fishes and dragon fishes, besides star tortoises, are the main attractions to smugglers.

Dolphin hotline launched *BBC News* November 4, 2003

A hotline has been set up to reduce the number of dolphins which are washed up dead on Cornwall's beaches. So far this year, 200 carcasses have been washed up on beaches in the county.

Arctic and Antarctic sea ice marching to different drivers. *Brightsurf.com*, November 12, 2003.

A 30-year satellite record of sea ice in the two polar regions reveals that while the Northern Hemisphere Arctic ice has melted, Southern Hemisphere Antarctic ice has actually increased in more recent years. However, due to dramatic losses of Antarctic sea ice between 1973 and 1977, sea ice in both hemispheres has shrunk on average when examined over the 30-year time frame.

Mantis shrimp fluoresce to enhance signaling in the dim ocean depths. *Brightsurf.com*, November 17, 2003.

The tropical mantis shrimp has the most sophisticated eyes of any creature on the planet, yet it often lives at murky depths where the only light is a filtered, dim blue. Why does it need such complex vision? Marine biologists and physiologists have now discovered at least one use for these eyes in the deep, blue ocean: to see the fluorescent markings mantis shrimp use to signal or threaten one another.

Formation of lava bubbles offers new insight into seafloor formation *Brightsurf.com* November 19, 2003.

Scientists studying the formation of the sea floor thousands of feet below the surface have a new theory for why there are so many holes and collapsed pits on the ocean bottom. In a recent article in the journal Nature, the researchers say the holes and pits of various sizes are probably formed by lava erupting onto the seafloor so quickly it traps water beneath it, forming bubbles of steam that eventually collapse as the water cools. The hardened crust then breaks, forming pock marks and glassy black plates of ocean crust with stalactites on their underside.

Mediterranean dolphins' net peril *BBC News*, November 20, 2003

Turtles, dolphins and sharks are among the unintended victims of Mediterranean fishing fleets, the World Wide Fund for Nature warns. Driftnets which hang beneath the water and trap anything which happens to swim into them are to blame, it says. It believes that in some parts of the sea so many dolphins are killed that their survival in the region is threatened.

Leaf munching sea lion saved, *BBC News*, November 25, 2003.

Phoebe - who lives at Chester Zoo - swallowed 6kg of willow leaves. Vets from the University of Liverpool saved her life by cutting her stomach open and removing the foliage. It comes two years after they operated on Phoebe previously when she swallowed a large number of stones.

Whales found dead in Tasmania, *BBC News* November 25, 2003..

Over 100 pilot whales and 10 dolphins have been found dead after beaching themselves on Australia's island state of Tasmania, which appeared to have been dead for several days.

Algae threatens great coral reef, *BBC News* November 27, 2003

Australian scientists say they are concerned that the blanket of golden algae could smother and kill the coral. Seaweed-like fronds of the blooms have been seen for the past three summers on reefs north of the Queensland city of Cairns, which is popular with tourists.

Survey finds huge coral fields *BBC News*, 2 December, 2003

The rich pockets of marine life were discovered by a Devon Wildlife Trust survey in Lyme Bay. The European Union-funded sonar and video survey was carried out this autumn at Beer Home Ground, a fishing area about three miles from the Devon coast. The results have amazed marine experts at the Trust, who feared dredging for scallops might have completely degraded the area.

Whales drawn to emergency sirens, *BBC News*, 3 December, 2003.

It is the first time such a strong response to a man-made signal has been reported in whales, researchers claim. The alarm could be used to check waters for the endangered northern right whales before conducting military exercises which could harm the animals.

Australia life-line for Barrier Reef, BBC News, 3 December, 2003

The Australian Government has submitted a plan to parliament to make the Great Barrier Reef the most protected coral reef system in the world. It wants to increase so-called green zones, where commercial and recreational fishing is banned, from 4.5% of the 2,000-kilometre (1,200-mile) reef to 33%. The plan, which is expected to be approved by parliament and come into force by the middle of next year, would create the world's largest network of protected marine areas.

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