New format

the Courier

july-august 1998

On the road with Brazil's landless

Youssou N'Dour Africa's world musician

20,000 worlds under the sea

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31,rue François Bonvin
75732 Paris Cedex 15 France
Fax:(33) (0) 1.45.68.57.45 - (33) (0) 1.45.68.57.47
e-mail:unesco.courier@unesco.org
Internet:http://www.unesco.org
Director:René Lefort
Editor in chief:Sophie Bessis
Secretary, Director's Office/Braille editions: Annie Brachet (Tel:(33) (0) 1.45.68.47.15)

Editorial staff (Paris)
English edition:Roy Malkin
Spanish edition:Araceli Ortiz de Urbina

Sophie Boukhari
Lucia Iglesias Kuntz
Amy Otchet
Seydou Amadou Oumarou
Jasmina Sopova

Translation
Miguel Labarca
Glenn Naumovitz
Xavier Perret
Director, art and production unit:Georges Servat
Page layout and design:Eric Frogé
Illustrations:Ariane Bailey (Tel:(33) (0) 1.45.68.46.90)
Documentation:José Banaag (Tel:(33) (0) 1.45.68.46.85)
Liaison with non-Headquarters editions and press: Solange Belin (Tel:33 (0) 1.45.68.46.87)
Administrative Assistant: Theresa Pinck (Tel:(33) (0) 1 45.68.45.86)

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Circulation and promotion
Fax:(33) (0) 1 45.68.57.45

Subscriptions and customer service
Michel Ravassard (Tel:(33) (0) 1.45.68.45.91)
Sales and subscription agents
Mohamed Salal El Din (Tel:(33) (0) 1 45 68 49 19)
Stock management and shipping
Pham Van Dung (Tel:(33) (0) 1.45.68.45.94)

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Land-hungry in Brazil

Photos by Sebastião Salgado

The occupation of vast under-used estates by Brazil's Landless Rural Workers' Movement (MST) might seem like a struggle from another age. In fact the movement is offering new responses to the greatest scourge of modern Brazil—social exclusion.

When thousands of machete-wielding Brazilian farm labourers take over their Promised Land it may look like a scene from the remake of a great film epic. In reality, it is not the workers who are out of sync with the times but the great landowners or *fazenderos* who own most of the land in Brazil, an enormous country with 350 million arable hectares.

In few countries is there such a glaring inequality in private land ownership as there is in Brazil. At the bottom of the ladder, five million families do not have have even the smallest plot to cultivate. Just above them, six-and-a-half million "family smallholdings" are packed into the quarter of the farmland where 80 per cent of Brazil's rural population lives. At the top of the ladder, 500,000 great estates, averaging 600 hectares each, occupy three-quarters of the arable land. Brazil's National Institute for Settlement and Agrarian Reform (INCRA), a public body, has found that 150 million hectares of the *fazendas* are under-used, including 20 million fertile, easily accessible hectares that could be farmed immediately.

On 17 April 1996, an MST procession was marching to the capital of Pará State in the Amazon region when military police opened fire at Eldorado dos Carajás,killing nineteen.Since 1985, over a thousand people have been murdered, executed or have "disappeared" in the ▶

Above, on a sugar pantation near São Paulo. These workers are known as bóias frias, or "those who eat cold food", because they bring their meals in their knapsacks.

A combative art

The *New York Times* has hailed Brazilian photographer Sebastião Salgado as the author of "some of the most compelling photojournalism in the last twenty years," and as "an artist using journalism as a vehicle for his art." The French daily *Le Monde* has dubbed him "one of today's masters of black and white photography".

The 53-year-old economist-turned-photographer has used Paris as a base for years while traveling the world over for his extraordinary photo coverage of the "wretched of the earth".Between 1986 and 1992, he scoured 26 countries on every continent to capture on film the impact of the major social transformations taking place. The investigation resulted in a book (*Workers: an Archaeology of the Industrial Age,* Aperture Books, 1993) published in nine languages and featuring in some 60 exhibitions.

In 1994,Salgado began focusing on migrants. He decided to dedicate six years—up to the year 2000—to covering the hundred million international migrants and some 40 million who stream into cities from the countryside each year in search of work.

"I want to state the case for migrants and those who take them in. To show their dignity in their desire to integrate and their courage in facing their ordeals. To show how they contribute their spirit of enterprise and the richness of their differences. To show, from the migrants' example, that we must build the family of all humankind on the basis of solidarity and sharing."

Convinced that MST is "the only political movement really fighting for human dignity in Brazil",Sebastião Salgado has used his work as a photographer to support its struggle. The results have proven to be a surprising success with "Terra" (Phaidon), a book of 109 photographs taken in Brazil between 1980 and 1996 with a preface by the Portuguese writer José Saramago and a CD by singer Chico Buarque. The book featured on Brazil's best-seller lists for months, and has been published in seven other countries. At the same time, 45 of the photos were used in an exhibition of which 3,500 copies were made for Brazil alone, where they are being shown in trade union offices, churches, universities, cultural centres and public places, as well as in MST premises.

Outside Brazil,non-governmental organizations like Frères des Hommes (France and Belgium), Christian Aid (United Kingdom) and Solisfond (Switzerland) are promoting the exhibition, which can be bought for $500.Proceeds from the exhibition and book sales will be used to set up a training school for people working in the *assentamentos* orhomesteads. The celebrated architect Oscar Niemeyer is ready to donate plans for the school,which is to be built in a suburb of São Paulo and will enroll around a hundred students at each training session. ■

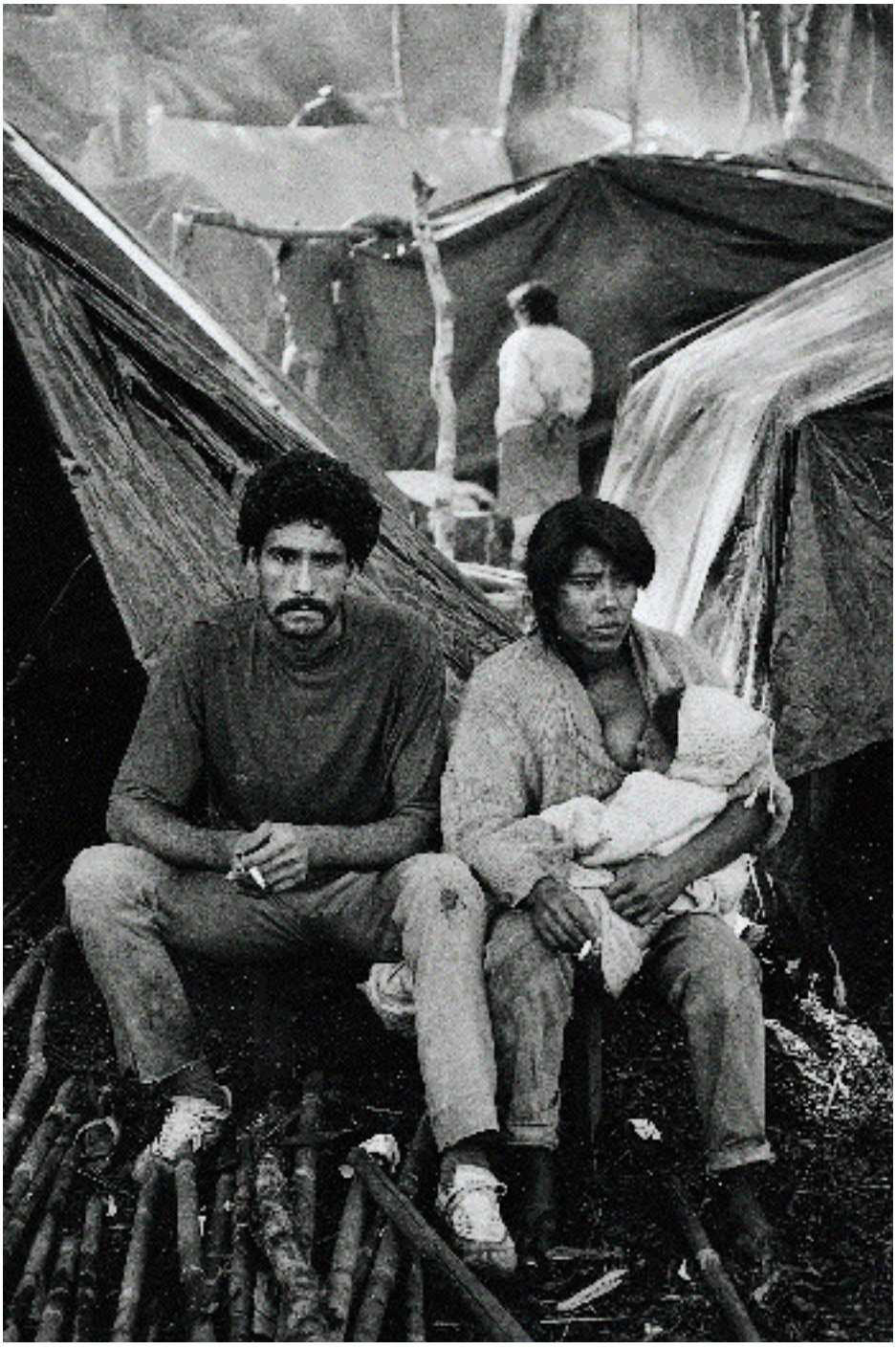
Northeastern Brazil can no longer feed its inhabitants because of the immobility of the agrarian structure and the spread of desertification.Right,people in Ceará State take to the road in search of a better life.

process of appropriating unused land or confirming a usually precarious right of occupation.

"For big landowners, the peasants' demands are an intolerable threat," says João Pedro Stedile,a member of the MST national executive. "They strike back violently with their henchmen or through a state machine in which they have a great deal of leverage."

The movement has nevertheless been successful. In 1991, some 15,000 landless peasant families were living in *acampamentos*, temporary roadside camps set up as close as possible to the unused or under-used lands of the big estates. A highly visible illustration of the clash between exclusion and unfair privilege, they attracted widespread media attention. Today, their ranks have swelled to more than 40,000. Moreover, about 150,000 families have recently been settled on over five million hectares in more than 1,500 *assentamentos*, homesteads set up for the beneficiaries—or the victors—of the battle for agrarian reform.

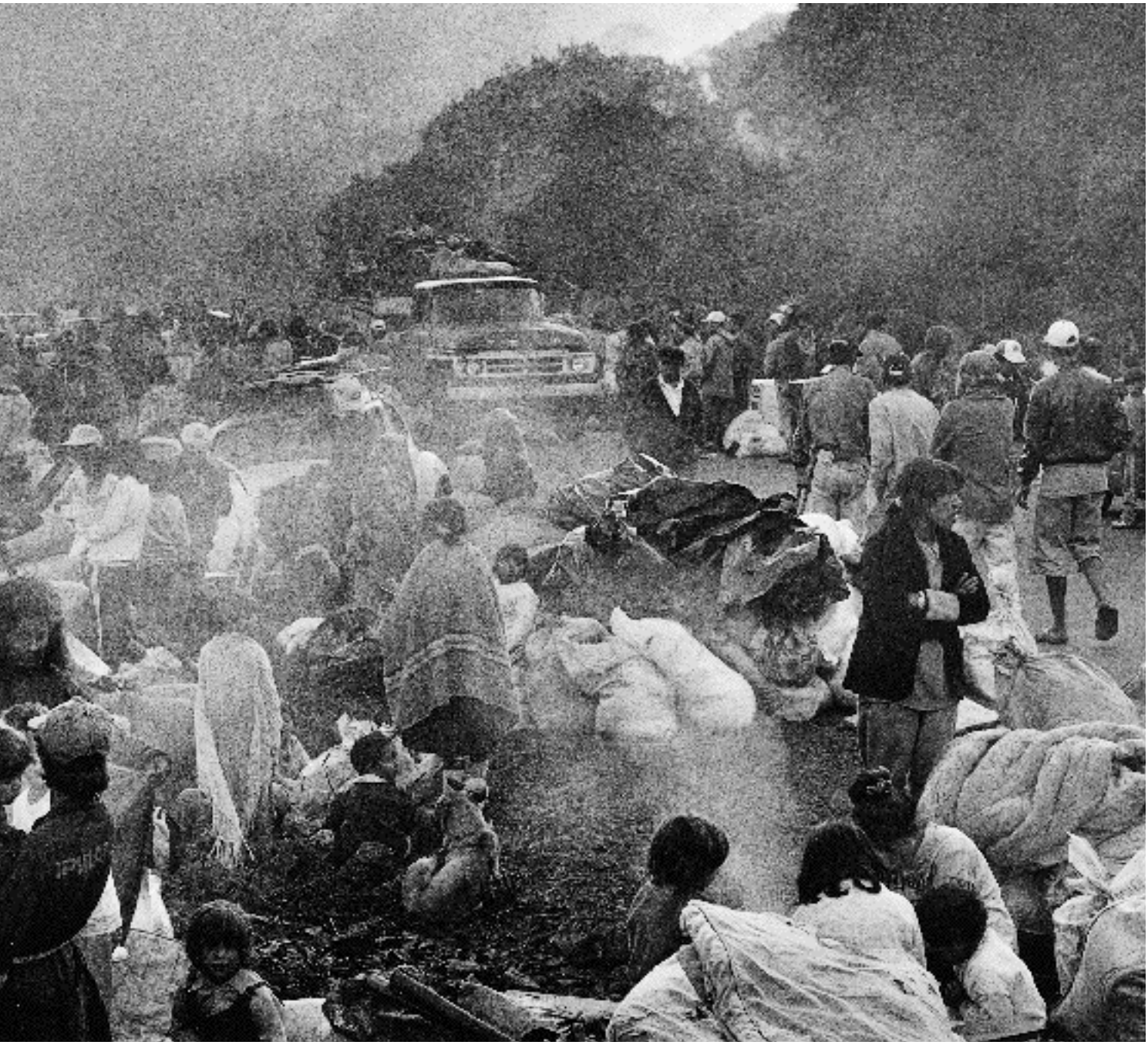
After being at a standstill for decades, land reform is starting to pick up speed again. The first land redistribution law dates back to 1964, but subsequent military governments gave priority to settling the Amazon region. President Fernando



Above, occupation of the 83,000-hectare Giacometi fazenda in Paraná State. After years of struggle, it should eventually support 4,000 families.

Left,waiting for land and a home.

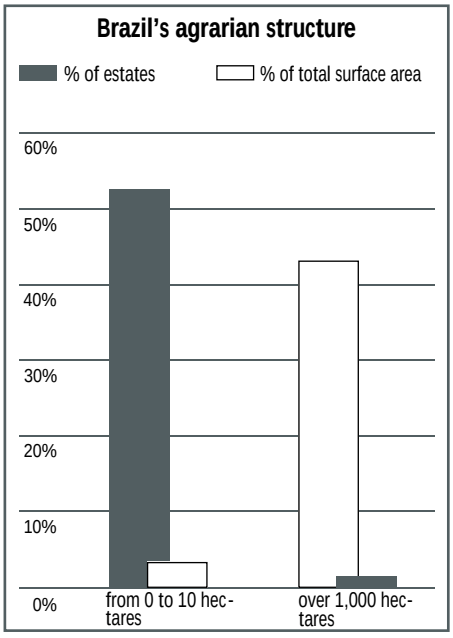
Double page overleaf:after more than 5 hours on the road,a column of marchers over 12,000 strong forces its way on to the Giacometi fazenda as the dawn mists begin to clear.



Henrique Cardoso says that "the agrarian structure, which was inherited from the colonial period, is inadequate and unjust." By settling 300,000 families on more than 14 million hectares between 1995 and 1998, he claims that his government will have done "more than has ever been done in the past." But this leap forward is also the result of a shift in the balance of power, for which the MST is largely responsible.

The rural exodus, in which the urban population rose from 30 to 80 per cent in half a century, helped build a wall of indifference between the towns and the countryside. With great tactical expertise, MST thrust the agrarian question into the spotlight. At the same time, by forcing its way into the big estates, the movement has created a series of faits accomplis that compel the government to take account of the landless and negotiate with them. The typical MST member is under thirty-five, did not finish primary education, has at least three children, is a descendant of European immigrants who arrived in Brazil in the first half of the twentieth century, and before joining the movement worked either as a seasonal day labourer or a full-time agricultural worker.

In just a few years, the movement has managed to create a network of alternative economic and social ventures. For example, 400 "farm co-operation" groups ▶



A school at Santa Clara camp, Sergipe State, which houses 650 families (around 2,500 people).The teachers themselves are landless workers. Basic teaching materials are provided by the MST's co-operatives. The benches and tables were made by the camp's occupants.

exchange information on innovative agricultural methods that are gradually gaining ground among local farmers. Some 850 primary schools and 20 high schools are up and running, while day-care centres and community restaurants are easing women's load of household chores.

The authorities can no longer sideline the MST when it comes to agricultural issues. By building a participatory and egalitarian structure that goes against the grain, it offers alternative perspectives to broad swathes of Brazilian society. Its adversaries denounce its political radicalism and illegal methods, while its defenders call it Latin America's most promising social movement. Brazilian economist Celso Furtado goes so far as to say that it offers "the only answer to mass unemployment in Brazil" because "a return to subsistence agriculture is preferable to urban poverty." The MST is facing this challenge with the slogan of "Agrarian reform: everyone's struggle." ■

Ana Maria Galano
Federal University of Rio de Janeiro

Below, a family in its new home in the settlement of Conquista da Fronteira,Santa Catarina State.

A fresh **outlook**

Unesco-Ines Forbes

Federico Mayor

UNESCO's connexion with the men and women around the world whose role it is to discover, to think and to communicate, to work with knowledge and ideas, is at the heart of its activities. This is an enormous—and awesome—privilege, and UNESCO's perspective on our times,on its promises and its failures,is all the sharper and more original because of it.

The sharpness is due to the quality of the information UNESCO gathers from leading specialists in the vanguard of international research and development in a wide range of disciplines. The originality stems from the convergence and confrontation of all these flows of information, which create a momentum that transcends the barriers between disciplines and the borders between states. This perspective is thus universal in the sense that it is both planetary and all-embracing.

What does it reveal? The range of possibilities facing humankind is now wider than ever before, largely because of advances in science and technology. The speed and scope of this expansion have led to a threshold effect, a leap into the unknown. The balance has been disrupted between the rhythm of time, the division of space, the assimilation of new knowledge, the authority of institutions and the exercise of that authority. We are faced with an existential choice. Either we rush headlong into the future, managing these upheavals in an unimaginative, short-sighted fashion. Or else we acquire together the means to become informed, to analyse, discuss and evaluate the advantages and drawbacks of the possibilities available to us, before deciding how we can move towards a future in which everyone can benefit equitably and thus peacefully from this immense stock of knowledge.

The range of possibilities facing humankind is now wider than ever before, largely because of advances in science and technology.

In the twentieth century, physics and chemistry made tremendous strides. Their success brought abundant energy and made it possible to manufacture countless products that have become invaluable in fields ranging from medicine to telecommunications. In the twenty-first century, biology and information technology will continue to advance and interact. As a consequence, far greater resources will be produced, for health care and agriculture, for example. Humanity will also find it possible to accelerate or alter natural changes and even to produce the genetic material of an "artificial nature" resulting from human willpower and imagination.

But to what end? Is humankind engaged in a grand design, a common purpose? Today, distances are shrinking, frontiers are disappearing and national sovereignty is crumbling, yet there are no signs of the emergence of the twenty-first century's planetary agora, where such a design could be freely shaped, accepted and applied.

For now, the law of the survival of the fittest still prevails. Power lies in the hands of those who combine possession of the most advanced knowledge with massive resources. Walls are going up across the planet as well as within each nation. They divide actors from spectators, subjects from objects, haves from have-nots in every sphere of politics, economics, society, culture and education.

UNESCO has the privilege to receive this contradictory message, which holds out tremendous hopes and warns of terrible dangers. It also has the duty to reflect it accurately and spread it widely. The *UNESCO Courier* has always contributed to this process. Its new format, the first issue of which you are now reading, remains faithful to the magazine's original purpose of presenting information and viewpoints from leading world specialists. But it also breaks new ground as it seeks to provide livelier coverage of the crucial issues of our time, and bring our ideals of peace, justice and freedom closer to our readers. We hope that the *Courier* will stimulate you to think anew about the world. ■

Fanning the **flames**

Drought was partly to blame for the huge fires that recently swept through tropical forests in Asia and Latin America—but the main culprit was human avarice.

For almost a year now, vast forested tracts of the globe have been burning down one by one. It all began in August 1997 in Malaysia and Indonesia. Then in April this year it happened in the Amazon, the Philippine island of Palawan and eleven States in Mexico.

On 19 September 1997 a state of emergency was declared in Sarawak, the Malaysian State in the northern part of the island of Borneo. About two million people were warned to stay indoors because of the thick smoke (twelve times more carcinogenic than tobacco smoke) from forest fires in Kalimantan,the island of Sulawesi and Irian Jaya, in Indonesia. Fumes from the hundreds of thousands of hectares ablaze affected some 70 million people in Southeast Asia to varying degrees.

Indonesian environment minister Sarwono Kusumaatmadja said the health of 20 million of his compatriots was threatened.The least hardy of them died. Many accidents occurred. Air and sea traffic was disrupted. An Airbus plane crashed in Sumatra on 26 September 1997, killing 234 people.

El Ninõ's fault?

The guilty party was said to be El Niño (which in Spanish means the Christ Child), a climatic phenomenon which appears at Christmas-time every three or four years, and sometimes every seven to ten.When the trade winds, which usually blow across the Pacific from east to west, lose strength, an enormous mass of warm air about the size of the United States, normally held in position by winds near Indonesia,heads for the coast of Peru and then moves away in the opposite direction, towards the east.

This movement is part of a climatic fluctuation known as the El Niño Southern Oscillation (ENSO) which is thought to be responsible for the weather disturbances around the world last year and this.

In 1997, the monsoon rains came late. In Indonesia, the fires began in August during one of the most severe droughts of the past fifty years. In fact, they had been smouldering since 1982-83, when a heavily-logged area of 3.5 million hectares—as big as Belgium—had burned. The conflagration was helped along by the abundance of peat in Kalimantan, as well as by seams of coal and lignite which sometimes run close to the surface. Even heavy rains failed to put out the smoulde-

# of greed

ring fires which burned on for lack of bulldozers to cut wide trenches to act as firebreaks.

But if unusual weather fanned the flames, the main culprits were human beings. A distinction must be made between small peasant and big farmer. Both use fire as a tool, but to different degrees. A fire on one hectare of land can be put out. Bigger conflagrations cannot be controlled and lack of water and fire-fighting equipment, along with difficult access, mean that forests are lost.

Fire has always enabled the native peoples of Borneo and Sumatra to live off the land. Their often-criticized slash-and-burn method of cultivation is not as harmful to the environment as is sometimes thought, as long as the land is left fallow for some time. The soil is not naturally fertile, so the absorption of ash from fire over two or three years enriches it. The secondary forest grows back and fifteen or twenty years later the peasants burn it down again.

Miriem Bouamrane, a young economist who has lived in Java and Sumatra and works for the International Centre for Research on Agroforestry (ICRAF) based at Bogor, near Jakarta, cites the Dayaks, one of the region's main ethnic groups, as an example. "They aren't being irresponsible," she says. "These are age-old practices. They live in very close contact with nature and only burn a small area and watch that it doesn't spread. They also worship trees in their religion and are always planting them. They use the products of the trees but also save from extinction species like the damar, which produces the resin which is their main source of income." The most convincing evidence of this is that just about the only places where the tropical forest survives are the areas where the Dayaks live.

But the "settlers" which the government encourages to leave overpopulated Java with an offer of between one and five hectares of land on neighbouring islands behave differently. They do not have the same knowledge and try to make quick profits growing rice, pepper or coffee.

In northern Brazil, 10 km from the Venezuelan border, a farmer looks out over land he has cleared by burning.

© Gregg Newton/ Max PPP, Paris

Scorched earth

The Brazilian State of Roraima, along the border with Venezuela and Guyana, went up in flames in January 1998. But according to an official of the Amazon Research Institute (INPA), the fire really began there twenty-eight years ago, when the then-military government began the settlement of Brazil's Amazon interior by luring small farmers from the overcrowded south-central and north-eastern parts of the country. "In 1978," says Reinaldo Barbosa, "the State had 80,000 inhabitants, 32,000 of them Indians, and was 72 per cent forested. By 1996, the population had grown to 262,000. The settlers conquered Amazonia by burning down the forest." Like the settlers in Indonesia, the newcomers in Roraima had used fire rather than bulldozers, and between 1978 and 1996 cleared land increased fifty-fold. ▶

© Gaira Magazine/Reuters/Max PPP, Paris

In Borneo, a mother and her young son fight a fire sweeping through their pepper plantation.

The forest—a refuge and a nursery—was their foe. "The plans of the Settlement and Agrarian Reform Institute (INCRA) only spread poverty by encouraging the settlers to destroy the forest," says Barbosa. "The proof is that a hectare of cleared land in Roraima is worth ten times more than a hectare of forest." The Environmental Institute (IBAMA) suggests that the settlers, who are officially not allowed to clear more than half of their 100-hectare plots, start fires illegally to do the job.

Land ownership is crucial in a country where two per cent of the landowners possess more than half the surface area being farmed and are greedy for more. Walter Blos, head of the National Indian Foundation (FUNAI), warns that many white farmers are keen to get their hands on the 10 million hectares of Indian reservations that fires have already significantly encroached upon.

Stricter laws

In Indonesia, timber companies and commercial tree plantations have been quite legally carving up the tropical forests for more than fifteen years in pursuit of maximum returns. And fires stoke up the profits. Not only do the logging companies not have to clear the forest floor of unsaleable timber, but they enable the fire-cleared ground to be planted with crops like palm oil or eucalyptus which bring in quick profits.

According to Indonesia's forestry minister, between 500,000 and 700,000 hectares of forest have been turned into plantations in the past fifteen years. On the burned forest areas, which range in size from 300,000 to 900,000 hectares, 560 deliberately-started fires were recorded. Sometimes this was to the detriment of the perpetrators: according to the UN Food and Agriculture Organization (FAO), the fires in mid-October also consumed 76,000 hectares of productive forest and 90,000 hectares of coconut, palm oil and rubber plantations.

President Suharto reminded the country that starting fires had been banned since 1995, but this did not deter the big companies. In October 1997, 160 Indonesian firms were found responsible for starting fires. Out of forty-six investigations, five led to legal action. In Malaysia, the seventeen firms found guilty were fined a total of $8,000 and that was that. In Brazil, President Cardoso signed an environmental protection measure into law on 12 February. It does not punish slash-and-burn, so as not to penalize Amerindians like the Dayaks, who use the method with care. But it decrees prison terms and the closure of firms found guilty of ecological crimes. It is tougher than the law it replaced, which only enabled the government to collect six per cent of the fines imposed. But will it be more of a deterrent?

The experts at ICRAF are very pessimistic. "The forest fires in Indonesia will not stop until all the country's forests have disappeared," they say. The cause of the fires in the Amazon and Mexico are the same. Are the forests there also doomed to destruction? ■

France Bequette

Fears for a new millennium

Genetic manipulation, the emergence of unknown viruses and the impact of new information technology are three fears of the future shared by environmentalists and the public at large. In the next 20 years, specialists say, radically new threats will be added to the list of those besetting the planet today. In a survey carried out in 72 countries by the French ministries of research and the environment with support from the European Commission, a thousand scientists were asked to rank the dangers in order of importance. The poll's results were published in early 1998.

Genetics and biotechnology top the list of concerns. "Basically this has to do with genetically modified organisms," says Alain Pavé of the French National Centre for Scientific Research (CNRS). "People are afraid that genes introduced into certain plants will spread into the environment. This is possible either through hybridization of different plant species or through a virus that picks up the genes and takes them elsewhere."

Second, researchers are afraid that the results of their work are analysed too hastily. "Climate forecasting is a typical example," says Pavé. "The models converge where temperature increase at planetary level is concerned, but there is no agreement as to how it will affect different regions. The data we have cannot justify worldwide measures to cut greenhouse gas emissions." This does not prevent catastrophic scenarios on the consequences of global warming in local contexts from making the rounds.

Researchers themselves are sometimes tempted to engage in more or less inspired guesswork. For example, they fear the emergence of new diseases "through fear of viruses like HIV or Ebola spreading from their natural environments," Pavé says. "In all likelihood, Aids developed as a result of contact between people and wildlife in central Africa. But we still don't know what mechanisms govern these phenomena."

Some scientists are wary of new information technology, which they regard as a threat to diversity. "Our environment is shaped by culture," Pavé explains. "If societies become standardized, so will landscapes." However, he acknowledges that no one knows what the long-term effects of information technology will be. Perhaps that's precisely why people are worried.

S. Bou ■

Poison of the earth

They are harmful to people and the environment, but nothing stops dangerous pesticides from crossing borders. At least for now.

Some people who want to die know that paraquat is a cheap, effective poison. Just one teaspoonful is all it takes. Trouble is, the herbicide also brings a slow death to those who want to live.

A 1996 Greenpeace study says that managers of rubber and palm oil plantations in Malaysia, including some owned by Western companies, were using and over-using paraquat and many other highly toxic substances. When inhaled or absorbed through the skin, they can damage the liver, kidneys and lungs and cause nosebleeds, miscarriages, sterility, cancer, and neurological and behavioural disorders.

In the southern countries, they are often sprayed excessively by poorly-informed farmworkers who lack protective equipment. They can be found in markets between the sugar and the washing powder in harmless-looking boxes that do not make the slightest mention of their harmful effects.

David Pimentel, a specialist at Cornell University in the United States, says that each year pesticides kill 220,000 people and make another three million sick. "Eighty per cent of all pesticides are used in the developed countries," he notes, "but fewer than half the poisoning deaths occur there." In all, 25 million workers are at risk in developing countries.

© Jean Sprague/Panos Pictures, London

In Haiti, a training session in the use of pesticides.

An expanding market

Over- and carelessly-used pesticides not only kill people. They endanger the future as well. Pimentel says their indiscriminate use "causes $100 billion worth of damage to the environment every year," including $8 billion in the United States alone. Among other things, pesticides kill the natural enemies of certain pests, boost those pests' resistance to chemicals, destroy pollinating insects, fish and birds and contaminate food, water and soils.

Meanwhile, business is booming. The world pesticides market has grown steadily over the past decade. In 1996 estimated sales amounted to approximately $30 billion, according to Barbara Dinham of The Pesticides Trust, a London-based non-governmental organization. "The pesticides trade," she says, "is dominated by ten major agrochemical companies who control 80 per cent of global sales." Europe, the United States and Japan are the main exporters,followed by developing countries such as India, China, Mexico, South Korea, Indonesia, Brazil and Colombia. The market is growing at a brisk pace in Latin America and Asia, and African countries are boosting imports for their export crops.

But the trade includes chemicals that are banned or strictly regulated in industrialized countries. The Foundation for the Advancement of Science and Education (FASE), an American non-governmental organization, says approximately 14.4 tonnes of pesticides that are illegal in the United States were exported from the country every day in 1995 and 1996. Europe is no better, but Dinham says it is "unfortunately not possible to pin a number on European exports because there are no details concerning them in customs records."

Tightening the rules

So far, legal curbs on the trade are only local or voluntary. In late 1989 FAO drafted a "prior informed consent" procedure (PIC), asking countries exporting "extremely hazardous" products to obtain permission from importing countries. But only the European Union has made the procedure mandatory. A convention on trade in pesticides and hazardous chemicals that will be signed in Rotterdam this September aims to make it universally binding. But no one can say how effective it will be.

After more than two years of negotiations sponsored by the FAO and the ▶

United Nations Environment Programme (UNEP),ninety-five countries agreed on a draft last March. It says that the products concerned—so far only twenty-two pesticides and five other industrial chemicals that are banned or strictly regulated in two countries in different regions—can only be exported with the importing country's explicit consent.

Why not ban the trade outright? "There is no global consensus," says Paul Whylie of Jamaica's Pesticides Control Authority. He argues that "the Convention is another means of putting pressure on manufacturers because they have to go through heavy procedures." But that still does not mean they will be used. "Governments will not reject a pesticide, even a very hazardous one," Dinham says, "if the country makes heavy use of it, unless they have a substitute that costs the same." Carl Smith of FASE adds, "I don't think the PIC agreement will reduce the trade in chemicals. But it's a step in the right direction" which shows that governments are at least willing to share information. The stakes are high. "Data does exist," Smith says,"but it is generally guarded by industry as 'confidential business information'. Without a clear picture of what the countries participating in the PIC process are importing and exporting, it will not be possible to know if the parties are abiding by the convention."

The global agrochemical market in 1997

Value split by region

North America	33.5%
Latin America	13.4%
West Europe	24.5%
East Europe	3.1%
Japan	11.3%
Rest of East Asia	8.5%
Rest of world	5.7%

Agrochemical usage by product type

Herbicides	48.3%
Insecticides	27.5%
Fungicides	18.6%
Agbio products	1.5%
Others	4.1%

Agrochemical use by crop

Fruit & vegetables	26.1%
Rice	10.4%
Maize	11.8%
Other cereals	15.0%
Cotton	8.6%
Soybean	9.4%
Sugar beet	2.8%
Rapeseed	1.6%
Others	14.3%

Source:British Agrochemicals Association, Peterborough,UK and The Pesticides Trust,London

PIC does not provide for sanctions on rule-breakers, and there are plenty of ways to get around the agreement. Especially since production of most outdated hazardous chemicals is increasingly located in developing countries. For example, India manufactures DDT and China produces chlordane and aldrin. If these countries see economic benefits in producing hazardous pesticides, they will most likely continue producing them. This raises an ironic possibility. In the end, the developing countries that the convention is intended to protect could become the leading exporters of chemicals on the PIC list. Furthermore,Whylie adds, "A pesticide may be shipped as a consumer chemical, like pharmaceutical products and cosmetics, which are not subject to PIC procedures. Hazardous substances can always travel under those labels." And then there's the black market. "The convention doesn't address illegal trafficking," says Fatoumata Ndoye of the Gambia's Hazardous Chemicals and Pesticides Control and Management Board. "Our borders are porous. We need resources for the training of customs officers."

But at a time when development aid is dwindling, no additional funding to train people how to handle, inspect and control hazardous substances is planned. Yet that may be exactly where the efforts should begin.

The organic alternative

If farmworkers knew how to use pesticides properly, consumption would be cut in half, Pimentel says. In some countries, such as Sweden, consumption has already plummeted by over 50 per cent. Likewise,Indonesia has slashed the use of pesticides on rice by 65 per cent while boosting the crop yield by 12 per cent. But, adds Pimentel, "people use more of them than they should because pest control is a complex technology." They are spurred on by aggressive chemical industry advertising campaigns and easy access to chemicals, which are sometimes imported to southern countries as part of development aid programmes.

Smith says the intensive use of pesticides is just one link in a food production chain that few call into question. "Chemical-intensive, export-based agriculture has one clear benefit: cheap food for citizens of developing countries. It is also clear that farmland has been degraded, ecosystems polluted and the variety of subsistence crops diminished. The number of landholders is decreasing and profits from agriculture are concentrated in fewer hands. These trends create a climate that encourages the marketing and use of pesticides. Organic methods are more time-intensive and may require more workers. In the short run, an organic approach might seem less profitable." For whom? ■

Sophie Boukhari

Troublesome residues

FAO estimates that there are more than 100,000 tonnes of obsolete pesticides in developing countries, including 20,000 in Africa.Stocks in the Near East countries are put at 5,000 tonnes. Several countries in Asia and Eastern Europe have stocks in excess of 5,000 tonnes each.Due to the absence of environmentally sound disposal facilities stocks are constantly increasing. Some are over 30 years old.

Disposal costs vary from $3,500 to $5,000 per tonne. Costs of disposing of pesticide stocks in Africa alone are estimated at over $100 million. The best disposal methods is high-temperature incineration, according to FAO. None of the developing countries—except for a few newly industrialized nations—have facilities for the safe and environmentally sound disposal of pesticides. Without financial support from agro-industry, governments and aid agencies, this environmental problem cannot be solved.

FAO has published guidelines in English, French,Spanish and Arabic on the accumulation,storage and stock control and disposal of bulk quantities of obsolete pesticides.

For further information:

E-mail:alemayehu.wodageneh@fao.org

Internet:http://www.fao.org/ag/agpp/pesticid

Ending **apartheid** in education

Salim Vally*

South Africa is responding to one of the people's main demands by opening up the education and training system to all citizens.

© William Matlala/South African Labour Bulletin, Johannesburg

Four years after the fall of apartheid, South Africa is finally rebuilding its educational system. "The basic idea is to facilitate the democratic transformation of the national education and training system," says Samuel Isaacs, director of the South African Qualifications Agency (SAQA) in charge of setting up the new education system, which is called the National Qualifications Framework. A committed pastor and citizen, Isaacs was at the forefront of the anti-apartheid struggle.

Education and professional training were at the heart of the political struggle against the former system, and "education for all" was a key theme of Nelson Mandela's speeches as soon as he became president. Youth demonstrations against segregation in education and the attempt to impose the teaching of Afrikaans, one of the white minority's two official languages, touched off the Soweto riots, crushed by a bloody crackdown in 1976.

Many grassroots organizations, local church and religious groups and women's movements, which were very active in the 1980s, set up evening and technical training courses for non-white adults to offset the public education system's shortcomings. Today these courses are officially recognized.

The new system includes proposals for lifelong education made in the early 1990s by the powerful 1.8-million-strong Congress of South African Trade Unions (COSATU), which had, alongside the African National Congress (ANC), played a key role in the mobilization against apartheid. COSATU's demands focused on better training for black workers.

Today the education of non-white adults is a priority. "Blacks, Coloureds and Asians," according to the official classification, account for 87 per cent of the popula- ▶

© Lily Franey/Rapho, Paris

A school in 1990, deprived of basic equipment. A new system is being created to eliminate educational injustices.

tion but hold most of the unskilled, low-paid jobs and have few opportunities to upgrade their qualifications. The Job Reservation Act had excluded them from many jobs and training programmes. In the late 1980s, only 17 per cent of technicians, 3 per cent of architects and 0.1 per cent of engineers were black. In public administration, Whites held 96 per cent of managerial positions, and while the country's economy is based on mining, there has only ever been one black mine manager. The result of these discriminatory policies is 38 per cent unemployment among Blacks, compared to 6 per cent for Whites.

Qualification certificates

Under the new system currently being developed, students with "non-formal" training may enter the "formal" educational system at any age. Students leaving school at any level must have access to professional training.

"In concrete terms," says Isaacs, "a person with ten years' on-the-job experience in accountancy will be able to obtain a certificate that will allow him or her to get a pay raise, apply for a job as an accountant somewhere else or continue training—to become a chartered accountant, for example. A highly qualified nurse who wants to study medicine will enter medical studies at the intermediate level."

Around forty Education and Training Qualification Assurance Bodies (ETQA) will be authorized to issue "qualification certificates" in every industry, from chemicals to transportation, retail and environmental protection. An inventory of all the available training opportunities in the country is being drawn up. At the same time, schools and universities will have to change their programmes to make more room for science and technology and encourage greater self-sufficiency on the part of the learner. The reform, which is called Curriculum 2005, should be completed by that year.

To fund the programme, employers, including the state, must pay a training tax amounting to between one and 1.5 per cent of their wage bill. Some companies already offered training programmes, mostly to managerial staff. But in 1996, 42 per cent of companies spent less than one per cent of their wage bill on training, and 56 per cent of small firms offered no training at all.

Each year the government increases the proportion of the education budget allocated to adult education and training. Although the amount seems minimal—one per cent of the total education budget—it has doubled since 1994. In 1997, 450 million rands, or $83 million, were spent on adult education and training.

Today, 10 to 15 million adults in South Africa lack basic education or skills. An average 350,000 adults take training courses each year, but the SAQA expects that the figure will rise to 700,000 in 1998 and 2.5 million by 2001.

It remains to be seen whether these targets will be met. Some specialists wonder if the reform is not too complex for a still-developing country and fear that the system favours the best qualified workers. Above all, critics point to a contradiction between the government's education plan and its free-market economic policies, with budget cutbacks, especially in education. Still, South Africa's far-reaching education reform is a first step towards achieving the goals of millions of people who were involved in the long struggle for democracy and equality. ■

*University of the Witwatersrand, South Africa

(with Nadia Khouri-Dagher)

A second chance for success

In the French city of Rheims, a group of teachers is carrying out a promising experiment to give school dropouts a second chance.

Nadia, a fifteen-year-old Algerian girl, came to Rheims in the middle of the 1997/98 school year. It was impossible to admit her to the final stage of secondary school, especially since she barely spoke French. When she was sent to the Robert Schumann School to take a Vocational Insertion Course, or "Cippa" (Cycle d'Insertion Professionnelle par Alternance), she expected the worst. Little did she imagine that she would soon be working in radio, films and publishing, as well as teaching Arabic to her classmates and teachers.

"It all started fourteen years ago," explains Jean-Luc Muracciole, a literature teacher who is responsible for the Rheims Cippa, "when the Education Ministry created a scheme to enroll school dropouts in a sandwich course, where they'd work two weeks for a firm and spend two weeks in a booster class to prepare them for readmission to the normal educational programme." Muracciole has taught in prisons so he has personal experience of problem situations—but even so, he took on the task with considerable trepidation. It would be no easy task, he thought, to teach these young people a trade with a minimum of dignity attached to it.

Instead of trying to adapt the students to the school system, Muracciole tried to adapt the system to the students. He broke down the barriers between the major subject areas, using sound and pictures to establish an audiovisual link between physics and languages. Instead of conjugating verbs, the students are taught to communicate with the outside world, where they learn how to make films about subjects discussed in the classroom, taking turns as cameramen, actors, set designers, directors and press agents. Philosophy, which is taught in the final years of secondary school, is used as a bridge between maths and French. The students read the works of modern authors and then meet them personally in radio interviews, to give them a taste of journalism and production.

The courses are given à la carte: some are taught to the entire class, while others are given individually or to small groups. Three teachers cover the basic subjects. Director Ludwig Trovato teaches video and gives lessons in Romani, the language of Europe's Gypsies. Even students find themselves being pressed into service as teachers—Nadia, the Algerian girl, was asked to teach her mother tongue to a class including two of her own teachers. The same holds for Corsican, Italian, Portuguese and Russian.

Guest speakers from the world of literature, philosophy, journalism and publishing also give talks. At the same time, the students follow correspondence courses provided by the National Centre of Distance Education (CNED). "Since this course is entirely based on written education, it rounds out our oral approach," explains Jean-Luc Muracciole. It is also helpful in preparing the students for France's school-leaving diploma, the baccalaureat: "It enables the students to take part in university or professional life, and it helps us, the teachers, to evaluate our methodology by comparison with the traditional system. One year we had a 100 per cent success rate."

Preparing to make a film in Romania. The Gypsy historian Mateo Maximoff in a classroom with students and director Ludwig Trovato (at left).

© Bruno Espagnol

© Cippa, Reims

Adapting the system to the students

Currently, anyone at least sixteen years old who has failed to complete his or her secondary education (and this includes voluntary dropouts) can register with Cippa and continue studying. The only snag: the maximum quota of 24 places is being over-filled with more than 50 students per year, and there is a long waiting list which could soon easily reach 500. Muracciole wants to go further and create an experimental school—and he is doing his best to persuade the authorities to provide the funds.

Romain, who recently entered the school, describes how he threw in the towel just before the end of the final year of secondary school: "I couldn't take it any more, it was such a rat race. My friend Stéphane told me how great Cippa was, so I decided to register. After the first week, I felt completely at home. Here we're taught by the older pupils as well by the teachers. It's like one big family. When classes are over we go on talking things over . . . in the street or in a café. People talk about everything under the sun." Stéphane entered Cippa in late May of 1997, after dropping out of high school and, later, the Compagnons de France crafts school. So far he has taken part in filming the first two of a series of thirty-five videos commissioned by the French Museums Service, and he loved every moment of it. "It's fantastic to communicate impressions, textures and light with a camera!", he says. He is the cameraman on a film sponsored by the city of Dole, in eastern France. It is a modern version of *Romeo and Juliet* with a French Romeo and a North African Juliet.

Sindie, aged nineteen, was in charge of the script. She has two years to go before taking her baccalaureat in Medical and ▶

Social Sciences, and came to Cippa three years ago. Since then she has tried her hand at all kinds of things: book publishing (the house publishing firm, "La Terra Trema", already has six books to its credit); an exhibition on Italian writer and film-maker Pier Paolo Pasolini; and the editing of a feature-length film entitled *L'oralité en question*, which a team of her classmates shot in Marrakesh.

Oral communication—*oralité*—is one of the main vectors in the transfer of knowledge, as Jean-Luc Muracciole is fully aware: "For young second and third generation North Africans," he says, "Arabic is the language for expressing feelings, while French is the language of authority, order and obligatory integration. French has a harsh image, and by increasing the proportion of oral communication in the classroom, we help them bring the two cultures closer together."

The students are responsive to the idea. After Marrakesh, one film crew has gone on to shoot a movie with the Gypsies of Romania, another is in Corsica—an experience which has awakened an interest in regional languages. "I discovered Corsican at a concert given by the 'I Muvrini' group," says Fred, with all the authority of his twenty years. He feels he has learned enough at Cippa to enter university to take a liberal arts course or enroll in a film school. He is already at work, outside Cippa, on a radio project. He knows about radio from his hour-long programme every Saturday night on Rheims' "Radio Primitive",interviewing French and North African writers.

New projects

This year the students are leaving the radio studio for one of the best cafés in Rheims, the Brasserie Bleue, to hold philosophical debates attended by several hundred people from all walks of life. In autumn they will launch the first issue of a quarterly magazine, *Salle d'Attente* ("Waiting Room"), as well as start working on a CD-ROM.

This educational experiment—the only one of its kind in France—has already proved its worth. According to a report by the Rheims education authority, 99 per cent of the school's graduates have found their place in society. The course could be used as a model in other areas, where the school dropout rate is even more alarming. Jean-Luc Muracciole believes that, in countries with a strong oral tradition, the method would be even more successful than in France: "We've seen proof of this in Morocco and Romania. Cippa hopes to 'twin' with schools in other countries, so that we can introduce their teachers to some of our methods." ■

Jasmina Sopova

© Bruno Espagnol, Reims

A recent debate on Corsican oral traditions attracted an audience of over 600. Above, Jean-François Bernardini (with microphone) of the I Muvrini musical group.

Hard times for teachers

The world's 57 million primary and secondary school teachers work in conditions that are a matter for concern. They are neglected by educational policies and are benefitting little from the new technologies which were supposed to revolutionize their profession. The latest (1998) edition of UNESCO's World Education Report is categorical: ". . . it has not just been teachers' salaries and status which have failed to benefit in recent years from policies towards public expenditure on education," the report points out. "Teaching and learning conditions and the material situation of the schools generally, in probably a majority of countries,have also failed to benefit."

In the countries of the South, the number of pupils and students has exploded in recent decades. But the number of teachers, their salaries and above all school equipment have not kept pace because of budgetary belt-tightening. In India, over 60 per cent of primary school teachers teach more than 50 pupils on average, 34 per cent teach between 51 and 100, and 5 per cent over 100. Many schools have no blackboard and in some cases no desk for the teacher, and few textbooks, if any.

In the industrialized world, "students' social behaviour"is "of growing concern in a number of countries". The Report denounces violence at school, which is detrimental both to teachers' morale and to educational efficiency.

The Report shows the limits of hopes vested in new technologies by recalling that most of the world's schools do not even have electricity. At best the new technologies help to stimulate "thinking and debate about teaching and learning" and enable teachers "to 'network'with other teachers about what they are doing". Perhaps to tell each other about what a hard day they have had. **N. K-D.** ■

World education report 1998: Teachers and teaching in a changing world. UNESCO Publishing, Paris. 150 French francs. Available in English and Spanish. Russian and Arabic editions forthcoming.

20,000 worlds under the sea

The sea

It is time humankind stopped abusing the generosity of the ocean, wellspring of Earth's life-support system.

© Michael Friedel/Rapho, Paris

'How can the ocean be in trouble? It's so huge!" The speaker, an avid fisherman, had just read an article about pollution creating a so-called "dead zone"in the northern Gulf of Mexico, and was sceptical."I love the ocean," he said."But I can't imagine that we can do much to harm a system so large and resilient.The sea seems infinite,timeless!"

My friend's perception of the ocean has been a common one—until recently. As the waters of the world have become increasingly stressed, an awareness of their importance to humankind has come into sharp focus. Fishermen find it increasingly difficult to find once numerous species—cod, capelin, swordfish and many more. Phenomena such as the El Niño have created widespread appreciation of the role of the ocean in shaping climate and weather. Water evaporates from the sea's surface and forms clouds that yield fresh water back to the land—and sea. About 97 per cent of Earth's water is marine, and of the remaining 3 per cent, 97 per cent is frozen as polar ice and snow. Water, of course, is vital for life. There may be water without life, but nowhere, even in the most arid deserts and driest valleys in Antarctica, is there life without water.

The recent discovery of water on Europa, one of Jupiter's moons, has aroused much speculation about whether life might be prospering there, perhaps associated with undersea volcanic activity, like the communities that develop around hydrothermal vents in our own deep sea. Plans are now underway to send spacecraft to Europa that can deploy a robot capable of boring through three kilometres of ice before descending into a sea that may be forty kilometres deep. Meanwhile, Earth's ocean remains largely unexplored. We have barely begun to imagine the energy potential of harnessing the waves, the healing powers of marine bacteria or the sustainable possibility of feeding the world's hungry through algae. A veritable treasure trove,the ocean's greatest gift may well be the Earth's history captured in so

and its treasures

Sylvia Earle*

In the Philippines, the life-sustaining encounter between land and sea.

many forms—from the remains of a shipwreck to the yearly bands of a coral reef.

But perhaps the most astonishing thing upon entering the ocean with a face mask and flippers is the discovery that it is not just a place filled with rocks and water. It is like a soup, a special kind of minestrone, where the bits and pieces are alive! "Living fossils" are everywhere. Nearly all of the thirty-three major divisions of animals and a dozen broad categories of plants and other organisms that have existed for hundreds of millions of years are at least partially represented there; only about half are terrestrial.

Every living thing on Earth acts on the surrounding environment, initiating small but real changes. All are components of the grand machinery that makes Earth what it is: a living planet, our life support system. The immense diversity of life causes change and provides the ingredients necessary to respond as change occurs. The resilience of natural systems is remarkable, evidenced by the ability to rebound after storms, fires, collisions with comets or natural climatic swings, all the while retaining a basic framework within which living things prosper—though not necessarily the *same* living things.

Human rapacity

Knowing that our lives depend on keeping Earth more or less as it is in terms of life support functions, it makes a lot of sense to figure out whether the swift changes we are presently witnessing—and causing—may set in motion events with undesirable consequences. Certainly, no species in the history of the planet has been as rapacious and effective in consuming and displacing other species and entire ecosystems as our own. Our impact, some say, can be likened to that of a slow-motion comet striking earth, the repercussions gradually becoming manifest, rivalling and compounding the impact of storms, volcanoes, disease—even, it now seems, nudging the grand processes that cause ice ages to come ▶

From blazing Ardour Cosmic Order came
and Truth; from thence was born the obscure night;
from thence the Ocean with its billowing waves.

From Ocean with its waves was born the year
which marshals the succession of nights and days,
controlling everything that blinks the eye.

Rg Veda X, 190,
(14th century, India)

Facts and figures

- 70.8% of the earth's surface is ocean, or 361.3 million km^2 out of a total surface of 510 million km^2. By volume, 97.957% of the water on the planet is oceanic water and associated sea ice.
- 60% (3.6 billion) of the world's population lives within 60 kilometres of the coast. These figures will rise to 75% (6.4 billion) within three decades.
- 80% of all ocean resources are concentrated on the continental shelf.
- An estimated 80% of the world's biodiversity lives in the ocean, much of it undiscovered. The largely unexplored deep sea may be home to 10 million species we know nothing about.
- The latest available figures (for 1992) put global offshore reserves of oil at 36.5 billion tonnes and of gas at 21.4 trillion tonnes.
- An estimated 12.5 million fishermen (10 million of them artisans), operating from some three million vessels, land around 90 million tonnes of fish per year. The fishing industry provides a livelihood, directly or indirectly, for about 200 million people.
- The average depth of the world's oceans is 3,800 metres. The deepest point, in the Marianas Trench in the Pacific Ocean, is 11,000 metres beneath the surface.
- The largest ocean, the Pacific, measures over 166 million km^2. The highest submarine mountain, near the Tonga Trench between Samoa and New Zealand, is 8,700 metres high.
- Average global sea level has probably risen about 18 cm over the past century and is currently rising at 0.1-0.3 cm per year.

The sea's mean surface temperature is 16^0 Centigrade. ■

and go.

At night, our cities glow with an otherworldly light, created by consuming millions of years of fossil wealth. Complex, naturally productive ecosystems are disappearing, to be replaced by geometrical plots bearing vulnerable single-species crops. Other changes are less obvious—the removal of millions of tonnes of living creatures from the ocean in the past century, and the addition of billions of tonnes of trash—excess fertilizers, pesticides and other noxious substances. Might such actions alter the way natural systems behave? Should we worry about the consequences of taking unprecedented quantities of wildlife from the sea?

Energy 'middlemen'

We have perfected ways of killing the ocean's giants and their diminutive cousins—the nine species of great whales, more than fifty kinds of "small" whales, dolphins and porpoises, and all marine turtles. Many are now endangered or threatened. Bluefin tuna weighing 450 kilos, huge halibut, cod as large as the fishermen who catch them, century-old sturgeon, large swordfish, marlin, sailfish, sharks and many other once common giants are suddenly rare. Acoustic sensors developed to find enemy submarines now locate fish, squid, shrimp and other creatures for hunters to engulf with enormous nets, some large enough to swallow a dozen jumbo jets.

Recently, the populations of more than 100 marine species listed by the World Conservation Union as threatened or endangered, sharply declined. Large populations of ocean wildlife are dwindling. The three remaining concentrations of wild creatures in the sea are now being taken to produce protein concentrate: pelagic squid, large swarms of krill, and the deep, vertically migrating midwater communities of small creatures generally known as the "deep scattering layer."

And yet crustacea, like certain squid, are linchpins in complex ecosystems. In effect, they are the energy "middlemen," concentrating and converting plant energy into something palatable and usable by hordes of other creatures. An example of the importance of a single crustacean species is the Antarctic krill, *Euphausia superba*, a translucent pinkish-red finger-long creature equipped with enormous black eyes and the wonderful ability to emit an eerie blue-green version of bioluminescence. The billions of its kind make up an essential part of the living web that prospers in the Southern Ocean ecosystem. Krill swarms are consumed by penguins, terns, gulls, seals, sea lions, squid, fish, and several species of whales whose existence depends on enormous quantities of them.

So vital is this one species to the entire Antarctic realm that it would make sense to ensure that nothing disturbs its continued prosperity. Instead, several nations annually

It is said that Alexander himself entered a colymphas [a kind of bathyscape] and was lowered to the sea bed to find out the depth of the ocean and discover the specific nature of the sea and the abyss.

Aethicus Ister, *Cosmographia* (8th century, probably Ireland)

In many parts of the world, ways of using the sea's resources in harmony with ecosystems are dying out. Below, a traditional method of fishing in the Maldives.

remove thousands of tonnes of the creatures before shipping them off for conversion into high-protein food for poultry, cattle and direct human consumption.

Besides predation, many other factors undermine the abundance and diversity of marine life. It is obvious that shoreline development, construction of marinas, seawalls and jetties, cutting mangroves and filling in marshes, coupled with the impact of rivers bearing heavy loads of excess fertilizers, biocides, and sediment, have taken a toll.

How can we be sure of the impact on ocean wildlife? Despite the swift and unprecedented insights into the nature of the sea yielded by technology, most of the ocean remains unknown and unexplored, even within the depths that divers can conveniently travel—from the surface to fifty metres down. The maximum ocean depth, eleven kilometres, has been attained only once, in 1960, when two men peered for half an hour through the small porthole of the bathyscaphe *Trieste*. Recent additional glimpses have been supplied by cameras lowered on the tethered Japanese robot, *Kaiko*, but these great depths—like 95 per cent of the rest of the sea—have yet to be really seen by humankind.

An uncertain future

It is easy to disregard places we cannot see, not worry or care about creatures we have never met. As troubling as the problems are relating to obvious habitat destruction and predation, the greatest cause for concern must certainly be ignorance. Some shrug and say, "What's the problem? Humankind appears to be doing pretty well. Look at the numbers." After all, it took all of the time from the dawn of civilization to the year 1800 before our population barely reached a billion. Less than a century and a half later that number had doubled, and now, at nearly six billion, world population continues to climb. And yet our own future may be in jeopardy.

There are no easy answers to the question of what must be done, but there is hope that a significant "hedge" against the unknowns is coming into focus with the establishment of a growing number of marine sanctuaries in coastal areas—places comparable to national parks, wilderness areas and nature reserves on the land. More than 1,200 marine protected areas have been designated by various nations. While "protection" is far from complete (commercial and sport-fishing continue in most) and the total area is still small (a fraction of one per cent of the ocean as a whole), the actions taken thus far may reflect the beginning of a new trend that will lead to finding harmony—or at least an enduring place—within the natural systems that sustain us.

The ultimate question is,"what does all this mean to us, to our future?" Can we use our awesome power to use—not use *up*—the natural systems that support us? Can we overcome the greatest threat to the oceans and thus to our future—*ignorance?* There are many unknowns, but this much is certain: we have the power to undermine the healthy functioning of the sea that supports all life on Earth—but no sure way to heal the harm. For ages, the sea has taken care of us. The time has come for us to take care of the sea. ■

* Deep Sea Ocean Exploration and Research, United States

A marine glossary

Abyssal plain: a flat, gently sloping or nearly level region at the bottom zone of the oceans at depths between 4,000 and 6,000 metres.

Continental shelf: the shallow underwater extension of a continent up to a depth at which there is a marked increase of slope towards oceanic depths.

Continental slope: the steeply descending bottom between the edge of the continental shelf and the abyssal plain.

Coral reef: a massive limestone structure built up through the constructional cementing and depositional activities of anthozoans of the order Madreporaria and certain other invertebrate and algal species.

Demersal: living close to the bottom of the sea.

Eutrophication: enrichment of natural waters with inorganic nutrients (ammonia, nitrate, phosphate) by which phytoplankton growth is stimulated. Eutrophication leads to increased biomass, decomposition in the worst cases resulting in oxygen depletion and mass mortality.

Exclusive economic zone (EEZ): legal concept introduced by the 1982 United Nations Convention on the Law of the Sea extending a country's rights over the exploitation of certain natural resources to 200 nautical miles out from the coast.

Hydrologic cycle: the cycle of water in the hydrosphere during which the water in the ocean evaporates, precipitates, and returns back to the ocean through any of a variety of routes.

Intermediate waters: water masses formed in high latitudes that flow beneath the surface waters but above the deep waters.

Mineral nodules: hard,nodular deposits of typically a few centimetres in diameter found in places on the ocean bottom and enriched in heavy metals such as manganese, iron, nickel,cobalt and copper.

Mangrove forest: a variety of tropical inshore communities dominated by several species of shrubs or trees that have the ability to grow in salt water.

Niño, El: an episodic increased warming of the equatorial Pacific Ocean due to atmospheric changes causing large-scale changes in oceanographic and atmospheric conditions and leading to droughts, floods, storms, hurricanes, cold and snow. Peruvian fisherman call it El Niño—"The Infant Jesus"—because it arrives around Christmas.

Oceanic crust: the type of crust underlying the oceans that is typically 8 km thick and somewhat richer in iron and magnesium than the continental crust.

Pelagic: of or pertaining to the waters of the oceans, as opposed to **benthic.** For example, pelagic organisms inhabit the waters, whereas benthic organisms live on or in the ocean bottom.

Plankton: organisms free-floating or drifting in the open water of the oceans with their lateral and vertical movements determined by water motion.

Seamount: a large, isolated and underwater elevation characteristically conical in form.

Thermohaline circulation: circulation in the ocean that is driven by the density of differences caused by temperature and salinity. Thermohaline circulation predominates over wind-driven circulation in most estuaries and deeper parts of the ocean.

Trench: a long, narrow, characteristically very deep and asymmetrical depression of the sea floor, with relatively steep sides.

Tsunami: large waves, sometimes up to 30 metres high,which are created by the shock from an underwater volcanic eruption,earthquake, or landslide. ■

Research: the state of the art

Oceanographic research is unlocking the sea's mysteries. But only the wealthy can afford it.

"All I know is that I know nothing". As they take stock of current knowledge of our "small blue planet", many modern oceanographers could well echo this humble admission attributed to Socrates. Although we are starting to become aware of the oceans' extraordinary influence on the earth's ecosystem,research is still in its early stages and so much remains to be discovered that it will take time to fully unlock the mysteries of the sea.

Two decades ago the ocean was thought of as a cornucopia of mineral wealth. But while considerable efforts are still being deployed to explore these riches in order to offset the inevitable depletion of terrestrial mineral resources, many disappointments have combined with the high cost of tapping these marine resources to dampen the high hopes that once prevailed.

However, the threats looming over the climate have spurred scientists to study the oceans' role as a climatic regulator. Since the early 1990s, research has focused on the still poorly understood field of oceanic circulation,especially in the ocean depths, and the ways in which the various levels of the oceans intercommunicate. The havoc wreaked by El Niño has something to do with these concerns, but the broader aim is to extend the current horizon of climate prediction to some thirty years, which might help to prevent certain widely predicted catastrophes.

Scientists say that oceanic circulation is important on several counts, not least of which is to help us understand how fish—and pollution—travel. Awareness of future threats has also given fresh impetus to the study of coastal ecosystems. Researchers are trying to find out more about how they function, and to develop resource extraction and management methods which are less destructive to these resource-rich areas.

Geological research over the past 30 years has revolutionized our understanding of continental drift and plate tectonics and opened up a whole new realm of study with the discovery of new biological and biochemical systems along the planet's active faults (see page 29). The scope of marine research is enormous, ranging from the impact of iron on biochemical reactions in the marine environment to ways of influencing the oceans' capacity to absorb CO_2, and is set to expand.

But oceanographic research is very expensive, and only the richest countries can afford it. The United States, Japan, France, the United Kingdom, Germany, Canada and Russia lead the field, although a number of major southern nations, such as India, China and Brazil, are on the verge of joining them. To take one example, France's Research Institute for the Exploitation of the Sea (Ifremer) employs 1,200 people on some thirty sites and has a $160-million annual budget. Research in general is mainly funded by governments, especially since the military authorities are interested in using the ocean depths as a testing ground for naval warfare.The private sector usually focuses on areas of economic interest, such as geology in the case of oil companies and research on fish stocks in the case of the fishing industry. But the small countries are still not players, even if they have a seaboard of their own. ■

Sophie Bessis

On course for co-operation

Set up by UNESCO in 1960, the Intergovernmental Oceanographic Commission (IOC) is the only United Nations body with responsibility for basic oceanographic research. Its mission is to coordinate international research programmes aimed at improving ocean management and to advise its 125 Member States. The Global Ocean Observing System (GOOS) and the Tsunami Warning System in the Pacific are two notable IOC endeavours. GOOS, set up after the 1992 Earth Summit in Rio de Janeiro, is the superwatchdog of the seas. Using information collected by thousands of coastal satellite stations, planes, drifting buoys and ocean research vessels, it seeks to understand and predict trends in the marine environment. The purpose of the Tsunami Warning System in the Pacific is to avoid tragedy by forecasting tsunamis, giant seismic sea waves which took 2,000 lives and wreaked a billion dollars in damage between 1992 and 1996.

S. Bou ■

Climate's hidden engine

John Gould*

We are on the threshold of understanding the oceans' role as the lungs of the planet and a driving force behind climate.

The port of Naniwa,

This morning is the first time I
have seen it.
Everywhere in this haven
Are world-weary boats
like me
Setting sail on the sea?

Ise *monogatari*
("Tales of Ise"; probably 9th century, Japan)

For most people their greatest involvement with the sea is when they stand on a beach and look out to the horizon only a few kilometres away. Yet, below the surface and beyond the horizon is a hidden deep ocean that influences the lives of everyone on Earth. Arguably the most important influence of the oceans is the role that they share with the atmosphere, biosphere and cryosphere in determining the Earth's climate.

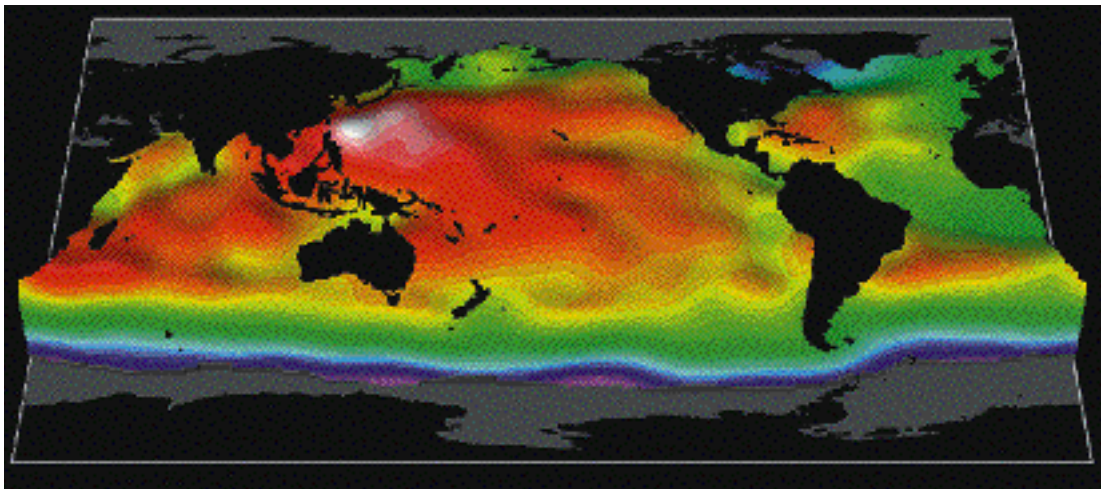
Scientific exploration of the oceans started only 125 years ago with the global circumnavigation by the British admiralty vessel *HMS Challenger*. That and subsequent expeditions mapped the oceans' depths and water properties (temperature and salinity) so that by the mid-twentieth century we had developed a general, if imperfect, understanding of the ocean's physical processes.

Today, scientists are in the middle of a major project—historically even more important than the work of the *Challenger*. It is called the World Ocean Circulation Experiment (WOCE) and is part of the the World Climate Research Programme. The project is charting the complex ocean currents using modern research vessels, buoys and robot instruments to collect very precise measurements. Satellites are observing sea surface temperature, winds, waves, tides and the changes in the sea surface slopes caused by currents. By using some of the world's largest computers to analyse this data, we are beginning to reveal the ocean as climate's hidden engine. We are about to enter a new age of ocean exploration.

To understand in the simplest terms the key role of the ocean, think of it as an enormous reservoir for the sun's heat. The oceans have an extraordinary capacity to store and move heat. In fact, the heat needed to warm the top three metres of the ocean by one degree Celsius would warm the entire atmosphere by the same amount. This enables the ocean to save the excess heat of summer and then slowly release it during the next winter. We clearly see the effect this has by comparing the temperature differences between winter and summer on an island and in the middle of a continent at the same latitude. For example, the Azores and Kansas City are both close to 40^0 N and yet the temperature ranges are 7^0 and 29^0 C respectively.

This storage capacity is just one part of the climate equation. Ocean currents also carry heat around the world. The Gulf Stream and its branches, for example, bring heat from Florida towards Ireland and onwards to the Arctic, leaving northwestern Europe about 10^0 C warmer than Labrador, which sits at the same latitude. In simple terms, the ocean's surface current system carries heat from the equator towards the poles, the water returning in cold deep currents. Scientists on the *Challenger* saw evidence of this when they measured surface equatorial water of almost 30^0 C, while at the bottom temperatures were near 0^0 C.

The heat transport is enormous too—the North Atlantic, for example, is carrying heat polewards at the rate of 1,000 million megawatts (equivalent to fifty times the global population's energy consumption). This system of ▶



© WOCE, Southhampton

Satellite image of ocean surface currents. Red areas are those where heat exchange with the atmosphere is most intense.

warm and cold currents is referred to as the thermohaline circulation. The Atlantic branch is in some ways the key to the global system. A round-trip on the thermohaline "conveyor belt" can take a thousand years.

The thermohaline circulation is driven partly by the winds and the earth's rotation and partly by the conversion of surface water to cold, deep dense water at high latitudes. Its name, thermo (heat), haline (salt), gives a clue as to how it works. The salt prevents water freezing when heat is lost to the atmosphere in the polar winters, and so dense water (below 0^0 C) sinks to the seabed in small, intense "chimneys" and feeds deep, narrow currents threading their way equatorward along the ocean floor. This water slowly mixes with warmer water above it and thus completes the "conveyor belt".

By mapping these circulation routes, scientists are on the threshold of understanding the oceans' role in climate and its variability. The present El Niño event is a wonderful example of why this is important. When an El Niño occurs, warm water usually held in the western equatorial Pacific by the prevailing winds migrates eastwards towards South America. This causes weather changes both locally and around the world. Thanks to an observational network of Pacific buoys and computer models, we were able to predict in early 1997 that an El Niño was starting. However, we could not precisely forecast the severity of the impacts on weather patterns around the globe. We still cannot be sure which of the many anomalous events in 1997 were attributable to El Niño, but past experience suggests that many were.

As we learn more about climate we start to see other patterns emerging. The difference between atmospheric pressures measured in the Azores and in Iceland is a measure of the strength of westerly winds over the Atlantic. This North Atlantic Oscillation (NAO) index can be linked to colder and warmer winters in Europe as the winds bring heat from the ocean to the land. This helps to explain the unusually mild European winters of the early 1990s. In contrast, the bitter cold and snow of the 1940s which led to Hitler's botched assault on Moscow were linked to extremely low NAOs.

Clearly, the ocean holds a key to more precise and longer-range weather predictions. With advanced warning, farmers could plant drought-resistant crops if need be. An early forecast of unusually high temperatures or wet conditions might enable doctors to prevent the onslaught of tropical diseases.

Predicting climate is a harder problem. The uncertainty surrounding global warming and the impact of greenhouse gas emissions has given a new impetus to ocean research. WOCE has involved scientists from thirty countries making observations over the past eight years. That experiment's findings and our knowledge of El Niño will be built on by a new project on Climate Variability and Predictability (CLIVAR) to model all aspects of the climate from the seasonal/interannual monsoons to long term (decades to centuries) climate variability and the possible influences that humanity may have.

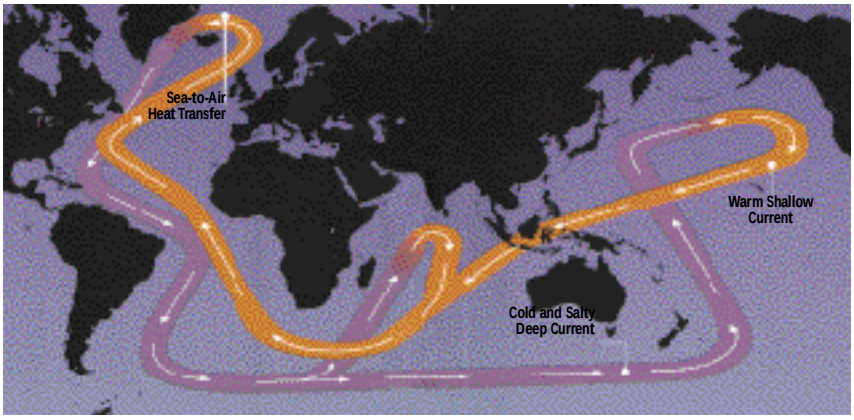
We have much to learn about the effects of global warming on the seas. The list of concerns is endless. Rising sea temperatures affect everything from sea level rise to availability of fish stocks. Some computer models suggest it could also trigger a breakdown of the Atlantic component of the "thermohaline conveyor belt", which might create at least a temporary end to Europe's relatively mild climate.

Finally, global warming might also affect the ocean's capacity to absorb carbon dioxide (one of the most problematic greenhouse gases). The seas currently draw about two billion tonnes of CO_2 out of the atmosphere each year. (To put this in context, human activities release about seven billion tonnes each year). However, rising temperatures limit the seawater's physical capacity to absorb CO_2. Can we afford to take even more risks and neglect the oceans? ■

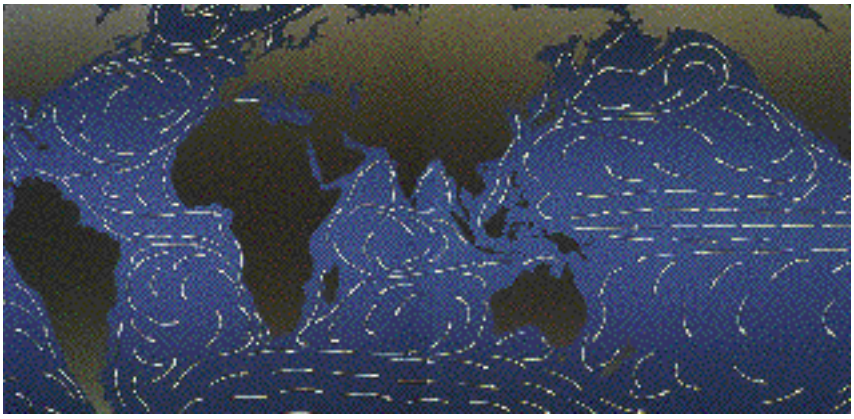
* Southampton Oceanography Centre, UK

This blue cupola is like
a sea
with the world in the midst of it, like an island;
night and day are like joined waves.

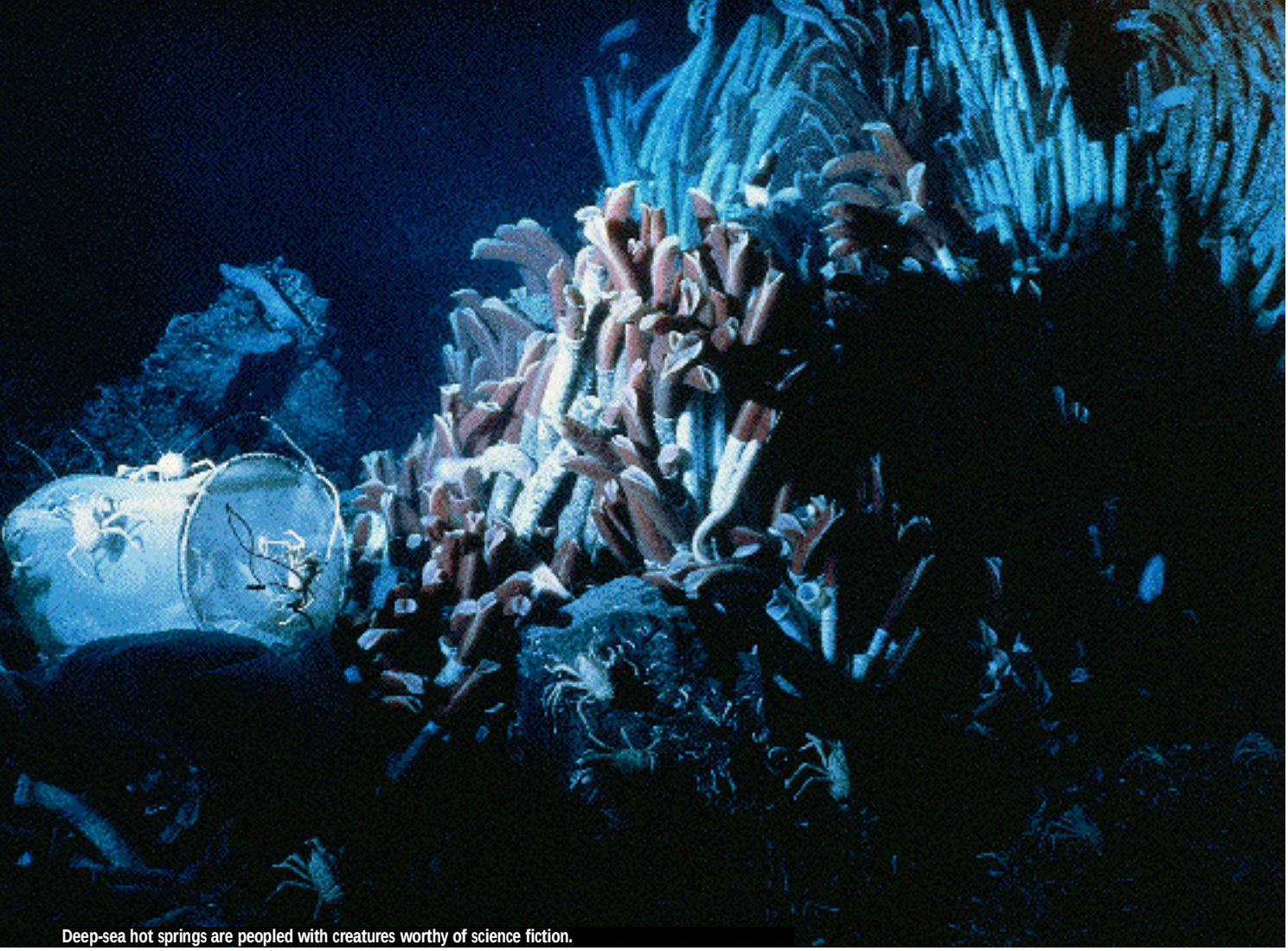
Asadi Al-Tusi:
Garshâp-nâme
(11th century, Persia)



Simplified chart of the thermohaline circulation.



Surface circulation of ocean waters.



Deep-sea hot springs are peopled with creatures worthy of science fiction.

The world beneath the waves

Cindy Lee Van Dover*

A multitude of strange creatures inhabit parts of the sea floor where, some scientists believe, life itself may have originated.

"The deepest parts of the ocean are unknown to us. What goes on in these remote abysses? What creatures live beneath the surface of the waters? What is the constitution of these beings? We can hardly imagine. . . . if Nature still keeps secrets . . . nothing is more admissible than to suppose the existence . . . of new species or even new genera."

These prophetic words were uttered by Professor Aronnax, the earnest marine biologist who is the narrator of Jules Verne's novel *20,000 Leagues Under the Sea*, published in 1870.

More than a century after Jules Verne penned these words, one of Nature's deepest secrets was revealed to latter-day submariners. In the valley of a mountain range in the eastern Pacific Ocean, where the heat of volcanism inexorably drives the separation of two oceanic plates, geologists discovered animals worthy of nothing less than science fiction. I myself have seen the thickets of giant tubeworms with haemoglobin-red plumes emerging from white tubes, yellow mussels huddled in great piles over cracks in basalt, clams with thick chalky shells lying exposed on the sea floor. All of this and more, thriving in the noxious chemical soup of what has come to be known as one of the most productive habitats on our planet and the environment where some scientists think life itself may have originated: deep-sea hot springs.

Life in the abyss

New species and new genera are the least of the discoveries at deep-sea hot springs, though they abound and already make up a lengthy list of more than 400 novel Latin binomials. A whole new style of living was revealed as biologists rushed to understand how a giant tubeworm, taller than me and as thick around as my wrist, ▶

could be sustained in an environment as scarce in food as the deep sea. Bacteria, both free-living and symbiotic within host animal tissues, are the key. Animals at deep-sea hot springs are sustained by microscopic bacteria that grow on simple chemicals dissolved in the venting fluids.

Discovery of seafloor hydrothermal vents and their attendant communities stands out as a spectacular example of how poorly we have known our ocean. Scientists working in the soft-sediments of the bathyal deep sea tell another cautionary tale worthy of recollection should we ever become too sanguine about our knowledge of marine biodiversity. Working with sieves, microscopes and tremendous patience, biologists have identified nearly a thousand species of worms, snails, and crustaceans in a small volume of cold mud from deep waters off the east coast of North America. Our deep seas are repositories of biodiversity, with some estimates of the total number of global deep-sea species reaching into the millions, rivaling the celebrated diversity of tropical rain forests. Virtually nothing is known about their biology, their role in the ecosystem or their potential useful attributes.

Dwindling diversity

Deep-sea work requires high-tech tools for access, but anyone with an old pair of canvas shoes can explore the intertidal zone of coastal wetlands and beaches. Marine plants thrive in these sunlit waters: red, brown and green algae create three-dimensional forests within which live incredible numbers of molluscs, crustaceans and worms. There are rich and diverse littoral habitats: rocky shores and sandy beaches, mangrove swamps and salt marshes, coral reefs and mud flats, shallow lagoons and deeper bays. These are the habitats patently at risk from a plethora of anthropogenic effects including pollution, development, over-fishing, trawling, and global warming. As coastal habitats are compromised or disappear altogether, whole suites of species disappear as well.

Not long ago I read about the dwindling populations of horseshoe crabs that gather ritually on beaches at full moon on a spring tide in June to mate and lay eggs. I used to haunt the beaches where horseshoe crabs landed, always astounded by their fantastic numbers. These animals are relicts of the Mesozoic, a time when dinosaurs ruled the earth, but their long history never prepared them for the demanding economics of catfood and fertilizer production in this modern world. Two decades ago they were uncountable. Are they to go the way of the passenger pigeon, slaughtered to extinction in the nineteenth century?

For a variety of reasons, healthy marine habitats do not necessarily support high numbers of species, and biodiversity per se may not always be paramount. Rather, as in terrestrial habitats, it is loss of diversity that generates concern. Because some marine habitats may naturally have relatively low diversity but a high abundance of animals, loss of a single species can greatly modify the ecology of a system. A case in point is Chesapeake Bay, the largest tidal estuary on the east coast of the United States. Oyster reefs once dominated the Chesapeake's shallow waters. These animals feed by filtering seawater, and not so long ago the equivalent of the entire volume of water in the Bay was filtered within a week. Oyster populations have declined due to exploitation and disease and what took one week to filter now takes one year. The effect cascades through the water column as the particulate load increases, light penetration decreases, and a host of other consequences transpire.

In terrestrial ecosystems, loss of charismatic mammals or the last remnants of virgin forest results in a dramatic visual sensation as well as a numerical debit on the tally of species or habitats. Loss of marine diversity takes place out-of-sight, invisible beneath the waves, yet the toll on the planetary legacy we leave to our children is the same. Worse, remediation of habitat damage or restoration where habitat has been lost is a difficult task at best in shallow waters and all but inconceivable in deep waters of bathyal and abyssal environments. ■

*University of Alaska Fairbanks, USA

Endangered coral reefs

Snorkel in sunny, warm tropical waters over the vibrant rainbows of coral heads and reef fishes and your head goes dizzy with the magic of diversity. Over 90,000 species living in coral reefs have been described, and the total number is at least one million. Why is the figure so high? The microtopography of a growing reef is complex, creating abundant surfaces for attachment and hiding places to accommodate small invertebrates and habitats for fish. Reefs are typically insular oceanic habitats. One can envision an always expanding species pool as a reef is successfully invaded by the chance arrival of drifting larvae of a species from some remote location. The invader, isolated from its parent population, gradually adjusts to its new environment and develops into a daughter species. Where there was once one species, now there are two. Each one has some likelihood of invading other reefs and in such a way diversity of coral reefs blossoms exponentially over geologic time.

This diversity is now threatened by the flash of dynamite of the myopic fisherman who destroys the habitat that sustains the resource he seeks to gather. Coral reefs are victims of many other unsound practices, with the result that as much as 10 per cent of them have already been degraded beyond recovery. If unchecked, loss of coral reef habitat will progress at a rate of 10 per cent per decade. Global warming is a particularly insidious danger. Corals lose their algal symbionts when the seawater temperature rises just a degree or two above normal, a phenomenon known as bleaching, which often results in death of the coral. Disease hits harder when corals are stressed by warmer than usual temperatures. A sick coral reef is dizzying only in the staggering loss of biodiversity. **C. L. V. D.** ■

An old sailor . . . had once heard it said . . . that under the Arctic pole there was a terrifying whirlpool . . . in the midst of which there must have been a dreadful bottomless gulf, into which rushed all the waters of these seas and communicated via the centre of the earth with the seas which are beneath the Antarctic pole.

Anonymous: "The passage from the Arctic pole to the Antarctic pole via the centre of the earth", 1780)

© C. Rives/Visa, Paris

Japanese women prepare recently gathered algae for consumption.

Anyone for algae?

It's great for your health and easy to farm. Whether you like it or not, there may be seaweed on your plate.

Seaweed–or algae–is everywhere in our food nowadays. Chunks of it float around in Korean soups, paper-thin sheets of it are wrapped around Japanese rice balls, and it lies hidden in the alginates and carrageenans in hamburgers, yoghurt and strawberry ice cream. " Seaweed-based food additives are now so commonly used in prepared and fast food that virtually everybody in Europe and North America eats some processed seaweed every day," says Michael Guiry of the National University of Ireland, where marine algae are also used as a fertilizer and food supplement for livestock. In other parts of the world, especially the Far East and the Pacific, seaweed is a traditional part of the staple diet.

There are three categories of seaweed: red (4,500 species), green (900 species), and brown (1,000 species). Red seaweeds are the most numerous, green the most widespread and brown the largest. Some species of kelp off the Californian coast can grow to be 50 metres long, in "forests" that are just as vast and complex as those on land. Every year 140,000 tonnes of kelp are harvested for the extraction of food additives. Most of the edible green and red seaweeds are eaten unprocessed.

The most valuable seaweed species are known by their Japanese names: *nori* (*Porphyra*), *kombu* (*Laminaria*) and *wakame* (*Undaria*). They are so easy to digest and so ▶

rich in vitamins, mineral salts and oligo-elements that they deserve to be called "the vegetables of the sea". *Wakame*, for example, has a very high calcium content,and *nori* contains 50 per cent more vitamin C than oranges.

In some parts of Asia, seaweed provides the poor with good, cheap nutrition, and in the rich countries it helps people lose weight. "It seems that Westerners, unlike Asians, are unable to assimilate seaweed,and that's why we consider it to be a low calorie food," says Guiry. The total seaweed market is worth over $5 billion, with food additives alone accounting for $600 million. Kazutosi Nisizawa, former President of the Japanese Phycological Society, says "the world's total yearly harvest is 8.4 million tonnes of green seaweed, 2.8 million tonnes of brown seaweed and 1.2 million tonnes of red seaweed." China is the leader, producing 3.5 million tonnes of *kombu* yearly—the world's biggest harvest. This is even more impressive when we know that from the fifth century on China imported dried seaweed from Japan, until it began to farm its own in the 1950s, growing the plants on long ropes stretched under the water. The Chinese now hold the title of the world's biggest seaweed consumers.

Meanwhile, the Japanese harvest of *nori* is the world's biggest in value, worth a total of almost $1.3 billion. The Japanese seaweed industry employs some 35,000 people. Japan is also the world's leading seaweed exporter, ringing up sales of $170 million in 1995, according to FAO. Seaweed, of course, is a historic staple of the Japanese diet. "The Japanese currently eat some twenty different species, and they have been using six of them since as far back as the eighth century," reports Guiry. "Seaweed accounts for about 10 per cent of the modern Japanese diet." Even the Japanese gods love seaweed, it seems. "In a book dating back to 701," recounts Nisizawa, "it is written that several varieties of edible seaweed were used as offerings in the temples." Even today, there are towns in Japan where the meal served at the betrothal ceremony must include *Laminaria*, which is believed to bring good luck and happiness. In many countries, seaweed has long been part of the traditional pharmacopeia, and scientists today hope to see it as an ingredient of tomorrow's medicines. Researchers are currently trying to isolate substances in seaweed which could be used to treat high blood pressure, cholesterol, cancerous tumours and other ailments. ■

Sophie Boukhari

From Chile, a $50-million crop

They walk on the water, beating the waves with a "corvo", a 10-metre-long pole. They scrape the rocks with iron knives, then stop to pick up brownish,slippery, floppy things which they pile in heaps, before returning to the water, scraping and bending again. For several generations, the seaweed gatherers have been lords and masters of a place which belongs to no one. They are regarded as demi-gods, and it is said that when they ride their horses down the streets, or walk with their arms laden with rolls of dry seaweed,it means that bad weather is on the way.

On these windswept shores, they gather seaweed in the traditional way, from spring to autumn, just as the Mapuche Indians did 200 years ago. Near Temuco and Chiloé,in the central regions of Chile and in the very heart of Araucana,they gather "cochayuyo"and "luche" (*Durvillaea antarctica* and *Porphyra*),with which they make bread and cakes, or cook with mutton. Further south, near Puerto Montt, they have for over twenty years been gathering "luga roja carrajinado", "luga cuchara" (*Mazzaela* or *Iridaea*) and "pelillo" (*Gracilaria*),using diving suits and breathing tubes which enable them to work underwater for long periods without oxygen tanks.

When the work is done, the beaches are spread with red and brown seaweed which is flattened out and left to dry in the sun. The gatherers and their families later carry it away in rolls or bundles weighing between 40 and 60 kilos, which they sell for a pittance to merchants and dealers. The following day, the gatherer will be back on his rock jutting out of the water, "corvo"in hand to prod the waves.

The traditional way of gathering seaweed is tending to disappear just as seaweed's economic importance is growing.

However, this traditional way of gathering seaweed is tending to disappear, just as seaweed's economic importance is growing. It is not only used unprocessed as food but also to make algina, agar-agar and carrageenan,substances which are used in the food,pharmaceutical and cosmetics industries, and to solidify cultivation media in bacteriology. The seaweed gatherers are gradually becoming professional farmers.

Seaweed gathering began in Chile in the 1950s, and during the present decade is yielding 160,000 tonnes of biomass per year, almost 5 per cent of total world production. The industry employs some 12,000 families.

In 1983 over-farming depleted the natural underwater "meadows" of pelillo, the raw material for the production of agar, as a result of which scientists, entrepreneurs and seaweed gathering co-operatives got together to replant the shoreline. Of the 1,200 meadows currently under concession,342 are active farming centres, operated along the northern shore by big companies and in the South by co-operatives of traditional gatherers. Eighty-two per cent of the current pelillo crop is transformed by Chilean factories into agar for export to the United States, Japan, Singapore and Thailand. The remaining 18 per cent of the seaweed is dried and exported,mainly to Japan. Total earnings from Chile's seaweed exports are about $50 million.

Pelillo farming has helped to stabilize production and reduce pressure on natural meadows; at the same time, it ensures a constant supply of raw material to the Chilean agar industry. Currently, 75 per cent of Chile's total seaweed crop is being transformed into a high added value product. The same results are expected in the short term for the red seaweed used to produce carrageenan.

C. L'H.T. and G. C. ■

The tidal power station at La Rance (France).

Harnessing ocean energy

The winds of heaven and the waters of the sea are sufficient to move me; even if we do not see the sunrise the journey will not have been in vain.

Liu T'ieh-yün (Liu E. 19th century, China): *The Travels of Lao Ts'an*

The world's oceans could provide a limitless source of energy, according to Indian chemist Madanjeet Singh, an international authority on the subject. But exploiting ocean energy is no simple matter, if only because the possibilities of doing so differ from region to region.Experiments have been carried out with tidal and wave power and with ocean thermal energy. Few applications of these technologies are currently in use, but their number could increase in the coming centuries—if they attract investment on a massive scale.

Ocean tides constitute a clean and inexhaustible energy source, free from the climatic irregularities which are a constraint on wind and solar power. But places suitable for exploiting them are few and far between, for if a tidal power plant is to operate efficiently certain conditions must be met. A river estuary where the difference between high and low tide is at least five metres is necessary. It must be possible to construct a dam, and there must be a nearby source of electricity supply to make up for the intermittence of power production linked to the times of high and low tides.

One of the world's most suitable sites is the ▶

estuary of the river Rance, in western France, where the difference between high and low tides averages 8.17 metres, peaking at 13.5 metres during the equinoxes. The world's first tidal power plant began operating there in 1966. It is still the biggest, with a capacity of 240 megawatts (MW).

Tidal power plants consist of a high-capacity dam built across an estuary to hold back the water at high tide.At low tide sluice gates in the dam are opened to release a cascade of water that drives a turbine to generate electricity.

In China, says Singh, "eight plants with a total capacity of 6,210 kilowatts exploit tidal energy." There is a 20MW plant at Annapolis in Canada. But although many other suitable sites exist, construction costs are considered too high, especially as hydroelectric power is plentiful and cheaper. Tidal power plants are planned on Russia's White Sea and on the Severn and Mersey estuaries in the United Kingdom.

Putting the waves to work

In 1945, Japan became the first country to consider using sea waves as an energy source, followed by Norway and the UK. The first power plant to use wave power, OSPREY (Ocean Swell Powered Renewable Energy), began operating in northern Scotland at the beginning of August 1995. A 2MW facility, OSPREY was designed along the following lines: waves entering a kind of submerged chamber open at the base pushed air into turbines to generate electricity sent via an underwater cable to the shore about 300 metres away. Unfortunately, the plant was damaged by the waves and then destroyed by a storm.The engineers who designed it did not give up, however, and a cheaper and more efficient version is being developed to supply small islands with much-needed electricity and to power a seawater desalinization plant.

Quite different technology is needed to turn the sea's thermal energy into electricity. The sea's surface temperature in the tropics ranges from 27 to 31°C all the year round and that of deep water ranges from 6°C at a depth of 1,000 metres to almost 0°C at 4,000 metres. This temperature difference can be used to power a motor based on the same principle as that of the heat pump. A liquid is turned into gas in an evaporator, and then drives a turbine which generates electricity, before passing through a condenser, where it is turned back into liquid.

The snag is that the process requires huge turbines. The first practical application of this method was by the French engineer Georges Claude, who in 1930 loaded pipes and turbines onto a ship off the coast of Cuba. American engineers are working on the idea of siting floating power plants off the southern coast of the U.S. and one facility has been operating in Hawaii since 1981. Such plants could supply floating cities of the future with electricity, air-conditioning and fresh water, while the unpolluted,nutrient-rich cold water brought up from the depths could be used to breed fish and shellfish and grow edible seaweed.

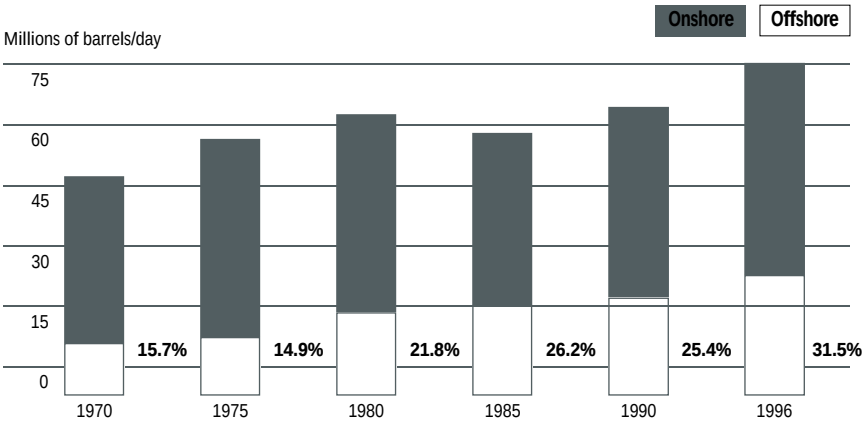
But according to Scottish engineer S. H. Salter, the most promising device is a "tapering channel", invented by a Norwegian, Even Mehlum.As Singh describes it,"The waves are funnelled into a tapered natural or artificial channel. The water level rises and the water eventually spills into an elevated reservoir behind the narrow end of the channel. The water then flows back to the sea through a turbine, generating electricity in the process." This reliable, low-cost system is already operating in Norway and Java.

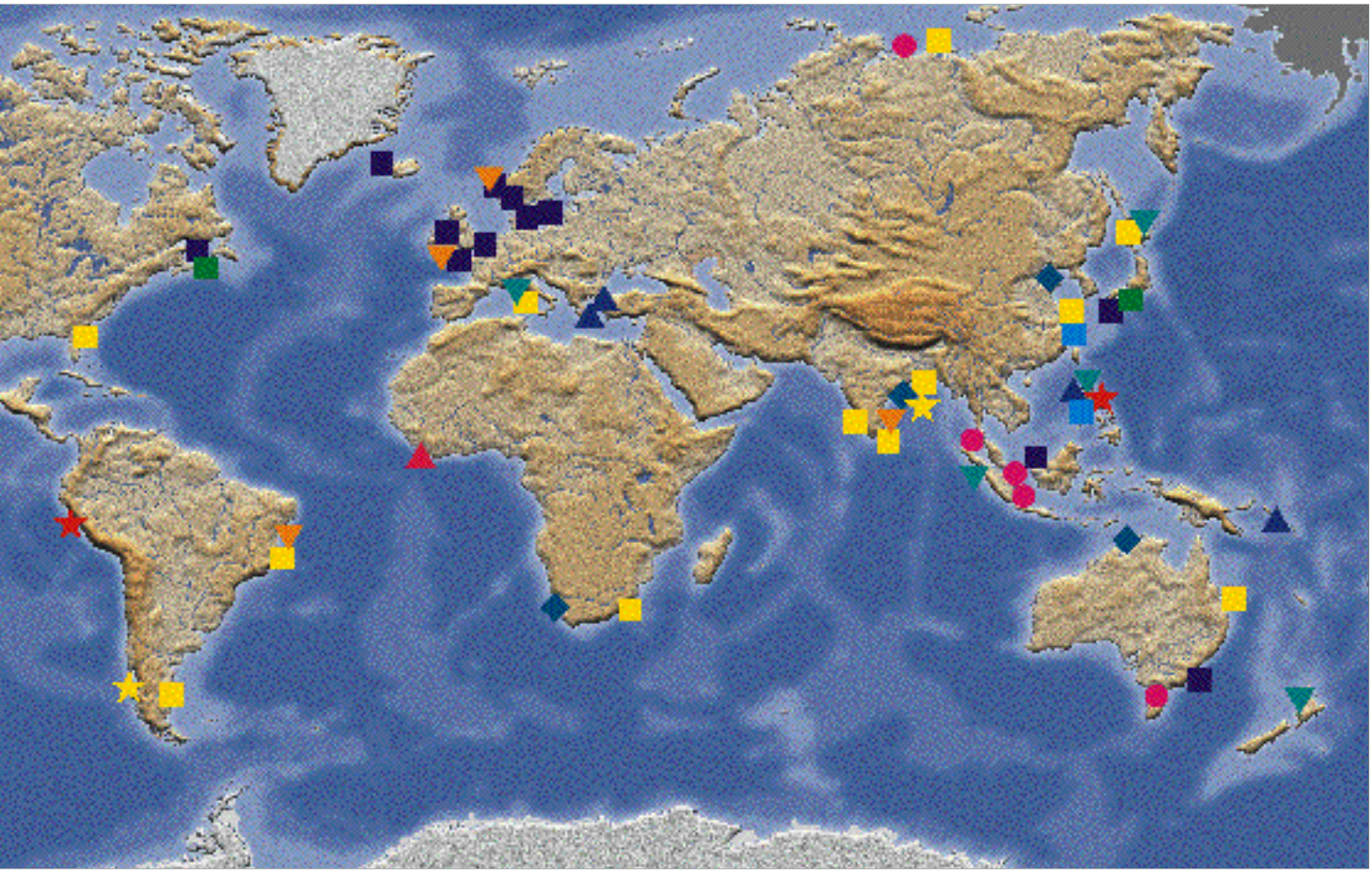
Salter believes that if we use our imagination we will find an endless variety of ways of harnessing the sea's energy. One of them would be to use the difference between sea levels. In Egypt, water running through an underground canal linking the Mediterranean to the El-Qattara depression could be used to generate electricity. In Israel, the same principle could be used in a canal between the Mediterranean and the Dead Sea which would gradually descend 400 metres, although the estimated billion-dollar price tag is a deterrent.

Mr. Singh concludes that "clean energy from the sea will be especially popular when the price of oil is no longer governed by economics but by environmental costs. Cutting carbon dioxide emissions will help save the planet." ■

France Bequette

World onshore and offshore petroleum production





Map based on BRGM data

Offshore **mineral** resources

When the ninth year had passed over,
And the summer tenth was passing,
From the sea her hand she lifted,
And her forehead she uplifted,
And she then began Creation,
And she brought the world to order,
On the open ocean's surface,
On the far extending waters.

Kalevala-
The Land of the Heroes
(Finnish epic)

Raw minerals are found in deposits which have accumulated and concentrated over tens or hundreds of million of years. Mineral extraction on land has not always been sufficient to satisfy world demand, and so researchers and industrialists have turned to the sea and the seabed,a rich and promising but still little-known world.

Minerals under the sea come in several forms:

- Loose deposits come from three sources. Some are detrital,like sand or gravel, or consist of "placer"deposits containing tin, titanium, gold, rare earths, zirconium and diamonds. Others are of biological origin,such as shells of marine creatures which have turned into sand. A third category originates from elements suspended in water, yielding chemical deposits which produce, for example, barytes or metal-rich sediments.
- Rock deposits, which are the undersea extension of seams of coal, tin, iron and other minerals.
- Deposits dissolved in sea water, such as sodium chloride, magnesium and iodine.

Offshore mineral extraction has grown to the point that it now involves, or soon will,almost two-thirds of the 103 chemical elements identified in 1869 by the Russian chemist Mendeleyev. Mineral sands, also known as beach sand, come from the bedrock of continents worn away by the weather and the passage of the seasons, especially in tropical latitudes. The minerals are freed and carried away by rivers, first to beaches and then to the seabed of the continental shelf.

Extracting these minerals is important because they have become indispensable to modern technology, which depends heavily on titanium, zirconium and rare earths (which include nine heavy minerals—radioactive thorium, and eight lighter ones). Titanium, considered a strategic metal, provides a white colouring for paper and plastic, and plays an important role in the aeronautical industry and in manufacturing golf clubs and tennis rackets. Zirconium's refractory qualities make it useful in the thrust nozzles of jet aircraft. Rare earths, which contain quartz or rutile (titanium dioxide), supply state-of-the-art technologies such as the red colour in television pictures or the catalysis of engine exhaust gases. Rutile has an amazing resistance. It does not wear out and cannot be corroded by other chemicals. But deposits of it are scarce and unevenly distributed. The biggest are in Australia, Madagascar, Cameroon, Ghana and Sierra Leone.

Beach sand is mined using huge, super-powerful dredges which can scoop up as much as 2,500 tonnes an hour. Between 90 and 98 per cent of the dredged material is waste which, after the minerals have been separated out by gravity, is put back where it came from. The most conscientious mining companies try to leave the landscape as they found it. They set aside topsoil, and later replace, fertilize and replant it.

F.B. ■

The memory of the sea

From fish scales…

The secrets of the planet's past lie hidden in the ocean depths. Palaeoecologists like Tim Baumgartner sift through kilos of mud to uncover the clues.

Off Alexandria, a 2-tonne section of an ancient statue is hauled from the sea.

■ **What is palaeoecology?**

Palaeoecology looks to the past—using the remains of plants and animals—to reconstruct ecosystem behaviour and see how these systems respond to climate change. This work is done by a wide range of specialists, each with his or her own particular interest, or fetish you might say. Some study tree-rings, ice cores from polar and mountain glaciers, even the history of forest fires.

The ocean is a particularly rich source of information. Scientists look to yearly bands of coral growth, for example, to reconstruct histories of El Niño over the past several centuries. My fetish is fish scales deposited in ocean sediments.

■ **What can the ocean tell us that a glacier cannot?**

Ice-cores are wonderful sources of climate history but they cannot tell us how an ecosystem responds to those conditions. Ocean sediments provide imperfect pictures that have to be reassembled, like jig-saw puzzles. They help us begin to disentangle and understand the interaction between natural variability in the ecosystem and human intervention. The trick is learning to read the language of these natural archives.

I work with a team (through Scripps Institute in the U.S. and Mexico's Centro de Investigación Científica y Educación Superior de Enseñada) to recover and analyse sediments from a few rare sites. In one of the best sites—the Santa Barbara Basin off the southern California coast of the United States—three metres of mud give us almost 2,000 years of history. We first X-ray the mud to reveal the annual layers. We can then count the fish scales to reconstruct changes in population sizes of fish like sardines and anchovies. Then we work out the background clues. Tiny one-celled animals called Foraminifera, for example, capture the history of the water in their calcium carbonate shells. By analysing their remains, we learn about the temperature and salinity of the water at the time the shell was secreted, helping us trace ocean circulation in the past.

■ **But isn't 2,000 years of history just a drop in the bucket in terms of natural history?**

That's true if we look back over the whole panorama of earth history. But the past 2,000 years is a critical period for considering the effects of fishing or greenhouse gas emissions. What sets our fish scale history apart is the high resolution. This is like the number of volumes in a collection of history books. Our work offers five-year "chapters" with the option of looking every two years. In contrast, much of earth history has a far lower resolution because the measurements used give averages over hundreds to thousands of years.

The fish scale record has played an important role in understanding the decline and collapse of the sardine population off California in the 1950s. While this was immediately attributed to overfishing, the palaeo-record showed that the population has gone through many increases and declines over the past 2,000 years. This evidence was then used by some to argue that the modern decline was a purely natural phenomenon. A closer look at the fish scale record, however, shows that this decline differs from the pre-fishery declines in two ways. First, it culminated in a collapse instead of an expected four to five-fold reduction in population size. Secondly, the population took at least thirty years longer to recover than if there had been no overfishing.

■ **What else have you discovered?**

Something completely unexpected—from the shells of a tiny snail floating in the upper 100 metres of the ocean. The shells captured the water age at the time they were secreted. Water age is measured by radiocarbon (the isotope carbon-14) as the last time the shell was in contact with the atmosphere. We expected some bouncing around in these numbers but not the kind reported by our collaborators at the Lawrence Livermore National Labs in California. During the period studied—350 A.D. to 1940—it appears that there was a 50 per cent reduction in the rate of supply of older radiocarbon from the deep ocean to the near-surface ocean off California. This is still a mystery, but ultimately,

I went on the sea ice.
Seals sighed in their holes.
Bewitched I listened to the
song of the sea
and the groaning of the
young ice-floes.

Inuit song

© Stephane Compoint/Sygma, Paris

it must be related to the circulation of deep and intermediate waters in combination with other processes. Now remember that the ocean is the main reservoir of carbon dioxide, so variations of this magnitude are essential to understand. Eventually, we also must compare these data with data from other sites and go back another 5,000 to 8,000 years.

■ **What is stopping you?**

First, sites with such high rates of sedimentation are very rare. They must also be deep enough to avoid stirring by waves and currents. And the bottom water must be very poor in dissolved oxygen so that we don't have worms burrowing into the layers. Between southern Chile and western Canada we have identified ten possible sites, with another promising area off the Namibian coast of Africa. But developing these sites is not cheap. A research vessel can easily run to $15,000 per day. We also need to help scientists in these countries do this work. So before we can find more sites, we must find more funding. ■

Interview by Amy Otchet

...to sunken treasures

In May 1998 the 25-tonne, 11-metre-tall colossus of Alexandria made its first voyage when it was shipped to Paris to be displayed in the square facing the Petit Palais. In Antiquity, the statue stood before the Alexandria lighthouse, one of the seven wonders of the world. After six centuries at the bottom of the sea and five years of excavations, it took barely five weeks to assemble the four pieces of granite discovered by archaeologists. The 2,300-year-old statue of the Greek pharaoh Ptolemy II has at last been restored to its original splendour.

Many mysteries lie at the bottom of the sea. The most spectacular of them are shipwrecks. More than four million people have visited the 16th-century English warship *Mary Rose* since she was raised in 1982. The wreck of the *Wasa*, the pride of the Swedish navy that sank in 1628, has been Stockholm's biggest tourist attraction since 1961. Last but not least there's the wreck of the *Titanic*. In 1985 televised pictures of the sunken luxury liner mesmerized audiences around the world, 73 years after she came to rest on the ocean floor.

Many other archaeological discoveries have not made front-page news, but provide valuable information about the past. The excavation of a 14th-century-B.C. trading vessel off the southern coast of Turkey has helped us understand trade in the Mediterranean area during the Bronze Age. Lisbon's National Archaeology Museum has listed 850 ships that have sunk off the Azores since 1522, their holds often laden with precious stones and metals. These wrecks shed new light on trade between Europe, the New World and the West Indies.

The sea usually preserves vestiges of the past better than the earth, but archaeological excavation under water is much more difficult than on land. Chance plays a role in finding sunken treasures, but it is technology that has worked wonders. There is a downside to technology, however. Remote-controlled submersibles and satellites that can scan the ocean floor are available only to those who can pay—mostly modern-day pirates.

Many sites coveted by treasure-hunters may end up suffering the same fate as the wreck of the Dutch-flagged *Geldermahlsen* that went down in the South China Sea in 1752. Christie's, one of the world's biggest auction houses, sold the cargo for $16 million in 1986, reaping a handsome profit for the salvager. The recovery of the cargo led to the complete destruction of the coral-encrusted wreck and its resting place, wiping out a chapter of history forever. ■

Sue Williams

Landlubbers all over the world thrill to the exploits of intrepid solo yacht racers.

"I've never sailed this far South. Yachtsmen seldom come here, it's magical. It's an honour to stick my nose down here. This is Adventure with a capital A". Canadian yachtsman Gerry Roufs uttered those words before the sea swallowed him up during a violent storm between Australia and Cape Horn early last year. His death is an awesome reminder of the very real dangers incurred by these adventurers, whose thrilling exploits grip the public's imagination. Frenchman Christophe Auguin, who won the 1996-97 Vendée Globe, the dangerous round-the-world race via the South Pole that took Roufs' life, is another example of bravery.

Auguin, Roufs and other weather-beaten heroes like them are too modest to cry victory over the elements. Florence Arthaud, the first woman to win a transatlantic race, is one of the grittiest figures in the world of long-distance racing. On land she is surrounded by a circle of friends, but she loves being alone on the ocean. The yachtswoman's intense relationship with the sea led her to give up everything at eighteen, including medical school and a cozy life with her family in Paris' chic 16th arrondissement. Arthaud, who has been nicknamed "the sweetheart of the Atlantic", says she was drawn to sailing because it brings her back to life's basics: eating, sleeping and surviving.

Solitude is the recurring theme in the lives of all these sea-farers. From England's Transatlantic along the historic route between Plymouth and Newport, which made the legendary French yachtsman Eric Tabarly famous, to the Vendée Globe, which does not allow competitors to receive any assistance or stop off at ports of call, long-distance racing is first and foremost a personal challenge. Isabelle Autissier, a Frenchwoman from the Paris suburbs and one of five sisters, says that sailing "makes me feel totally self-sufficient. I do just what I want, when I want. Maybe I'm really trying to prove something to myself—or to others".

Alain Bombard, who voluntarily cast himself adrift in an inflatable dinghy in 1952, says one of the century's wildest exploits was Gérard d'Aboville's solo voyage across the Pacific in a rowboat. Like a modern-day galley slave, he set out from Japan in July 1991, reaching the West Coast of the United States in November of the same year. D'Aboville, the total solo adventurer, fulfilled his wildest dreams and proved to the world that willpower can move mountains. Although, in his own words, he did not spend "a single enjoyable moment" on the lonely crossing, D'Aboville achieved his goal. "I thought for sure crossing the Pacific was impossible, but mulled the idea over in my mind a long time. What I liked about it was reaching my goal. I got a huge thrill out of slowly working my way across the world's biggest ocean, which covers half the globe."

Dr. Jean Yves Chauve, a long-distance racing specialist and the official physician for most of the sport's major events, says that, in addition to a love of taking risks and accepting challenges, these far-roving adventurers seek a very personal kind of "retreat" from the world. As he sees it, solo long-distance yachtsmen—and women—are eager to discover the unknown latitudes of their own minds, most likely coming home stronger and wiser.

The experience changes some of them forever. Bernard Moitessier, who inspired many people to start sailing, never went home from the first round-the-world race, the Golden Globe, organized by the British in 1969. Although in the lead, after sailing past Cape Horn the great seaman decided to set out around the world a second time instead of heading for England. He didn't drop anchor until reaching Polynesia. "What does it mean to go round the world, since the horizon never gets any closer?" he pondered

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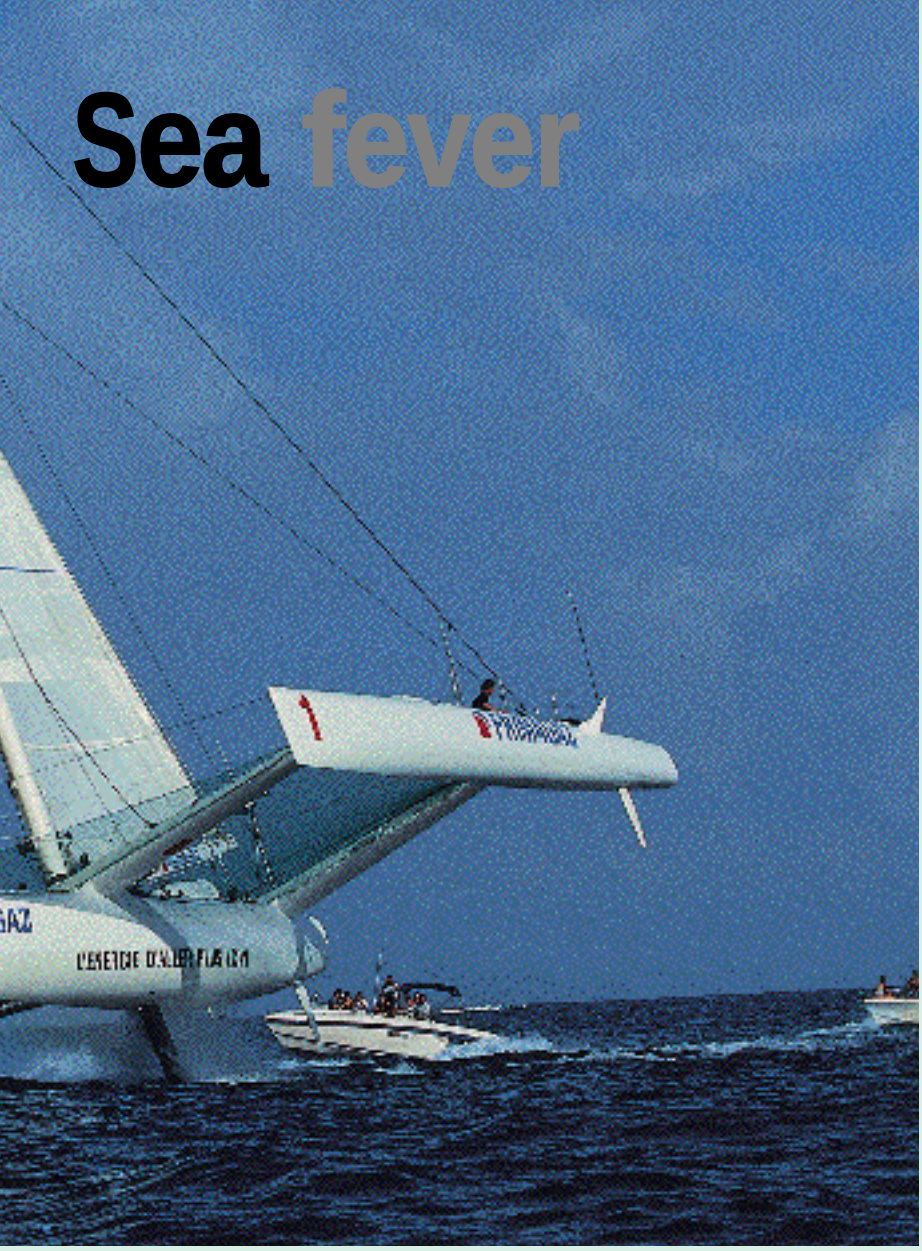
Sea fever



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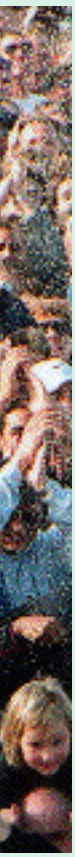


In San Diego, California, an enthusiastic crowd turns out to cheer the winners of the America's Cup in 1995.

'Sailing makes me feel totally self-sufficient. I do what I want, when I want.'

in *La Longue Route*, a first-hand account of his voyage.

Many will set out in search of a world Isabelle Autissier calls "the other side", looking for the unusual beauty that Moitessier found so stunning in these latitudes. The far south of the Atlantic, Indian and Pacific oceans—the roaring forties, the screaming fifties—is a boundless watery wilderness where none but a few thrill-seekers would ever dare to venture. Cam Lewis, who in 1993 became the first yachtsman to sail around the world in less than eighty days, wrote in his log book about not seeing any land, ship, plane or sign of human life for weeks. He described the sense of peace that came over him on the open sea and what it was like listening to the sound track of *The Big Blue* in stereo as the boat rode the crests of the waves in a violent storm, giving him just enough time to glimpse the vast expanse of ocean before plunging into a trough again.

Yet even when they take all the necessary precautions, those who venture out on to the open sea risk their lives. Especially since the high-tech craft they sail today zoom ahead at amazing speeds. The corporations that sponsor them want to see their investments pay off. Speed is the name of the game. A case in point was the 1998 Whitbread round-the-world race that pitted the best international racers against each other. New Zealander Grant Dalton wrote in his log book that this way of sailing is unsafe, but wondered whether he and his fellow competitors had any choice. If you don't want to finish last, you have to tear ahead at the risk of being smashed to bits.

Advertisers have been quick to seize upon the public's fascination with long-distance yacht racing as a way of reaching promising new markets. The genuine seaman, Dr. Chauve says, has the power to make others experience adventure vicariously. These races do have a strong impact on the collective imagination. A million people turned out in the Breton port of Saint Malo to watch the start of the Rum Route race in 1994. Several hundred thousand onlookers welcomed Christophe Auguin on his return when he reached the French Atlantic port of Les Sables d'Olonne. On a chilly winter's day a crowd over 300,000-strong cheered on Bruno Peyron and his crew as their catamaran finished a round-the-world voyage in less than 80 days. The yachtsman from La Baule got some idea of the public's enthusiasm from the thousands of messages that poured in during the hair-raising adventure. "I'm thinking of you all every day. It helps me forget the metro and the blues," said one message from Paris. A hospital surgeon followed every moment, writing "hang in there—we're keeping up with you hour by hour. We admire your courage and willpower." A message from the French Alps read, "you fellows are doing what other people only dream about."

In countries other than France, the excitement of experiencing these adventures vicariously runs even higher. The United Kingdom has knighted its greatest yachtsmen. New Zealand made eight attempts to win the prestigious America's Cup before succeeding at last in 1995. It was a great triumph for the three million New Zealanders, who live in the teeth of the wind and the sea all year round, and they're counting on a repeat performance when Auckland hosts the America's Cup in 2000. But national feelings should not come into play here. The sea has no borders. It is open to every dreamer. All it takes is a little humility on the part of those setting out and imagination on the part of those who stay ashore. As Bernard Moitessier wrote about his joy at being before the mast, "Wind, sea, boat and sails, a world that is both compact and considerable, without beginning or end, a part and yet the whole of the universe, my private universe, all my own."

Dominique André

Threats

In the rivalry for marine resources, environmental concern should not be seen as just another competing use of the oceans.

We tend to view the marine world as an infinite food supply, a bottomless pit for waste and a "common space"where we can play and fight, as and when we please. However, this is quickly changing as the world metaphorically "shrinks", as the oceans no longer present the obstacle they once were to travel or communications and as we explore their furthest depths. We have entered a new era of fierce competition for marine resources and space.

Sixteen of the world's 23 mega-cities (with over 2.5 million inhabitants) are on or close to the sea. In China about 100 million people have moved from land-locked provinces to new coastal economic zones since 1990. Coastal tourism, fisheries and offshore petroleum industries are major sources of revenue for many countries, particularly small developing island states.

Despite air travel, the oceans are still the great highways for trade, with ships transporting 80 per cent of international cargo. Indeed, the oceans largely make economic globalization possible by offering a cheap means of moving commodities around the world. Tens of thousands of vessels are at sea at any one time, all needing a shore to dock, load, unload and dispose of waste. Until recently the oceans were the obvious solution for waste disposal in general. Whole industries have been built up around dumping domestic sewage, industrial waste, decommissioned oil rigs and nuclear waste at sea.

Governments and their military forces, multinationals and local industry all have a major stake in the marine world. So it is not surprising to find increasing conflict between and among these actors. Some of the most heated disputes have occurred in the fisheries sector. As stocks collapse after decades of overfishing, vessels from different nations are chasing the remaining fish in a cut-throat competition that has in some cases escalated into violence. The North Atlantic "cod wars" between Canadian and Spanish trawlers in the early 1990s have probably attracted the most attention. In a heated dispute ten years earlier, a Danish vessel deliberately sailed into UK waters to catch forbidden fish and face arrest by the Royal Navy.

and conflicts

Susan Wells and Gordon Shepherd*

© Lapi diffusion/Gamma, Paris

The "big 5" use surface craft to transport part of their nuclear arsenal and deploy 200 nuclear submarines in the ocean depths.

The real culprit in all these clashes is the over-capacity of the world's fishing fleet, which grew twice as fast as catches between 1970 and 1990, largely due to huge government subsidies. Artisanal fishermen in developing countries in West Africa, for example, now find their resources plundered by "distant-water" fleets from the European Union which pay scant regard to the needs of local communities or ecosystems. The EU now has a network of fishing access agreements with nineteen African countries, for which licence fees often represent a tiny proportion of the value of the catch. Fishing conflicts have even reached the World Trade Organization; recently the United States tried to exclude tuna and shrimp imports from certain countries using catch techniques which kill dolphins and sea turtles.

Perhaps the greatest conflict to be resolved is that between human activities and healthy seas. The environmental community and its non-governmental organizations (NGOs) are often seen as separate "stakeholders", interested in simply preventing anyone from using the oceans. They are viewed as animal "huggers", especially given the attention paid to sea turtles or whales. And yet, the major role of most NGOs is to develop ways of ensuring the long-term health of the planet.

Environmental concern must cease to be seen as a competing "use" of the oceans, and be recognized instead as a fundamental component of all marine activities. Aside from a few exceptions like military exercises and shipping, human activities which depend on the marine environment require a healthy ocean. Marine parks and reserves, for example, may appear to compete with space for resorts and marinas, yet they play a vital role in protecting habitats on which fisheries depend and tourism is based.

Most of the issues covered by the media as conflicts between opposing camps are really about basic questions over access to and sustainable use of the ocean, from the public outcry over French nuclear testing in the South Pacific to NGO clashes with multinational oil companies such as Shell over oil spills and the disposal of rigs on the seabed. A similar "conflict" is brewing over developing new submarine fossil fuel sources, which flies in the face of all that we know about climate change.

In some cases, the damage predicted has not materialized or the potential impacts have been impossible to prove. But the concerns are still valid. We know so little about the oceans that it would be foolish to take anything other than a precautionary approach. This is clearly reflected in the United Nations Law of the Sea Convention, although it is important to note that work remains to be done because the convention ignores a crucial issue of the future: genetic resources of the high seas.

Yet international agreements and regulations can only go so far. We need to build a broad public constituency through initiatives like the International Year of the Ocean. The momentum is growing. A 1997 poll in the USA, for example, found that 55 per cent of Americans believe that ocean exploration should take precedence over space exploration.

> It would be foolish to take any other than a precautionar y approach.

At the same time, economic dependence on marine resources opens the way to creating social and economic incentives for their sustainable use. Eco-labels on products and services are starting to make a difference to consumers. Companies, NGOs and international agencies are looking into new ways of certifying fisheries management and aquaculture, in particular.

Moving beyond consumers, we need to shift the balance of power between all stakeholders so that coastal communities can reassert their rights to their marine resources. This is not just a pipe-dream. In the Pacific, authorities are formally recognizing the traditional structures and techniques revived by local communities to manage their marine resources. In Mauritania, the Imraguen (a fishing community) now have exclusive fishing rights in the resource-rich Banc d'Arguin Marine Park.

The time has come to bridge these scattered initiatives by reinforcing international and regional co-operation. This is not simply a question of good intentions but a realistic strategy for resolving the myriad of marine conflicts. The stakeholders have everything to gain in respecting what may well be the world's last wilderness. ■

*World Wide Fund for Nature (WWF)

In winter, the sea wind unleashes fury, salt, foam from enormous waves, and then nature looks oppressed, a victim of these terrible forces.

Pablo Neruda (1904-1973, Chile): *Memoirs*

Peace for the high seas

Elisabeth Mann Borgese*

Military imperatives must stop jeopardizing sustainable ocean management. Regional co-operation shows a new era of security is within reach.

Everything flows in the ocean. It is simply impossible to manage ocean uses in isolation, without recognizing their interaction. From fishing to offshore oil development, activities interact. What happens in one ocean area is likely to affect others, flowing across political boundaries or even the world ocean as a whole.

Hundreds of thousands of pages have been written about "integrated coastal management" designed to take all these interactions into account. However, one aspect has been avoided as far as possible at all the intergovernmental conferences because of its politically highly sensitive nature: the interaction between military and peaceful uses of the oceans.

This interaction may be of a specific nature. We have seen problems arise from the exemption of naval vessels from the environmental protection rules of the Law of the Sea Convention. Then there are accidents, such as collisions involving nuclear naval vessels and the loss of nuclear weapons at sea. A number of such incidents have occurred.

The conflict, however, is deeper. And it may not be possible to ignore it much longer. The management of peaceful ocean uses is too closely linked to the control of military uses. This general problem is related to an elementary fact: without peace and security there can be neither economic development nor environmental conservation. The next inevitable step lies in the integration of sustainable development and security.

This integration could be best pioneered at the regional level. While a number of regional seas programmes are already in place, the Mediterranean offers a unique opportunity. By establishing a regional commission on sustainable development, Mediterranean states have moved from a sectoral to a comprehensive approach, opening participation to any high-level minister involved in ocean affairs. There would be no reason to exclude defence ministers from this commission, whenever an issue of regional security conflicts with the peaceful uses of the sea and coastal regions. These ministers might form a "virtual regional security council" within the commission and promote naval co-operation for peaceful purposes.

In the absence of armed conflict, naval regional co-operation could extend to joint surveillance and enforcement of pollution regulations or fishing agreements. This co-operation is already seen in the South Pacific and the Eastern Caribbean.

Naval co-operation should also extend to humanitarian activities such as search and rescue, disaster relief or hydrological surveys and other forms of oceanographic research. In institutional terms, this is a simple extension of a process already in course.

Regional seas should be declared, wherever possible, nuclear-free zones. This is another way of integrating environmental and political security while, at the same time, interpreting, developing and implementing the new principle, enshrined in the Law of the Sea Convention (Article 88), reserving the high seas for peaceful purposes. This also includes the exclusive economic zones.

Promising beginnings have been made with the Declaration on the Indian Ocean as a Zone of Peace and the Antarctic Treaty. The Latin American Nuclear-Free Zone (established through the Treaty of Tlatelolco) should now be extended to the Caribbean. And new zones wait to be established within the Baltic, the Arctic, the Mediterranean and the Asian Seas.

Special regional arbitration tribunals could make another important contribution by settling disputes. Not all regional seas programmes will be able to move in this direction at the same pace. Power-political constellations may be impediments requiring less or more time to overcome. But the time has come to put the issue on the agenda for the next century. ■

*International Ocean Institute

Did sea define the land or
land the sea?
Each drew new meaning from
the waves' collision.
Sea broke on land to full
identity.

Seamus Heaney
(1939- Ireland):
"Lovers on Arran"

A strategic sea

Semih Vaner*

On the borders of the former Soviet empire, with an outlet onto sensitive areas of the Mediterranean, the Black Sea is attracting envious eyes.

In June 1992, heads of state from eleven countries—Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Romania, Russia, Turkey and Ukraine—signed a treaty in Istanbul setting up the Black Sea Economic Co-operation Region. Inconceivable fifteen years ago, this initiative is one of the most dramatic changes to have taken place in the region since the fall of the Berlin wall. Whatever the participants' calculations, tactical considerations and ulterior motives, the project illustrates their desire to ease tensions in the region and establish dialogue.

Two major changes have swept through the Black Sea region. First, the hermetically-sealed border between Turkey, a member of NATO, and its Warsaw Pact neighbours opened up. Second, relations between the former Soviet-bloc countries are radically different today from what they were before 1989. In this new context, regional security will probably continue to hinge on the two main Black Sea powers, Russia and Turkey, especially since access to the Bosphorus and Dardanelles straits is likely to remain on the agenda. But that issue will no longer be framed in the same way it was during the Cold War. Economic and environmental matters, especially the transport of oil from Russia, Kazakhstan and Azerbaijan, will be more important than they were in the past.

Passage through the straits is at the heart of the issues concerning the Black Sea because the transport of oil and gas from the Caspian Sea is one of the pivotal questions in the region today. The 30-year contract for exploiting Azerbaijani oilfields signed in September 1994 was called the "deal of the century". The agreement provides for the extraction of 511 million tonnes, half of which are earmarked for export. Planned investments amount to $7.5 billion. Seventy per cent of the profits will go to Azerbaijan while the members of the consortium, made up of Azerbaijani, Russian and Western companies, will split 21 per cent. Three smaller consortiums have been formed since.

Two proposed pipeline routes were ruled out from the start. The United States was opposed to the so-called "Iranian" route, and Azerbaijan opposed another that would have run in a straight line through Armenia. Two of the three options still under consideration involve the Black Sea.

The first consists of using the existing, ageing pipeline that connects Azerbaijan and the Russian Black Sea port of Novorossiysk. That option is financially advantageous and meets with Moscow's approval, but Turkey raises objections on security and environmental grounds, especially in relation to the cities of Istanbul and Canakkale.

The second solution would be to build a new pipeline through Georgia and Turkey. Two variants are possible. In the first, more likely choice, the pipeline would end up at Supsa, a Georgian Black Sea port. In the second, it would branch off at Tbilisi and lead to the Turkish Mediterranean port of Ceyhan. That solution is very expensive, but would have the advantage of "cutting the cake in two" and decreasing consumers' energy dependence on Russia. However, security is a concern since the Kurdistan Workers Party (PKK) has already announced its intention to sabotage the project.

The possibility remains of shipping oil via the Black Sea, to the Bulgarian port of Burgas and thence to the Greek port of Alexandropolis. That would pose several problems, including passage into the Aegean Sea, which is disputed by Athens and Ankara. Another obstacle is that this solution would bypass Turkey and its high cost could only be met by the European Union, which would put a further strain on its relations with Ankara.

A host of factors will influence the choice of a pipeline route, including the clout wielded by the United States and other powers such as China, especially in regard to the transport of oil from Kazakhstan. Oil, regional co-operation and military rivalries are some of the issues that still make the Black Sea one of the world's most sensitive geostrategic areas. ■

*Centre of International Studies and Research (CERI), Paris

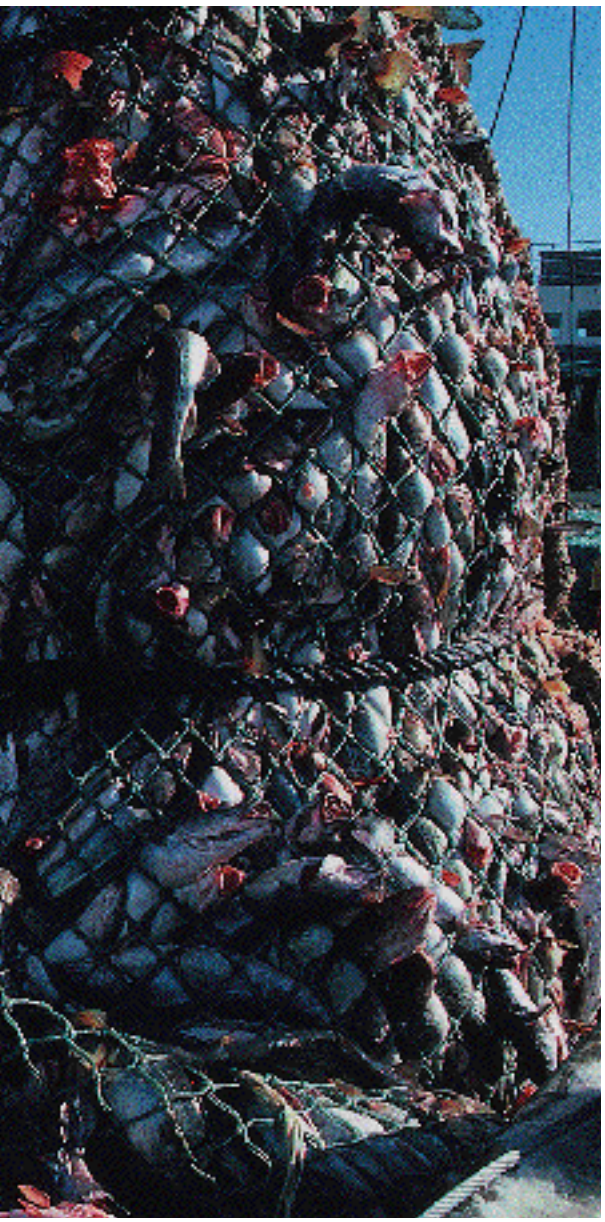
The cod collapse

The once prolific north Atlantic cod have virtually disappeared from Canada's east coast, leaving behind a trail of unemployment and anger.

The fish plant in the Newfoundland town of Trepassey sits mainly idle on Canada's northeastern shore–a depressing reminder of the days when cod were plentiful and the streets bustled with 1,400 working residents.

Trepassey is practically a ghost town now. The Sunday-night bingo game which used to draw hundreds of residents now sees about a dozen people gambling for a measly jackpot. The community used to screen movies in the parish hall but no one can afford admission these days, and many of the young people have left anyway. Families drift out of town almost every week, abandoning homes they know they'll never sell. "Some of them didn't even bother to board their windows," says Don Corrigan, a veteran fisherman who still lives in Trepassey. "They just locked the doors and moved on. They've no intention of coming back."

This is the human side of an environmental disaster. The cod collapse devastated entire communities in Newfoundland, leaving most people with no other skills to fall back on. Today, sustained only by government assistan-



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A cod trawler off Newfoundland.

Curbing the mighty shrimp

With "prawn farm is prison farm" as his slogan, S. Jagannathan led thousands of India's poor farmers and fishers in a seven-year struggle to ban the country's lucrative shrimp industry—a Herculean feat as India is one of the world's top producers. Despite outbreaks of police violence, passive resistance groups rallied the support of environmental and consumer groups at home and abroad before convincing the Indian Supreme Court that people's fundamental rights had been violated by the industry.

"While millions of people were denied a square meal a day, the country was being forced to produce shrimp for the affluent abroad," says Jagannathan,an 85-year-old disciple of Gandhi."Even as the government was withdrawing subsidies from the farmers, hundreds of millions of rupees were given as loans and subsidies to big business entering shrimp farming."

With fish stocks plummeting,aquaculture had been hailed as a godsend,particularly for developing countries interested in a new cash crop. Investors streamed into India's coastal states like Tamil Nadu,where the area under shrimp cultivation rose from 250 hectares in 1991 to 2,000 in 1995 and production grew from 450 to 3,000 tonnes.

Suddenly, local communities found the "outsiders" (shrimp cultivators) alienating them from the land they had depended on for generations. At the same time, saltwater and chemicals used for fertilizer and feed were seeping out of the vast ponds of brackish water used to grow the shrimp. The run-off and salinization damaged crop lands, mangroves, drinking water and groundwater aquifers. The brackish water ponds also drained fresh water supplies as saline levels rose with evaporation."To raise one tonne of shrimps requires 50 to 60 million litres of water, half of which is fresh water," says Bisham Gujja of the World Wide Fund for Nature. In addition,about 2.5 million cubic metres of effluent were discharged off the east coast daily.

Presented with these reports, the Supreme Court ruled in December 1996 that virtually all shrimp farms within 500 metres of the high tide line had to be closed by 31 March 1997 and a new aquaculture authority was to apply the "polluter pays"principle. However, farms continue to operate through "flimsy technical arguments", says Gujja. "But investors have pulled out of the industry. Even if the law is amended,aquaculture in India will never be the same because investors will be careful to follow environmental regulations and avoid displacing people—at least,that is what the hope is." **G. B. T.** ■

Many years went by and also
three or four ships, which did
not approach, did not drop
anchor, saw nothing. . . . From
shore
to scrubland, from
beaches to undergrowth,
everywhere the weather
is encysted . . . the sea brings
nothing to the
island but the foam of
backwash, the lapping of
waves bearing their own
secrets.

Andreas Embiricos
(1901-1975, Greece):
"Robinsons' island"

ce, fishermen fester with helpless anger: How did we let the cod die?

"The cod stocks failed because of greed," says Dr. Richard Haedrich, a respected fisheries biologist at Newfoundland's Memorial University, "People wanted all the money they could get out of the fish."

After greed, the answer gets more complex, involving a tangle of government rivalries and scientific arrogance. In the end, the cod were defeated by fishermen who became too good at fishing, scientists who ignored what they didn't know and politicians who refused to make the tough decisions—until it was too late.

By the time Canada's fisheries minister John Crosbie closed the northern cod fishery in July 1992 and threw 40,000 Canadians out of their $500-million a year industry, decades of over-fishing had decimated the ground fish stocks and virtually emptied one of the most bountiful areas of the Atlantic. At the time, Mr. Crosbie tried to pacify fishermen by saying the moratorium would be over in two years. Not twelve months passed and Mr. Crosbie was forced to amend his overly optimistic time line: it would be at least half a decade before the cod returned. Six years later, the cod stocks remain at the lowest level observed in history—what one senior fisheries bureaucrat termed "a calamity of almost biblical proportions." More recently, cod was listed as "vulnerable" on Canada's endangered species list.

The collapse of the North Atlantic cod is a tragedy with few innocents. Fishermen, both ▶

offshore and inshore, were guilty of misreporting their catches, of swarming the cod on spawning grounds, of dumping tonnes of unwanted fish overboard to rot on the ocean floor. The days of the radar and high-tech trawlers—both foreign and domestic—meant that entire schools of fish could be easily hunted down and sucked out of the Atlantic.

Scientists, meanwhile, consistently overestimated the size of the stocks. Fisheries science, at best, is imprecise. Too little is known about the nature of the cod and its relationship to the ocean food chain, predators like seals,and temperature changes. But scientists relied too heavily on offshore catch rates for population estimates, and confused efficient, modern fishing with what was really happening in the ocean. With the scientists guessing too high, fishermen slashed a far larger portion of the cod biomass than the quotas intended.

"They weren't fishing what was produced," says Dr. Haedrich, "They were fishing what was producing. Scientists never admitted how great the uncertainty was and when decisions were made they fell on the side of what was favourable economically, rather than what was conservative ecologically. Nobody stuck up for the fish."

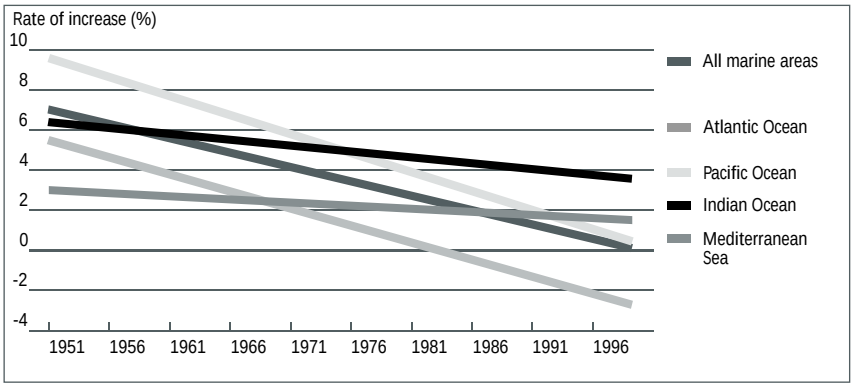
Protecting the cod fell to the federal Department of Fisheries and Oceans. But even when government scientists warned in the late 1980s that the stocks were in trouble, politicians in Ottawa hesitated to lower quotas and slice into the fishermen's income.The industry was already indirectly subsidized,crowded with fish processing and canning workers and fishermen who work for several weeks and then claim unemployment insurance for the rest of the year. Catching less fish would mean hardship particularly for the people in Newfoundland who have few other employment options. It would force layoffs—and the possible closure—of fish plants. Faced with this reality and intense lobbying from provincial politicians to maintain the fishery, the government in Ottawa set quotas based on social and economic factors, not science.

Today, in the out ports of Newfoundland, fishermen forced into poverty have begun to give up. Many of them no longer expect to see the cod return in their lifetime.They talk about selling their licences back to Ottawa and walking away from the sea for good—a painful step for people who thought they'd fish forever.

The moratorium, says Newfoundland fishermen Wilfred Williams, "destroyed everything I ever worked for. I made my living from the sea all my working life—where am I going to turn?" ■

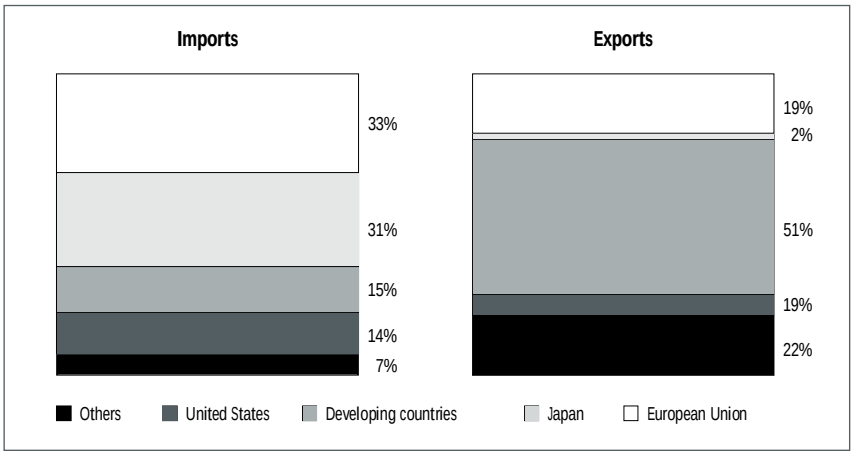
Erin Anderssen

Trends in the relative rate of increase in landings by ocean



Source: *The state of world fisheries and aquaculture 1996*, FAO

Share of major markets in total international trade in 1994



Source: *The state of world fisheries and aquaculture 1996*, FAO

Waste and want

Some 200 million people work in fishing worldwide (industrial and self-employed combined),while as many as 500 million depend on the oceans indirectly through jobs in tourism, shipping,oil and gas and other aspects of the fishing industry. In 1996 seafood production, including aquaculture, was valued at $120 billion. Half the world's catch is exported, especially to the developed countries, which absorb 80% of imports in value. One billion people depend on the sea for their main source of food every day. Global export earnings from fishing exceed those from coffee, tea, cocoa and sugar. But post-catch losses are very high,precisely in those places where the need is greatest. In Africa, losses to self-employed fishermen due to poor unloading,transport and packaging conditions, as well as the hot climate, range from 25% to 50% of the catch.

Aquaculture is booming. Farmed fish production tripled over the last decade, reaching 230 million tonnes in 1996. Farmed salmon output rose from around 34,000 to 300,000 tonnes, shrimp from 50,000 to 720,000 tonnes. Shrimp production has increased six-fold in Asia and Central America.Aquaculture already meets 20% of world demand for seafood and could grow by another 70% between now and 2010. The problem is, instead of reducing food shortages the industry invests in the production of expensive seafood that only those in developed countries can afford.What is more, since most of the farmed species are carnivorous, aquaculture consumes huge amounts of animal protein that would go to much better use on children's plates. **J.S.** ■

Marine blues

Pollution in the Tees estuary (U.K.).

The ocean is increasingly polluted because humankind goes on thinking of it as a garbage can.

Children feel sorry for dolphins choked by plastic bags and sea birds tarred with petroleum. Swimmers complain about the proliferation of jellyfish that float around in the deep blue sea. Scientists observe and measure pollution, and explain that they do not know how long the ocean can stand such stress. Defenders of the environment shout themselves hoarse: "The sea is not a garbage can! Stop the damage."

Each year, three to four million tonnes of petroleum end up in the sea. The "black tides" are, of course, spectacular and eye-catching, but the greater danger comes from the thousands of tonnes discharged into the wakes of ships. "Accidents such as those of the *Torrey Canyon* (1967) or the *Amoco Cadiz* (1978) are impressive," recalls Ray Griffiths, formerly in charge of the Marine Pollution Programme of UNESCO's Intergovernmental Oceanographic Commission (IOC), "but the marine environment is the victim of silent abuse, with heavier consequences in the long run, from the tanker degassing and waste oils from tank washing at sea."

The shipowners' lack of scruples is, however, responsible for only 25 per cent of marine pollution by hydrocarbons. According to Tony Knap of the Bermuda Biological Station for Research, this proportion is even declining. Tar concentrations in the open ocean are decreasing as the techniques for transporting and handling petroleum products improve. On the other hand, 60 per cent of this type of pollution is of land-based origin, essentially due to the discharge of used motor oil through urban sewer systems. The remaining 15 per cent comes from offshore oil-platforms for the extraction of natural gas and petroleum.

France's Research Institute for the Exploitation of the Sea, Ifremer, has drawn attention to another danger: the ever increasing shipment of toxic products, explosives and industrial and nuclear wastes by sea. The sea continues to wash ashore barrels and containers from cargo vessels.

Stowaway bacteria

Worse still, all kinds of "clandestine passengers" are shipped, in spite of themselves, from one end of the planet to the other: these are the bacteria, viruses and other organisms in sea water taken on board with ballast water. On arrival, this water is discharged without treatment or filtration. Consequently more than 3,000 species of animals and plants are transported each day. According to James Baker, the Administrator of the United States National Oceanic and Atmospheric Administration (NOAA), 80 million tonnes of "foreign" water are thus discharged into America's coastal waters each year. In the San Francisco area, he says, 212 exoteric species have been identified. The Mediterranean has also received a hun-

Sometimes the sea remembers the time of the corsairs and freebooters, the dark days of the slave trade. It thunders out cannon fire, oaths and the cries of imaginary birds.

Gisèle Pineau (1956-, Guadeloupe): "Sur un morne de Capesterre Belle-Eau"

© D. Dibbs/Panos Pictures, London

Bathing in oil-polluted waters off the Kentish coast.

dred or so new wild species in the last few years, of which the most famous is the "killer alga" (*Caulerpa taxifolia*), said to have been released from the aquaria of the Oceanographic Museum in Monaco. These intruder species may be responsible for the disappearance of some native fauna or flora and for the disturbance of local ecosystems.

The consequences of increasing maritime shipping are thus very varied and sometimes unexpected. Yet, just as for hydrocarbon pollution, shipping is not the only factor responsible. In fact, it accounts for only 10 per cent of all marine pollution. More than three-quarters of marine pollutants originate on land. They get into the sea by run-off directly from the land or via rivers. They can also get there by direct discharge or via the atmosphere, Griffiths adds. The main reasons are the lack of sewerage infrastructure, intensive agriculture and industry. About 70 per cent of wastes discharged into the Pacific receive no form of prior treatment, according to the UN Environment Programme's (UNEP) 1997 report on *The State of the Environment*. And according to a UNEP report on the Mediterranean, 1.7 billion cubic metres of municipal waste water are discharged directly, of which three-quarters is untreated.

The North and the South are in the same boat, the developing countries being increasingly handicapped by the strong population increase, lack of financial means and expertise, all of which prevent them from putting a stop to the problem. In France, for example, the water consumed by one third of the population is still not purified. In Egypt, Alexandria Bay is being asphyxiated, essentially by the discharge of sewage, to the extent that some places, such as the roadstead of Aboukir, are considered to be biologically dead.

The application of pesticides, herbicides and other poisons in intensive agriculture allows one part of the planet's inhabitants to have affordable food, but deprives everybody of certain marine delicacies. The excess of these chemical products is washed off the land into rivers and hence into the sea and "may affect the growth and development of marine organisms, notably crustacean larvae and juveniles," Griffiths explains. "They may also modify the structure of phytoplankton communities and disturb photosynthesis". Worse still, the phosphates and nitrates in chemical fertilizers, which also indirectly enter the sea, provoke "red tides", massive outbreaks of unicellular algae. "The toxins they contain progress up the food chain into the bodies of the top predators, such as the big fishes in the same area" which is not without danger to those who eat them. "These red tides can also use up the oxygen dissolved in the water" to the point of asphyxiating local fauna. The winds transport many agricultural pollutants over thousands of kilometres, even as far as the Antarctic and the Arctic. Abnormally high amounts of these chemicals have been found in the bodies of Inuits, who are major consumers of marine animal fats, in the Arctic, and also in the Antarctic's Adélie penguins.

And one evening,while he sipped a pastis [Mathieu Naurac] gave us the explanation while looking out over the sea: the lighthouses meant that men were there, ready to guide other men;all over the world there were lighthouses to stop vessels being smashed onto the coast.

Marie-Thérèse Humbert (1940-,Mauritius): *Un fils d'Orage*

Choked waters

The Baltic Sea is asphyxiated by industrial pollution, with paper-pulp producers discharging annually 200,000 tonnes of chlorinated products and mercury. Everywhere, industries dump their effluents into bodies of water and their gases into the atmosphere. For example, 66 billion cubic metres of industrial wastes are discharged annually into the Mediterranean. The ocean absorbs enormous quantities of mineral oils, detergents, phosphates, and heavy metals, including cadmium, lead, copper, zinc from metallurgical processes, and mercury, also in connexion with mining.

Overall, about a third of atmospheric pollutants directly fall into the sea or with rainfall. Of the seven billion tonnes of carbon dioxide produced annually by human activity, the ocean receives at least two billion. We know that the ocean is a formidable recycling machine for gases naturally present in the atmosphere, but how far will it be able to stand the extra load that we are expecting it to bear? Scientists wonder whether it will be able to adapt to the global warming induced by the greenhouse gases produced by human activities, without disturbing its equilibrium and its circulation.

In every corner of the planet, experts, United Nations agencies and non-governmental organizations are waving the red flag. The Mediterranean is in danger of "undergoing the same evolution as that of the Black Sea, whose water contains no dissolved oxygen below a depth of 150 to 200 metres, which limits the available living space for marine organisms, and especially of slow-growing demersal fish species," UNEP warns. Phytoplankton stocks have fallen by 80 per cent since 1951 along the coast of California, probably due to global warming, according to the Scripps Institute of Oceanography. Biodiversity is declining, but it seems we do not know enough to act. ■

Sophie Boukhari

Trouble in paradise

Underwater tourism, Grand Cayman Island.

© Michael Friedel/Rapho, Paris

How much tourism can the Caribbean's white sand beaches and turquoise waters absorb?

When the U.S. war correspondent Martha Gellhorn visited the British Virgin Islands in the 1940s, she came across a cove "where nothing had changed since time began, a half circle of white sand, flanked by huge squarish smooth rocks . . . and the water turquoise blue." When she returned many years later, she found her cove "full of sun-tanned bodies and ringed by boats . . . there were bottles and plastic debris on the sea-bed and picnic litter on the sand."

Tourism has taken over the Caribbean: in 1997 more than 14 million people took their holidays there, with some three million more dropping in from cruises. "Tar balls" on beaches indicate that oil tankers and other ships dump their oil and garbage overboard (despite laws against such practice), while pollution off Florida and in the Gulf of Mexico is causing serious concern.

However, it is the ever-growing cruise-ship industry which is a particular focus of concern for the Caribbean Sea. The larger and newer cruise ships have adopted a "greener" approach, with modern waste-processing facilities, according to the Center for Marine Conservation Organization in Washington. Yet a report by the Economist Intelligence Unit concluded that "there is much evidence that dumping of rubbish at sea does take place."

It is not just the seas that have been affected by the demands of the tourist industry. Those fragile ecosystems surrounding so many Caribbean islands, the coral reefs, are under stress as well. In Tobago, tourists destroy exposed coral by walking on it in plastic sandals; in the Bahamas souvenir shops loot the reefs for stock, loading their shelves with shells, dead coral and seahorses; in Granada, beach vendors sell earrings made out of rare black coral.

Belize has the second longest barrier reef in the world and well-publicized conservation projects working to protect it. Yet its two marine nature reserves have shown signs of environmental degradation—associated with too many people visiting a too fragile site.

In the Cayman Islands the local watersports association has complained to the government about the damage done by cruise ships dropping anchor on the reefs. Government scientists have acknowledged that more than 300 acres of coral reef have already been lost to cruise ship anchors in the harbour at George Town, the capital of Grand Cayman. Proposals to increase the number of cruise ship moorings continue to threaten the reefs. And by destroying the reefs, you destroy the tourist industry.

Short-term profits

While cruise ships bring waste on to the land, waste from the land is also dumped in the sea. A 1994 study by the Caribbean Tourism Organisation (CTO) showed that waste water treatment facilities in many hotels were of "limited value with regard to the treatment of microbiological and nutrient removal". The report also noted that 80-90 per cent of inadequately treated sewage was disposed of in coastal waters, near hotels, on beaches and around coral reefs and mangroves.

Since then, there has been increasing awareness among hotels and tourist boards of the environmental costs to the tourist industry of irresponsible policies. At least, in theory. The truth is that although lip-service is paid to environmental awareness, there is little enforcement of the limited legislation that does exist. Or as Calvin Howell, the former head of the Caribbean Conservation Association, explained: "The problem has been exacerbated by an attitude that approves of short-term rather than long-term sustainable development." The evidence for this is that foreign developers are still moving in to create resorts and golf courses on coastal lands.

The CTO has on many occasions appealed to the region "as a matter of urgency" to put together an environmental plan. This has yet to happen. Early in 1998, managers from Caribbean marine sanctuaries in more than twenty of the region's countries discussed ways of countering the threat to marine resources. Once again, co-operation was the theme. "We need to look at the Caribbean as one system," said Richard Curry of the Biscayne National Park near Miami. But another question remains: when will governments get the message? ■

Polly Pattullo

The expanding cruise-ship industry

Cruise-passenger arrivals (in thousands)

Year1992	1993	1994	1995	1996	
World	12,600	26,822	31,696	29,750	34,428
Africa	158	180	232	238	287
The Americas	10,436	10,632	10,680	10,717	12,216
East Asia/Pacific	343	273	294	305	324
Europe	1,644	15,720	20,471	18,469	21,570
Middle East	2	4	5	7	16
South Asia	17	13	14	14	15

Source: World Tourism Organization,Madrid,1998

The offshore islanders

The sea is so much a part of daily life on a North Sea gas platform that you almost forget it's there.

"It's your first trip offshore, isn't it?" The question needs no formal response. Only a newcomer to Conoco's Viking B gas platform could get lost in a dreamy gaze to the horizon or take a hesitant step on the metal grates of the decks, mesmerized by the sight of the North Sea rolling thirty metres below.

For offshore initiates, the sea appears to be a non-entity. The waves just fade into the background framing daily life. The closest you come to actually feeling them is when the crane rumbles to unload cargo—the vibrations gently rocking the platform perched on giant metal legs 140 kilometres off the coast of Lincolnshire (UK). Outside of a power failure, you won't even hear the waves roll above the hum, grind and whine of the equipment that keeps about six million standard cubic metres of gas surging daily through pipelines lining the seabed to shore.

"At first, you're just fascinated by the sea," says Vera Swan, one of the few female employees on the catering staff looking after the crew of seventy-odd men. "You get worked up over sunsets and stand quietly with the others. But after six years, I forget that I am out to sea."

"I'm new out here," says Steve Slinger. "So the sea is still a novelty for me. I thought the North Sea was grey but it can be a beautiful turquoise blue. I'm still in the phase of looking out and thinking 'Wow!' But that will probably pass," he says. "The hard part is not being able to go for a long walk. You feel penned in by the water. But I didn't come offshore to admire the waves. I came because the money is good. At forty-five, I've got no formal qualifications but a lot of work experience. Where I come from in Scotland, you are doing quite well by making £15,000 [$25,000] per year." Salaries offshore range between £28,000 [$45,000] and £70,000 [$115,000] for senior managers.

Money-making clearly surpasses sea-faring as the main offshore attraction. However, it is the routine of platform life which seems to drown out any romantic notions of life at sea. "It's just not the same as when you're on a ship and you actually go somewhere," says Hank Rawlins, who has worked offshore twenty-three of his fifty-five years. On the platform, everything is programmed. After two weeks of holiday at home, crew members arrive by helicopter for fourteen days of twelve-hour work shifts, essentially spent adjusting, testing and maintaining the machinery used to measure and compress the gas piped in from five remote-controlled fields nearby. The slightest adjustment requires consultation with a supervisor. "You can feel like a robot," quips crew-member, Mick Draper, "until you realize just what you are sitting on. Remember how easy it is to light your gas heating system at home and consider that out here, the gas pressure is 1,500 times that."

But once the shift is over, the biggest decision may be whether to have rice pudding at dinner or a work-out in the gym. For Viking life is surprisingly civilized. Stewardesses make the beds every morning, with fresh laundry folded at the door and meals waiting in the mess hall. Evenings are spent flipping through the daily tabloids (delivered by helicopter) or the television channels. While alcohol is strictly forbidden, smoking is permitted. And home no longer feels so far away with free telephone calls available.

Yet for all the creature comforts, the sea still sneaks up on the platform. The sea is so much a part of daily life that people stop seeing it. For example, you start preparing for a possible plunge into the frigid waves (2-6^{0}C) before even leaving the coast. Crew-members and visitors alike actually practise finding their way out of helicopters which have crashed and spun upside down in the murky, cold water of special pools. Once offshore, no one dares walk the deck without donning a bright red suit. If anyone does slip off, a surveillance team can spot and scoop them up with a "mother ship" and her "daughter" constantly patrolling the platform perimeter.

With so much attention paid to the lives the sea may take, it is easy to overlook what it gives. Fishing was a favourite pastime until the helicopter pilots began complaining about the smells of dinner-packages taken home. Birds literally drop in, exhausted by the North Sea's

© Brian Kloh Photography, Aberdeen


Viking B gas platform.
© Brian Kilsh Photography, Aberdeen.

dimensions. Suddenly another day spent adjusting machinery gives way to tenderness and curiosity, as crew-members flock to the lost creatures, feeding them, charting their arrival and even taking them ashore by helicopter.

More importantly, "you find confidence," says June Cerey, who does Viking's laundry during the night shift. After raising her sixteen-year-old son, she decided at the age of thirty-five to carve out a new life for herself offshore. After getting past the usual jitters of walking the grated decks and feeling a "wee bit scared" of the helicopter, the real challenge lay in walking through the mess hall during dinner. "I'd get so embarrassed at being the only woman. They're not the 'rough and ready' guys I expected, but real family men. Still, it takes some confidence."

"There is also a real sense of freedom," says Bob Thorpe, one of Viking's two supervisors. "Out here, you concentrate on your work without everyday worries like a broken washing machine. You get job satisfaction. Then you go ashore, and you focus on your home and family."

Above all else, the sea imposes self-reliance. "If there is an emergency, you cannot call an ambulance or firemen," says Thorpe. "We rely on ourselves. This is why you don't find the stereotypical macho guy out here. Men like that tend to be risk-takers, thinking they're 'too big' to follow safety procedures. They just don't last long because the rest of the crew won't accept them, especially since Piper Alpha." This is the name of another North Sea platform which exploded ten years ago, killing 167 of the 226 crew-members. A lethal mix of major design flaws, poor safety planning and incompetent leadership set off the fire. The sea proved to be the final escape. The sole survivors were those who jumped overboard.

Besides the give and take, the sea also demands respect, which may have been long in coming. When the North Sea drilling industry first began in the 1970s, environmental concerns were non-existent. Today companies like Conoco can no longer ignore them. According to the rules, the only thing to be dumped off Viking is human waste. Chemicals, fuel, bits of broken tools are carefully collected for disposal onshore. Yet despite all the precautions, gas leaks, primarily into the atmosphere, continue, even though they are a far bigger problem on drilling platforms.

On a more personal level, it is the sheer force of the sea which captures the crew's imagination and respect. "I have been offshore for about ten years," says Paul Preston. "I can walk past the waves in the morning without really seeing them. But I am still taken by the sea. During a storm, you see the strength of it and imagine the violence it can do. That's when I realize what a minuscule dot we are on. Maybe you need to forget that you are surrounded by the sea. Because if you began thinking about all that can go wrong, you could never work out here." ■

Amy Otchet


Maintenance work on the platform.


Tea break.
© Brian Kilsh Photography, Aberdeen.

Laws

Over the last fifty years, international maritime law has developed very rapidly. This is hardly surprising given the unprecedented demands now put upon the oceans, their resources and the marine environment.

The largest treaty ever negotiated, the United Nations Convention on the Law of the Sea is a fairly recent development, entering into force on 16 November 1994. Yet its roots stem back to the early 1950s when the UN International Law Commission was set up with the task of codifying and developing international law, a great deal of which is unwritten, arising from the consistent practice of states. While this customary approach is excellent for establishing principles, treaties are needed to work out the essential details.

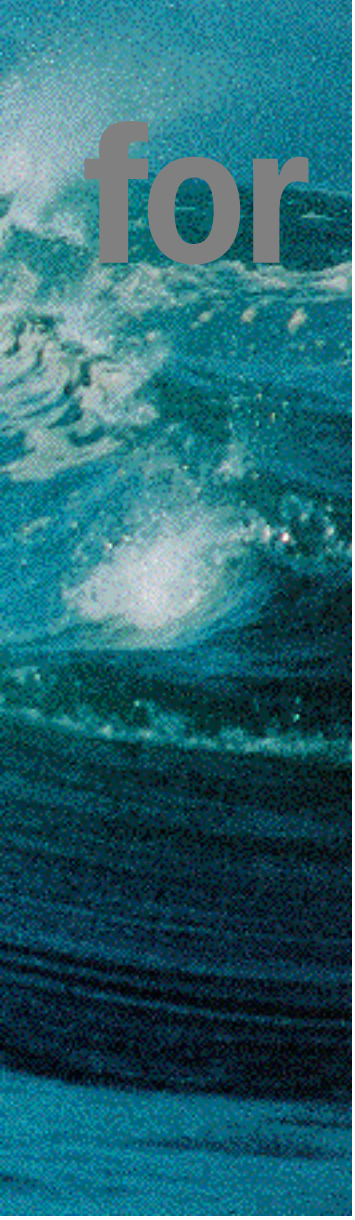
For more than 300 years, it was simply accepted that coastal states are each entitled to sovereignty over a body of water immediately beside the coast. This sovereignty was absolute except for the right of innocent passage by foreign merchant vessels. However, international law did not, for example, define the exact extent of this "territorial sea" (which was three and is now twelve nautical miles) or the conditions of "innocent passage". So in about 1951, the International Law Commission began working to resolve these old issues as well as some new ones: namely the conservation of the ocean's living resources and petroleum development on the continental shelf.

Concerned by dwindling fish stocks, countries like Portugal, Spain, Argentina, and Iceland had been pressing for decades for zones of fisheries conservation jurisdiction. However, they were outnumbered by the majority of coastal states who wanted to preserve more or less unlimited and unrestricted access to the living resources in what were still regarded as the high seas.

Turning to offshore petroleum, geologists had long known that the continental shelf had considerable potential. Declining domestic sources of oil coupled with increasing domestic

for the ocean

Ian Townsend-Gault and Hasjim Djalal*



© B. Bielmann/ACE/Cosmos, Paris

Forlorn, calmed by the
sea that washes, bears away,
drowns and decides. Sailing
without desire for moorings
on either side. . . Surrendering
fearlessly
and unconditionally to
the soft, terrifying,consoling,
enormous, incontestable,
incredibly beneficial authority
of
the sea.

Priska Degras
(1954-,Martinique):
"Du Marin à Grand'Rivière"

demand led American experts to look closely at the seabed of the Gulf of Mexico beyond the three nautical mile limit. Yet there was a problem. While companies were not prohibited from exploring beyond that limit, they enjoyed no legal security in conducting operations there. They also had no "legal" rights to any petroleum they might find. In order to provide a proper legal foundation for offshore petroleum activities (and the steep investment required), the American government proposed that all coastal states should have the right to extend their jurisdiction to the edge of the "continental shelf".

This proposal was accepted with great enthusiasm throughout the world. However, the motives for agreement were not all the same. For some countries, the extension was a cloak for control over the adjacent fishery. This fundamental difference prompted the International Law Commission to step in and lead the way to the First United Nations Conference on the Law of the Sea, convened in Geneva in 1958. Yet despite the fact that four Conventions—on the Territorial Sea and Contiguous Zone, the High Seas, the Living Resources of the High Seas, and the Continental Shelf—were accepted and signed, there was an obvious divergence between countries in favour of fisheries jurisdiction and those opposed. As a result, there were major gaps in some of the treaties.

A second conference convened in 1960 to resolve the issue was an absolute failure. From then on, states which considered that they had been victimized by the lack of jurisdiction felt obliged to take the law into their own hands. Countries like Iceland started enforcing exclusive fisheries zones to 12, then 50, then 200 nautical miles. Others followed suit; some willingly, others less so, but the former eventually prevailed over the latter while the Convention was still being negotiated.

Meanwhile, progress was made in dealing with mineral resources. Countries looked favourably upon the Convention on the Continental Shelf of 1958 which recognized "sovereign rights for the purposes of exploration and exploitation" on the seabed and subsoil of the shelf. It is important to note that the terms "sovereignty" or "ownership" are carefully avoided. The Convention's framers did not want to suggest that countries exercised absolute rights beyond the limits of the territorial sea, because this might ultimately endanger the freedom of the seas.

Rights and freedoms

The problem lay in defining the extent of these rights. A fixed limit was seen as artificial. On the other hand, a reference to the geographical feature "continental shelf" would not please coastal states like Chile which does not have a natural shelf of significant extent. So the edge of the "legal" continental shelf was fixed at the 200-metre isobath (the world's average shelf edge depth), or beyond "to the point where the depth of the superjacent waters admits of exploitation". In other words, all countries were guaranteed a minimum of control to a 200-metre depth, while those that had the technology to exploit deeper could still do so. We must remember that in 1958, 200 metres seemed to be an extraordinary depth. The problem was, of course, that science and technology developed faster than anyone had thought possible.

So by the early 1970s, it looked as if industrialized coastal states were about to carve up the world's ocean space. This was unacceptable for a number of reasons. First, it looked like a bonanza for coastal states at the expense of their land-locked cousins. Second, accidents of political geography sometimes resulted in curious boundaries. Countries with relatively long coastlines were clearly going to do better than ▶

others. Portugal, or Chile with its 4,200 kilometres of coast would have a relatively vast area of ocean space compared, say, to Spain.

There was also a serious ethical problem. If national jurisdiction was allowed to spread unchecked, it would be virtually impossible to fairly distribute the oceans' resources. To counter this, attention turned to limiting this jurisdiction and recognizing the areas beyond as the "common heritage of mankind".

Given the dimensions of the problems, the time was clearly ripe for another international conference. For example, the archipelagic states wanted recognition of their rights to the waters between and around their islands. Landlocked states wished to have their rights of access to marine resources clearly articulated. And there was an urgent need for detailed rules regarding the preservation of the marine environment—a topic virtually ignored in 1958. And who was to govern and profit from the area beyond national jurisdiction? There was also some feeling that the International Court of Justice could not properly resolve these issues. A tribunal was needed to specialize in the Law of the Sea.

A third UN conference ended in December 1982. All the participating countries voted for the Convention except four—Israel, Turkey, the United States, and Venezuela—and seventeen that abstained. Until recently, the countries becoming full parties to the Convention were found in Asia, Africa, and South America. This, and the continuing refusal of the United States even to sign the Convention, led some observers to dismiss the conference results, but it is now clear that such judgments were premature.

The major difficulty lies with mining the deep seabed, which is the area considered to be the common heritage of mankind. US firms prevailed on the Reagan administration not to sign, much less ratify, the Convention. However, a compromise on the regime for such mining was reached in 1994 which should prove acceptable to all (and is to the industrialized countries).

Yet as in 1958, not everything is perfect. For example, Canada's east coast has one of the world's most extensive continental shelves. According to the Convention, petroleum activities in this area are firmly under Canadian jurisdiction. However, control over living resources extends only to 200 nautical miles through the creation in 1994 of the Exclusive Economic Zones. The problem is, Canada's shelf goes well beyond this distance, with species swimming in and out of the zone. So, in theory, foreign vessels can remain just outside Canadian jurisdiction and catch as many fish as they please, to the possible detriment of Canadian fishers who are obliged to follow Canadian rules in or out of the zone. This has led to both a confrontation and treaty between Canada and Spain; the problem was resolved by an Agreement on High Seas Fisheries in 1995.

Conservation and control are the raisons d'être of the law of the sea. The concept of the "common heritage of mankind" recognizes that a country should not have the right to exploit a resource (e.g. the deep sea-bed) merely because it has the capacity to do so. The common heritage is held in trust for the peoples of all countries. The Convention forbids exploration or exploitation there without a mandate from the International Seabed Authority (established by the Convention and based in Jamaica) which must ensure that the benefits accruing are distributed equitably. The other expert bodies are emerging: the Tribunal on the Law of the Sea was established in Hamburg in 1996, and the Continental Shelf Commission now meets in New York. In short, the process is well underway.

'. . . a country should not have the right to exploit a resource merely because it has the capacity to do so.'

No-one should underestimate the challenges involved in implementing the Convention, which has now been ratified by 125 states. Yet in light of the fragility of our ocean environment, it is in the interest of both the industrialized and less-industrialized states alike to overcome them. ■

*The Indonesia-Canada Initiative for Managing Potential Conflicts in the South China Sea

The ten States with the largest Exclusive Economic Zones (EEZs)

State	Area (approximate) in sq.n.m.
United States	2,831,400
France	2,083,400
Indonesia	1,577,300
New Zealand	1,409,500
Australia	1,310,900
Russian Federation	1,309,500
Japan	1,126,000
Brazil	924,000
Canada	857,400
Mexico	831,500

On the Antillean Sea
which some call the
Caribbean, beaten by the
stormy waves and graced by
fleecy foam, beneath the sun
that chases her and in the
wind that pushes her away,
singing, her eyes full of tears,
Cuba sails on her map: like a
long green crocodile, with
eyes of water and
stone.

Nicolas Guillen
(1902-1989,Cuba):"Like a
long green crocodile. . ."

International maritime treaties

While the United Nations Convention on the Law of the Sea deals in more general terms with the different uses of the seas, there are a number of treaties and instruments on more specific aspects of marine affairs. Here are some examples:

Maritime safety:

International Convention for the Safety of Life at Sea (SOLAS)
Adopted in 1974,entered into force in 1980, 137 Contracting States.
The most important of all treaties dealing with the safety of merchant ships, its first version was adopted in 1914, after the *Titanic* disaster in 1912.It is updated by periodic amendments to keep pace with technical developments in the shipping industry.

Marine pollution from vessels:

International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties. Adopted in 1969,entered into force in 1975,72 Contracting States. It affirms the right of a coastal State to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate danger to its coastline following a maritime casualty.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. Adopted in 1972,entered into force in 1975,77 Contracting States.It prohibits the dumping of certain hazardous materials from vessels, aircraft,platforms or other man-made structures, requires prior permits for the dumping of a number of other identified materials and wastes.

International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)
Adopted in 1973. Due to the technical complexity and wide scope of the Convention, various parts of it have entered into force at different dates. Although Annex IV concerning sewage has been accepted by 70 states, their merchant fleets represent only 41.47% of world tonnage. Until countries with the largest fleets have accepted and the required minimum percentage of 50% is achieved, this annex will not enter into force.

This is the most important and ambitious of all international treaties on marine pollution, covering all the technical aspects of accidental and operational pollution from ships, except the disposal of waste by dumping and pollution arising out of the exploration and exploitation of sea-bed mineral resources.

International Convention on Oil Pollution Preparedness, Response and Cooperation. Adopted in 1990,entered into force in 1995,38 Contracting States. It combats major incidents or threats of marine pollution,requires ships and operators of offshore units to have oil pollution emergency plans, calls for the establishment of stockpiles of oil spill combating equipment and the holding of combating exercises.

Marine pollution from land-based activities:

No global agreement exists dealing specifically with the prevention and control of marine pollution from land-based activities. However, the non-binding "Global Programme of Action for the Protection of the Marine Environment from Land-based Activities" was adopted in Washington on 3 November 1995 and is expected to enhance proper management of land-based activities that could cause marine pollution.

Liability and compensation:

International Convention on Civil Liability for Oil Pollution Damage. Adopted in 1969,entered into force 1975, 100 Contracting States. Brought about by the *Torrey Canyon* incident of 1967,the Convention ensures that adequate financial compensation is available to persons who suffer oil-pollution damage from ships and places the liability for such damage on the shipowner.

Convention on Civil Liability for Oil Pollution Damage resulting from Exploration for and Exploitation of Seabed Mineral Resources
Adopted in 1977, not yet in force. It is designed to ensure that adequate compensation is available to victims of pollution damage from seabed activities by means of the adoption of uniform rules and procedures determining questions of liability.

International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea. Adopted in 1996,not yet in force. The Convention makes it possible for the equivalent of $250 million to be paid out in compensation to victims of accidents involving chemicals;covers not only pollution but also the risks of fire and explosion. ■

The unpunished polluter

Rémi Parmentier*

When international environmental policy first became a widespread topic of discussion in the early 1970s, some people suggested holding industry and states liable for damage caused by marine pollution. Later, France's first Environment Minister, Brice Lalonde, grabbed headlines by declaring "the polluters will pay", and state involvement in environmental issues was perceived as an encouraging sign. Yet, 25 years later, little progress has been made.

When people hear the words "marine pollution", they usually think of accidental fossil fuel spills. But most oil slicks are caused by intentional discharges from ships at sea, which would rather risk being caught in the act and fined than pay a special fee to use waste reception facilities in harbour. Experience shows that this fee, which covers the cost of waste storage, treatment and disposal, has a perverse effect by creating an incentive for tankers to empty their holds at sea to avoid paying it. If it were automatically included in the overall harbour fee, the financial incentive to dump at sea would disappear and marine pollution would be reduced. This theory was proven when a pilot project implemented between 1988 and 1991 by German *Länder* with seacoasts led to a significant decline in the number of oil-coated birds, demonstrating the measure's effectiveness.

Without indulging in conspiracy theories, environmentalists question the ties between the so-called dirty industries and governments, including intergovernmental organizations. The International Maritime Organization (IMO), the United Nations agency that regulates shipping, is a case in point. The dues of IMO member States are determined by the tonnage of their fleets, which gives countries with the most super-tankers an obvious advantage. As a result, some IMO delegations include members of the oil industry who "represent" the countries that lend their flags at sea.

IMO says that the fund set up in 1971 to

Sea tribunal makes a slow start

Marine pollution has been punishable by a fine imposed by an international court since the International Tribunal on the Law of the Sea was set up under United Nations auspices in October 1996. The tribunal is also in charge of settling disputes over the demarcation of territorial waters, fishing areas and navigation zones. Its decisions are binding on the 125 countries that have ratified the International Convention on the Law of the Sea.

The court is made up of 21 elected members, including five from the group of African states, five from the Asian group, four from Latin America and the Caribbean, three from eastern Europe and four from the Western world and countries not associated with any group, based on the geographical classification used in the United Nations. Judges, diplomats, researchers and professors, the members are all experts in maritime disputes.

After election, lots are drawn to determine which judges will serve terms of three, six or nine years. The Tribunal's statutes also provide for a rotation system leaving seven seats empty so that a partial election may be held every three years. Even after their terms of office have ended, the judges finish work on cases they have begun.

So far, the only case that has come before the Tribunal, which sits in Hamburg, Germany, is a dispute between Saint Vincent and the Grenadines and the Republic of Guinea. In November 1997 the Caribbean island nation went to the court to ask for the restitution of a freighter Guinea had confiscated for smuggling inside its territorial waters.

S. A. O. ■

© Mark Edwards/Still Pictures, London

With 45 hotels per km of coastline, Italy's Adriatic coast is one of the country's most popular tourist attractions. . . and no stranger to pollution.

compensate damage from oil spills has already distributed some $267 million—a pittance considering that in Germany cleaning up an oil-fouled beach costs between $2,800 and $5,500 per tonne of sludge. What's more, the fund does not cover damage caused by routine discharges at sea.

IMO policy towards the offshore industry has also been criticized. The suggestion in 1996 that operational discharges of wastes from offshore installations should be regulated like operational discharge from ships had the oil industry up in arms. To this day, the offshore industry's discharges are still excluded from the London Convention, which regulates the dumping of wastes at sea.

Similarly, when in 1995 Denmark's government proposed a moratorium on the submersion of offshore oil rigs, countries with very strong ties to the oil industry closed ranks and protested against the measure to protect their short-term interests, opposing a policy that could have given the steel recycling industry a major boost. ■

*Greenpeace International

A man,his eyes fixed on the ocean. . .
is there, motionless on the beach. . .
The ocean is immense, the man is small.
[. . .]
The night ended long ago,
the sun comes up anew above the shore
crimson with joy and grief.
And the man still looks at the ocean waves.
The man is immense, the ocean is small.

Aco Sopov:
"Staring at the ocean"
(Republic of Macedonia)

An action plan for the Med

Arab Hoballah*

"The Mediterranean is dying!" exclaimed Captain Jacques-Yves Cousteau in the late 1960s. His cry of alarm and many others pushed the Mediterranean countries to try to reverse the degradation threatening a sea that has cradled several civilizations and intensive trading networks dating back thousands of years.

The Mediterranean Action Plan, which was adopted in 1975, focuses on marine pollution. But the problem originates with land-based activities, and cannot be dissociated from the speed of social and economic change and the almost total lack of planned management of coastal areas.

The Mediterranean is under growing pressures that have increased needs in every area. The population of the countries around its rim is expected to rise from 400 million today to 550 million in 2025, with the eastern and southern shores accounting for two-thirds of the growth. Coastal areas are heavily built up and during the same period the coastal population will increase from 150 to 220 million. Lastly, the Mediterranean is the world's leading tourist destination. It attracted 100 million visitors in 1997 and the figure is set to double by 2025.

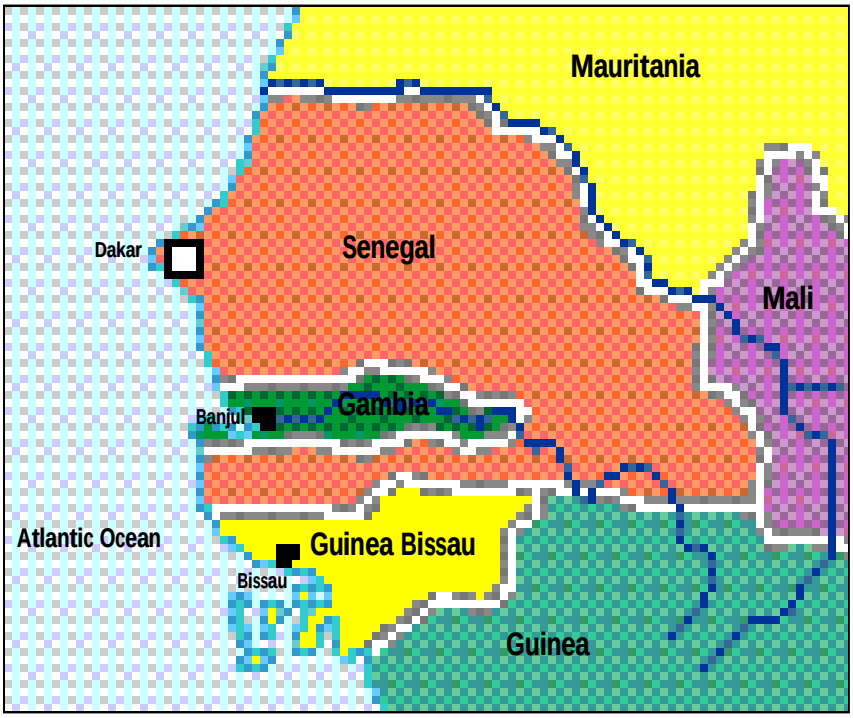
These concerns have led to the development of a series of alternative scenarios. Some, based on the continuation of present trends, forecast a grim future. Alternative scenarios suggest ways of reversing the damage and promoting sustainable development. Regional cooperation will be all-important, for the Action Plan cannot succeed unless the countries on the northern shores help their southern neighbours. The European-Mediterranean partnership programme launched in 1995 to turn the basin into an area of peace and a free trade zone by 2010 may be the first step towards achieving this goal. ■

*Mediterranean Action Plan

Senegal-Guinea Bissau

Agreeing to share

The Dôme Flore oilfield off the coast of Senegal and Guinea-Bissau, 70 kilometres southwest of the Casamance river, has caused the two countries plenty of headaches since it was discovered by France's Total company in 1960. The only known offshore oilfield within their economic zone, which is also rich in fishing resources, its reserves are put at 100 million tonnes of heavy oil and only one million tonnes of light. Clearly, the economic stakes are high.



After 16 years of legal battles and a few skirmishes in 1991, the two countries opted for a pragmatic settlement of their territorial dispute and in October 1993 signed an agreement to manage and develop their maritime resources jointly. Until then, such an outcome had seemed a remote possibility.

The earliest negotiations date back to 1977. When the two countries failed to reach agreement, they decided in 1985 to take the case to arbitration before a tribunal. Four years later the court upheld a Franco-Portuguese agreement of 1960 establishing the maritime boundary between their two colonies. But Guinea Bissau rejected this decision, arguing that the tribunal had failed to provide a map showing the exact boundary, as the two parties had requested.

In March 1991, Guinea-Bissau lodged an appeal against the decision with the International Court of Justice at The Hague. Dismissing the appeal eight months later, the Court upheld the Franco-Portuguese agreement of 1960 and asked both parties to agree on a border between their respective exclusive zones.

Guinea Bissau went along with the offer of bilateral talks and eventually accepted the Court's verdict. In 1995 the two countries set up a joint body called the Management and Co-operation Agency (AGC), for the joint development of resources located between azimuths 268° and 220°, starting from Cape Roxo on the land frontier between the two states.

The countries agreed on an equitable share-out of fishing resources, but not of oil. In accordance with the decision of the International Court of Justice at The Hague, 85% of oil profits will go to Senegal and 15% to Guinea Bissau. If new oil reserves are discovered, the 20-year agreement will be revised accordingly.

Senegal and Guinea Bissau have realized that they are better off getting along with one another than prolonging the dispute. The battle of Dôme Flore will not take place. ■

Seydou Amadou Oumarou

The Year of

"The Oceans, a Heritage for the Future" is the theme of EXPO '98, the 20th century's last great international exposition. Coinciding with the 500th anniversary of Portuguese navigator Vasco da Gama's exploratory journey to the Indies, the exposition is being held in Lisbon, the capital of Portugal, from 22 May to 30 September.

With over 145 countries taking part, and an expected 15 million visitors, EXPO '98 offers a unique opportunity to increase public awareness about the ocean and about United Nations activities in this field. The UN pavilion, set up under the joint leadership of UNESCO and the United Nations, is highlighting the whole range of co-operative ocean-related activities carried out by the United Nations family, as well as the monitoring and research activities of UNESCO's Intergovernmental Oceanographic Commission (IOC). This public information campaign is taking place within the context of the

Morocco- European Union

Co-operation in choppy waters

That Sunday, the air was pure, calm and peaceful and the sea was still.Only the rocking of a peaceful swell which died, panting,on the beach. Not a single bather. A moonlike landscape or of the world's creation. They say life sprang from the sea. That morning I too wanted to rise from the waves and land pure and fresh on other shores. To be reborn somewhere else, far, far away.

Henri Lopes
(1937-, Republic of the Congo): *Sur l'autre rive*

For the past ten years,the question of fishing rights has been a stumbling block in relations between Morocco and the European Union (EU). With a coastline of nearly 3,500 kilometres, Morocco offers major possibilities that have kindled a keen interest on the part of the EU. Five hundred Spanish vessels fish in Morocco's exclusive economic zone—95% of the Union's fishing fleet operating in the area.

Three four-year agreements have been successively concluded, largely concerned with granting the EU fishing rights in Moroccan waters in exchange for financial compensation. The first agreement, signed in March 1988, was brought to a more or less successful conclusion. The second, signed in May 1992, was revised midway through before being cut short. Morocco's fishing resources were depleted, so that in view of the need to preserve stocks, the two parties agreed to scuttle the deal one year before it was due to run out.

Nine months of tough negotiations ensued before a third agreement was signed in November 1995, which is still in force. The accord entitles the EU to new fishing rights off the Moroccan coast in return for a total of 500 million Ecus, and the deal cannot be revised until it expires—a concession insisted on by Brussels to ensure the stability of the agreement, which calls for, among other things, the creation of a Moroccan-European commission that will meet once a year to make sure the accord is being followed and to settle disputes, if any. But the only time the commission has met was in 1996. A second meeting, in December 1997, was suspended after it had barely begun.

Stressing the alarming drop in its fishing resources, which experts put at 27 per cent in 1997, Morocco decided to unilaterally increase the replenishment period to four months instead of the two provided for in the agreement. On 27 April, during Spanish prime minister José Maria Aznar's visit to Rabat, his Moroccan counterpart, Abderrahman Youssoufi, said co-operation on fishing must take new forms in the future. And in May, Morocco's fisheries minister ruled out any possibility of renewing the present agreement as it now stands. In the same breath, he decided to close the area along the Saharan coast between Boujdour and Dakhla to fishing for a one-year period, renewable if need be, in order to preserve sardine stocks.

Both parties have conflicting and complementary interests. The fishing industry employs 150,000 people in Morocco and accounts for 15 per cent of the country's exports. Fish stocks must clearly be preserved. On the other hand, European fishermen, especially in Spain, see no alternative to their activities. That is why more precisely targeted accords are being sought, such as the one Morocco has concluded with some Portuguese fishing companies. ■

Bahia Amrani

the Ocean

International Year of the Ocean (IYO), which has been proclaimed by the United Nations for 1998 and for which UNESCO is the lead agency.

IYO activities are designed to achieve three objectives: to make people aware that marine resources are not inexhaustible and that the ocean cannot absorb indefinitely all the pollution caused by uncontrolled development; to persuade governments to give the oceans the priority they deserve; and to develop a more effective system of global scientific co-operation to improve our understanding and management of marine ecosystems and ocean resources.

EXPO '98 is the most spectacular of the wide range of IYO activities, but there are many others. On IOC's initiative, an Ocean Charter has been drawn up. This is not a legally binding document but a declaration of commitment in which the signatories—governmental authorities and private bodies—pledge to initiate and respect co-operative actions to preserve the oceans and coastal areas. UNESCO is also preparing an ocean education package and a beach clean-up project. IOC is preparing an overview of current scientific knowledge, the first phase of which will be published by the end of the year. Also in the works are an encyclopaedia and an electronic atlas. Many countries are contributing to IYO, most importantly by holding high-level scientific conferences on ocean-related matters. The calendar and the themes of these conferences are featured in the IYO website (http://www.unesco.org/ioc/iyo/iyohome.htm). Research and training cruises are taking place aboard Russian, Norwegian, Chinese, Indian, Korean, Indonesian, Canadian, Malaysian and other vessels, which use their ports of call to draw public attention to the need for marine conservation. ■

Araceli Ortiz de Urbina

Galley slaves

Recruited by unscrupulous shipowners to sail in rust buckets flying flags of convenience, many sailors leave their rights ashore.

Don is from Sri Lanka. I met him in the Greek port of Piraeus. A victim of his country's civil war, his wife and two of his three children were killed when someone blew up the bus they were on. To support his surviving child, Don decided to go to sea. In Madras, he embarked on a freighter bound for Canada.

When the ship called at Halifax, Nova Scotia, Don checked the time it was due to leave before going ashore. But when he came back earlier than the scheduled embarkation time, the ship was gone. He had no identity papers—the captain had confiscated them when he signed up—and no money. He was taken in at a seamen's hostel where he managed to find legal assistance.

To prove he was telling the truth, Don wrote a long, detailed report on the ship's cargo and on events that had occurred during the voyage and gave the names of the rest of the crew. The document was sent to the Center for Seamen's Rights in New York, where it was checked and certified as accurate. The Canadian agents of the ship's Greek owner were ordered to buy Don a plane ticket home, but they refused to pay him his back wages.

Don, who still works at sea despite his ordeal, is a modern-day galley slave—exploited, badly paid or not paid at all—recruited by a front company to crew dilapidated ships often flying a flag of convenience.

One-third of the world's 37,000 cargo ships fly such flags. There is no link between the shipowner and the country of registration. All the owner has to do is sign up at a consulate anywhere in the world and pay. According to one London University transport economist, "companies register their ships under these flags so as to maximize profits and minimize costs by avoiding economic regulations and requirements which apply to vessels registered in their own countries."

They are spoiled for choice—twenty-seven countries offer the facility, which is purely a matter of money. Registering a ship in Cyprus is 65 per cent cheaper than in Greece and even less expensive if the country chosen is a tax haven like Panama, Bermuda or Gibraltar. Such flags mean there are no rules on hiring practices or working conditions to follow. The crews have no trade union protection or social security benefits. In fact, they have no rights at all.

On the dockside in Piraeus, seamen from the Philippines, Malaysia, Ghana and Chile all had grim tales to tell. One man who refused to clean the ship's toilets was tethered to the mast by a 1.5-metre chain for two days without water on the equator, and then locked in his cabin. Another told how his ship ran out of food for the last eight days of its voyage and the crew survived by catching a shark. Another seaman recalled how his ship's freezers, full of Senegalese shrimps, broke down and the crew had to eat their rotting contents day after day.

Yet thousands compete for such jobs, ready to pay anything from $300 to $1,000 to be taken on, after buying a passport, seaman's papers and sometimes an officer's or engineer's certificate, all of them available on the quiet at ports from Piraeus to Lagos. Some captains confiscate the crew's papers as soon as they embark, reducing them to slaves.

International organizations concerned with these issues have their work cut out. After more than a decade of negotiations, the United Nations Conference on Trade and Development (UNCTAD) drafted an international ship registration agreement in 1986 aimed at preventing shipowners from dodging their responsibilities by vanishing into thin air whenever a problem arises. Twelve years later, it is still not in force because fewer than forty countries have ratified it. A code of conduct has been approved by fifty-seven countries but rejected by those which offer flags of convenience.

In 1996 the International Labour Organisation adopted seven new recommendations on the hiring of seamen and their pay, hours and working conditions. The countries that ratify them agree to carry out inspections and publish

The sea. What joy to know it is so near. Of course we seldom went to the sea, but that doesn't matter. It's there, and that's that, behind the mountains, a few dozen kilometres from home . . . . It's because of the mountains that we seldom went to the sea.

Jean Portante (1950-, Luxembourg): *Mrs Haroy ou la mémoire de la Baleine*

© PradoGamma, Paris

On the waterfront in the French port of Le Havre, seamen wait to be hired.

the results. But inspectors are few and far between.

Owners of ships that fly flags of convenience are under no legal obligation to keep their vessels in good repair or look after their crews. Says Michael Roussos, a Greek Jesuit who helps stranded sailors in Piraeus: "If only ships could weep!" ■

France Bequette

Treasure hunters beware

Faced with advanced technology, laws full of loopholes and the growing number of treasure hunters and sports divers, several international organizations, working under UNESCO's auspices, are drawing up an international convention to preserve underwater heritage. But what exactly would it aim to protect?

According to a draft of the text presented in April 1998 by the secretariats of UNESCO and the United Nations Division for Ocean Affairs and the Law of the Sea, "underwater cultural heritage means all traces of human existence, including sites, structures, artifacts, and human remains, together with their archaeological and natural contexts, as well as wrecks, such as vessels, aircraft or other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural heritage."

But this definition "only applies to heritage which has been lost or abandoned and submerged for at least 100 years," explains Graham Henderson, the chairman of the International Council on Monuments and Sites' (ICOMOS) International Committee on Underwater Cultural Heritage. "It would be left up to states parties to introduce national legislation covering sites underwater for less than this period. But it would leave the *Titanic*, which sank in 1912, for example, unprotected.Nor does it apply to any military craft or their contents owned or operated by a state."

The *Titanic* case also illustrates the problem of heritage sunk in international waters, where the "finders keepers" rule still prevails. The draft proposes three solutions. States could either exercise tighter control over the activities of their nationals; ban the use of their ports by ships engaged in improper excavations; or forbid the entry of improperly raised artifacts into their territory. But the negotiating process is a long one and there is only a slender possibility that participants will agree on a final version of the convention before 2000.

In the meantime, treasure hunters can carry on searching for wrecks. They respond to the reproaches of legal "purists" by maintaining that they are just as useful as archaeologists because without their activities many treasures would remain undiscovered. The fact is, however, that they often act more like looters than enlightened amateurs. **S. W.** ■

Where the spirits roam

Esteban T. Magannon*

For centuries the waves have shaped the lives of the Orang Laut, Moken and Bajau. How much longer can the traditions of these small Southeast Asian communities withstand the pressures of 'modern' development?

For outsiders, they are the "sea nomads". Admittedly peaceful, simple folks, they are however mistrusted as fugitive pagan savages. Their houseboats look dirty, crowded with children, women cooking and a tangled mess of household belongings likely to include a cackling rooster among the Bajau and a dog among the Moken. Moored along beaches, lagoons, estuaries and even the backwaters of beach-front hotels, their floating communities are scattered throughout Southeast Asia.

They form three distinct cultural groups stemming from archipelagic environments: the Orang Laut from estuaries of the Lingga-Riau-Straits of Malacca mudflats, the Moken from the Mergui Archipelago and the Bajau from the Sulu Archipelago of the Philippines, in the adjoining islands of East Borneo, and those of eastern Indonesia, in particular the coasts of Celebes and Flores.

Their numbers remain somewhat of a mystery, partly due to imprecise census-taking. While they are counted as citizens in the countries where they are found, they are considered as ethnic minorities subject to discrimination reserved for "outsiders".

Anthropologists put their total population at about 35,000. Yet they estimate that probably not even one third of this number still live by tradition—meaning with the sea, not simply on the sea, nor by it—because of sedentarization. This distinction is important but often ignored as many anthropologists and others continue to oppose land and sea people, as if the two ways of life contradicted one another. The boat dwellers, in fact, oscillate between sea and land.

The Moken compare themselves to their "mythical sister" the turtle. They live between two elements, water and land. Moored in a lagoon or the leeward edges of an island, their houseboats are removed from the threats of coastal predators but not far enough to be swept away by ebbing currents.

With variations, their houseboats are the outriggers with mounted roofs common to Southeast Asia and the Pacific. The Moken *kabang*, for example, "are a marvel of ingenuity," according to anthropologist Pierre Ivanoff who studied them in the 1950s and 1960s. "Stable, light, able to carry five to eight people, they are capable of withstanding the worst storms of the Indian Ocean. They are seven to ten metres long, and one and a half metres wide. . . . Not a single nail is used in construction: the various sections are secured with wood and bamboo pegs, strands of rattan or various creepers," with palm leaves used for roofs and sails.

Again to outsiders, the boats look crowded. There is barely enough room to stand, let alone walk. Older men find their legs gnarled from the lack of movement. Yet here we fall into the trap of comparing our perception of space on land and at sea with theirs. With endless horizons as a backdrop for the constant interplay between water, air and light, these people live open and free.

The monsoons shape and regulate their lives. As the waves rise dangerously high with the rainy season, they seek the protection of the shore. The Orang Laut are settled on fixed sites in estuaries, while the Moken and Bajau move from one temporary mooring to another in lagoons or along beaches and the leeward edges of islands. This time is largely spent constructing

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A Bajau village on the island of Mindanao, in the Philippines.

boats or repairing them, while food is found hunting wild pigs, gathering fruits and vegetables and digging up tubers like yam. Once the dry season sets in, they ship off again.

The Moken also move from island to island, hunting sea turtles and collecting sand worms, shellfish, and clams for food. But paradox of paradoxes, they avoid the main fruit of the sea—fish! Sea-slugs are the closest they come and even these creatures are collected only to be sold to the Chinese, who love them. In contrast, the Orang Laut and the Bajau run after the fish, with the first group scouring estuary habitats and the second sifting through coral reefs and mangroves.

From Indonesia to the Philippines, the Orang Laut, Moken and Bajau oscillate between land and sea.

Clearly, the sea represents life. Children are always born on the houseboats, never on land. They play either on the strands or swimming around the boats. Women would never think of cooking ashore, even during the rainy season when their boats are moored along beaches.

In contrast, death and illness are bound to land. All of the sea people go ashore to heal or to bury their dead. Older people who feel that they have outlived their usefulness to the community often discreetly ask to be left on a deserted isle to die.

While spirits (*hantu*) roam everywhere—on trees, under water and rocks, in caves and even the air, their sole requirement of the sea-people is respect. The sea people believe that failure to respect the environment—the abode of the spirits—results in illness, conflict and death. A fisherman who dares to cast a net during the rainy season without performing the prescribed ritual inevitably suffers. The only cure lies in exorcism and appeasement. Basically, a shaman enters into a trance to invite the spirit to inhabit a wooden human image which is then brought to an island designated for the spirits. The dead are buried in common island cemeteries.

These associations of illness and death do not mean that land is the domain of evil or suffering for the boat-dwellers. It simply signifies that there are things which belong to the land and activities which are better done ashore than on water. Thus, girls are named after tender flowers while boys' names often reflect the strong qualities of trees or animals.

However, through their contacts with coastal and plain dwellers, land has historically been a source of misfortune for sea people. They recount this in their songs, legends, and epics which are sad. They recollect how the Orang Laut, aside from taking care of the rulers' hunting dogs and other menial duties, were practically the indentured defenders of maritime routes for the great Kingdoms of the Straits of Malacca; how the Moken became pearl-divers for the Chinese, and the Bajau trepang (sea cucumber) collectors for the Tausug sultans. These tasks were considered to be lowly, worthy only of savages. And yet, had it not been for these specialized roles, the sea people would have lost their cultural identity long ago.

Indeed, it looks as if fear of conversion to Islam, which swept the region from the fourteenth century on, greatly motivated the sea people to stay offshore. It is their best way of surviving and conserving their beliefs. All three groups are bound by a common thread: the opposition between us and them; *Orang sama* and *Orang bagai*, insiders and outsiders. Whereas their communities are structured on fleets organized around kinship principles, human relations are governed by the more fluid distinction between us and them. History has instilled in them a fear of those who do not belong to them. And their instinct is to flee—inevitably to the sea.

Today, it is increasingly rare to find the Orang Laut, Moken, and Bajau at their habitual moorings. Once again, they are fleeing. From what? From the onslaughts of blast-fishing, from the conversion of traditional fishing and collecting grounds into industrial production plants. Will they survive this time? ■

* Ethnologist, Inalco, France

When women are **the**

Long a taboo subject, sexual violence is only now coming to be recognized as a crime against humanity. Will the proposed new International Criminal Court be able to bring the guilty to book?

August 1992: young Bosnian Muslim women in a state of shock after being raped by Serb militiamen.

Violence against women during armed conflict is nothing new. With other innocent victims—children and the elderly—they have always been on the front lines of wars of all kinds—religious wars, civil wars or world wars. Historians have described how soldiers have raped women to intimidate civilian populations. But during this century the character of war has changed and this practice has become even more widespread. Where soldiers used to target other soldiers, the goal now is often to kill or terrorize civilians. Various forms of sexual assault may occur during fighting or in conjunction with looting and other crimes by armed forces overrunning an area. Soldiers may publicly rape women and detain them in special camps or brothels, where they can be tortured, raped and made pregnant.

Overwhelming evidence

There have been many examples of this kind of violence in the last decade. After Iraq invaded Kuwait in 1990, it was estimated that at least 5,000 Kuwaiti women were raped by Iraqi soldiers during the occupation. Two years later, shocking reports were published around the world about the use of rape and forced pregnancy as tools of "ethnic cleansing" in Bosnia. In 1994 and 1995, stories of sexual violence in war again appeared in the world media, this time from Rwanda. One United Nations report estimated that as many as 500,000 women and girls suffered brutal forms of sexual violence, including gang-rape and sexual mutilation, after

spoils of war

Valerie Oosterveld*

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which many of them were killed. In Algeria, the women of entire villages have been raped and killed. The government estimates that about 1,600 girls and young women have been kidnapped to become sexual slaves by roving bands from armed Islamic groups.

While men may also be victims of rape and sexual mutilation during armed conflict, it is widely recognized that sexual violence is usually targeted specifically at women. But women are often reluctant to report rape, either because they fear the social stigma or because they feel that it is useless to report the crime in conditions of chaos and societal breakdown. The extent of sexual violence often becomes evident long after the world knows the extent of other crimes. Stories of sexual violence in Rwanda emerged approximately nine months after the genocide had ended, as women began bearing babies conceived as a result of rape. According to estimates of the Rwandan National Population Office, women who survived the genocide gave birth to between 2,000 and 5,000 children, who are often known as "*enfants des mauvais souvenirs*"(children of bad memories). The same pattern is true of the former Yugoslavia, where women were raped until they were pregnant and then held until they were close to term. In 1993, it was estimated that between 1,000 and 2,000 women became pregnant as a result of rape.

Reports of mass rape in the former Yugoslavia led women's and human rights ▶

Life must go on

Juan Boggino and Diane Kolnikoff are psychotherapists at a counseling centre run by the Primo Levi organization in Paris, which helps refugees who have been tortured. Some of them, like the Haitian woman who has just arrived at the centre, are victims of rape. "She left her country after being raped in prison," says Kolnikoff. "She abandoned the child conceived during the rape and came to live alone in France. Since then, she has given birth to another baby, but still has thoughts of infanticide even though the second child has nothing to do with her past." Hers is one of many heart-rending stories, such as that of an African woman who is "always dreaming she has a weight on top of her that keeps her from moving."

Even years later, "the suffering never goes away," says Boggino. It manifests itself as a "deep breakdown of the individual and feelings of shame and humiliation that are especially strong since the crime was committed in front of witnesses, the family, the village. Young women who were virgins at the time of the rape say no one will ever want them. It is impossible for them to imagine having a normal relationship with a man." Horror gives way to the absurd. These women feel guilty rather than victimized. They cannot accept that "their torturers were the inhuman ones. They wonder why they survived while others died. They tell themselves their lives were spared because they let themselves be raped."

Nightmares, amenorrhoea, repeated illnesses, fear of physical contact and frigidity are the most common symptoms of their emotional suffering. For these women, silence is suffocating while speech is golden. It allows them to talk about what happened, to cry, to express their feelings and their anger. Speaking lets them separate themselves from the torture they went through, explains Kolnikoff. It allows them to live "with" rape rather than "in" it. After psychotherapy, some of them manage to feel comfortable with their bodies again, to give and receive pleasure and even to love the children "born of bad memories," provided they accept them as their own.

Talking about the rape also makes victims feel they have a right to point a finger of blame at the culprit, which allows them to shed feelings of guilt and shame. "But these women need to be believed. That's where the law and the courts have a decisive role to play." No cure is possible unless the rapists are named and brought to trial.

S. Bou ■

groups and then governments around the world to condemn these acts and call for an international tribunal to hold the perpetrators accountable. Following several Security Council resolutions condemning the massive, organized and systematic detention and rape of women, the International Criminal Tribunal for the Former Yugoslavia was founded in 1993. From the beginning, one of the purposes of setting up this court was to prosecute crimes of sexual violence. The tribunal was the first to recognize crimes of sexual violence as war crimes and as "grave breaches" imposing on states the duty to search for the allegedly guilty persons and bring them to court or extradite them for prosecution elsewhere. This is something new. Sexual violence is not explicitly called a grave breach in the main law of war documents—the 1949 Geneva Conventions and their 1977 Additional Protocols. However, it is generally accepted that these crimes meet the criteria of "willfully causing great suffering or serious injury to body or health" and "torture or inhuman treatment".

Sexual violence can also be regarded as a crime against humanity, like murder, extermination, enslavement, deportation, imprisonment, torture or persecution, depending on the surrounding circumstances. Historically however, crimes of sexual violence have rarely been prosecuted under any of these headings. One exception was the Tokyo World War II trial, where several Japanese officers were charged and held liable for the rape of 20,000 women during the occupation of Nanking (China) in 1937.

During the prosecutions of top-ranking World War II criminals at Nuremberg, rape was not listed as a crime against humanity. However, it was prosecuted in the national trials that followed Nuremberg, and it is now accepted as belonging on the list. Both the Yugoslav and Rwandan Tribunals explicitly include it in the definition of crimes against humanity.

The experience of these two tribunals has demonstrated both the progress that has been made and the difficulties that have arisen in prosecuting crimes of sexual violence. To date, twenty-six people have been charged with committing sexual atrocities; however, many of them are still at large. In June 1996, the first indictment dealing solely with sexual violence and enslavement crimes was issued. It alleges that, in 1992 when the city of Foca (south-east of Sarajevo) was overrun by Serb forces, Muslim and Croat women were detained and repeatedly beaten and raped. Only one of the eight men accused in this indictment turned himself in to the tribunal.

Few prosecutions

Unfortunately, the Rwanda Tribunal has publicly charged only two people with crimes of sexual violence, both in 1997—three years after it was founded. The first was Jean-Paul Akayesu, the mayor of Taba commune. Even though there had been reports of widespread sexual abuse in Taba, he was not initially charged with these crimes, and it was not until witnesses testified about rape, and a coalition of human rights and women's organizations submitted a brief, that the prosecutor amended the indictment to add sexual violence to charges of genocide, crimes against humanity and war crimes. This is the first case before the Rwandan Tribunal in which someone is specifically charged with crimes of sexual violence, and the first to address the issue of a leader's responsibility for encouraging or allowing others to commit rape.

Governments are now in the process of finalizing the statute of a permanent International Criminal Court. This court will be able to build on the advances of the Yugoslav and Rwandan Tribunals and will hopefully reverse the historical trend. ■

*Canadian jurist

In northern Uganda, 8,000 children have been forced to join the "Lord's Resistance Army" and many girls have been raped.

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Aids:

No one would deny that prevention is better than cure. But in the poorest countries, should treatment of Aids patients be neglected in favour of prevention on the grounds that caring for them is prohibitively expensive?

Thirty million people worldwide are infected with the virus that causes Aids, and over 90 per cent of new cases of contamination occur in countries of the South. Africa south of the Sahara alone has two-thirds of all reported cases. The disease is out of control in Asia—five million people in India may be HIV-positive. Meanwhile, the number of reported cases continues to diminish in Europe and fell by 27 per cent in 1997, says the World Health Organization's European Monitoring Centre. Mortality rates from Aids are down in all the industrialized

prevention or care

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Gambian women Aids victims and their newborn babies in a family planning centre. Will they have access to treatment?

As Aids continues to spread in most countries of the South, should its victims be deprived of access to treatment? A moral case is increasingly being voiced against the cost-effective approach to medicine.

countries. Would the results have been the same if prevention had been the only strategy used? Could so much have been achieved with the same meagre funds allocated to the countries of the South, where per capita spending on Aids is 100 times lower than in the developed world?

Yet the European Commission, the leading international contributor to Aids programmes in the developing nations, and the World Bank, in its 1997 report *Confronting Aids*, say the money should be spent almost entirely on prevention. World Bank experts argue that treating Aids patients would be at the expense of caring for victims of other diseases which are just as deadly, especially since anti-Aids drugs are expensive and complicated to administer. At a time when governments everywhere are scaling back their assistance to developing countries, institutions are lowering their expectations and reasoning in terms of cost-effectiveness, thus losing sight of the problem's ethical dimension.

The ethical question exists at three levels. Considering the drop in public development aid, should funds be earmarked to pay for expensive Aids treatment? Should nothing be done until the new drugs are available for all? Given the high cost of retroviral drugs, would it be right to select some patients for treatment and not others? It will take at least another ten years to develop an HIV vaccine. In the meantime, something must be done.

Right now, access to care in the vast majority of developing countries is limited at best to treatment for opportunistic infections. Moreover, medical treatment is usually not free, so the poorest people have no access to it. Do we have the right to ignore the plight of these suffering millions? A recent study in Thailand showed that the rate of HIV transmission from mother to foetus could be halved by administering AZT over a short period to pregnant women before they give birth. Since 550,000 babies are born with the HIV virus each year, it is easy to imagine how many lives AZT could save.

High stakes

The debate has been raging for some time. Arnaud Marty-Lavauzelle, president of Aides, a French non-governmental organization,says it started at the 1994 international conference on Aids in Yokohama. "We really became aware that it wasn't enough to rely on prevention strategies alone," he says. "With the new drugs and the need to transform the disease's image, we believed it was necessary . . . to include the dimension of access to care." Specialists increasingly blame the failure of prevention programmes on the lack of simultaneous treatment. Indeed, it is difficult to see how prevention could work if no treatment is offered after a positive HIV test. The idea that prevention and treatment must go hand-in-hand to provide an across-the-board response to the epidemic is making headway. "Of course prevention is essential. But it would be une- ▶

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The lengthening list of Aids patients raises the pressure on the facilities of Nsambya hosital in Kampala, the capital of Uganda. In the countries of the South generally, Aids statistics have exploded in recent years.

Region	population with HIV/Aids
Sub-Saharan Africa	20.8 millions
North Africa and Middle East	210,000
South and South-East Asia	6.0 million
East Asia and Pacific	440,000
Latin America	1.3 million
Caribbean	310,000
Eastern Europe and Central Asia	50,000
Western Europe	530,000
North America	860,000
Australia & New Zealand	12,000
Total	**30.6 millions**

Source: *Report on the Global HIV/Aids Epidemic*, Geneva, WHO, 1997

thical and counter-productive to write off the millions of people with Aids as a lost cause. The long-standing dichotomy between prevention and care is really a thing of the past," says Dr. Awa Marie Coll Seck, director of the United Nations' UNAids programme.

On 5 November 1997, UNAids announced the start of an initiative aimed at improving access to HIV drugs in developing countries. Four countries—Viet Nam, Uganda, Chile and Côte d'Ivoire—are taking part. To implement the pilot programmes they will have to gear their health care infrastructures and drug distribution systems to the special needs created by HIV, and their ministries of health will have to provide the bulk of the funding. African organizations of people living with the Aids virus are hopeful that retroviral drugs will soon be available in their countries, but so far none of the pilot programmes has really got under way.

Political overtones

The debate has spilled over into the political arena, which may speed things up. On 7 December French President Jacques Chirac, addressing the 10th pan-African conference on Aids, in Abidjan (Côte d'Ivoire), said, "it would be shocking, unacceptable and contrary to the most basic principles of solidarity to adopt a two-speed approach to Aids. . . . We must do all we can to extend the benefits of the new treatments to needy people in Africa and the rest of the world." The next day French health minister Bernard Kouchner suggested setting up an International Therapeutic Solidarity Fund with the aim of making access to treatment easier. The fund was discussed at length during the G8 summit held in Birmingham (UK) from 15 to 17 May. The snag: finding the $5 billion funding. That may take some time, although several promising leads are already being explored. For example, the multinational pharmaceutical company Glaxo Wellcome has announced it will supply pregnant HIV-positive women in developing countries with AZT at 50 to 70 per cent below the usual price. The reason for this sudden burst of philanthropy is that new outlets must be found for drugs that no longer work in the developed countries, and the economies of scale resulting from the potentially broader market make the price cut possible. Other private sources may also be tapped, but everyone knows they will not be enough. That is why the priority is treating pregnant women with HIV, which would reduce the number of babies born with the virus by 40 to 50 per cent. "It would be irresponsible to promise treatment for everyone," says Dr. Coll Seck. "The important thing is to make a start. The people and organizations that became involved in the fight against Aids early on, in spite of the social stigma involved, as well as pregnant women, should be considered priorities."

What about the others? The debate has come out in the open during the past few months, but there is hardly any doubt that many people will still be left out. "The only humanistic policy that can be imagined in the future," says Marty-Lavauzelle, "is to match globalization of profits with globalization of responsibilities." Fine words, but for the moment they are no more than that. ■

Sophie Bessis with Xavier Simon

Children behind bars

A minor in Madagascar has been serving a two-year prison sentence since 1996 for stealing a pineapple. He's lucky. In another country he might have been immediately put to death, like the homeless child in the village of Kounbra (Chad), who was found lying in a pool of blood and abandoned to the mercy of a pig, on a soccer field. In January 1997 he was shot for petty theft, says the human rights group International Prison Watch (IPW). The organization's report on children in prison, published in May 1998, describes conditions in the 51 countries where data are available.

No one knows exactly how many children are imprisoned around the world, and for good reason. The question is too thorny, and the definition of a minor varies from one country to the next. In South Africa, Bangladesh, Ireland, Pakistan and some states in the United States, seven-year-old children are held responsible for criminal acts. In Mali, Romania, the United Kingdom, Turkey and Viet Nam the age varies from ten to fourteen. In Mauritania and Luxembourg, children can be detained at any age. In 1995 nearly 70,000 minors were incarcerated in the United States, and in 1997 there were 1,200 in prison in South Africa and between 15,000 and 20,000 in Indonesia.

Sometimes placed in the same penitentiary facilities as adults, minors are the victims of many abuses. In Mauritania cases have been reported of children who are stripped naked, bound hand and foot, exposed to the sun and beaten with truncheons or electric cords. In American prisons, 40,000 minors are raped each year.

In the southern countries, their diet is usually spartan. In Burundi, for example, they are entitled to just one 300-gramme ration of beans or manioc flour a day. National legislation makes provision for medical care, but the reality is quite different. In some Russian prisons, scabies, tuberculosis and typhus are rampant among minors.

At Tongi prison in Bangladesh, young inmates receive training. Yet in a wealthy country like Luxembourg, no provision is made for their education.

Generally speaking, none of the countries mentioned in the IPW report has found a just way to treat minors who have broken the law. **S.A.O.** ■

A publishing **revolution**

Russian publishing is moving along the bumpy road to the free market.

A bookshop in St. Petersburg.

The situation started to change shortly before the break-up of the Soviet Union. The key event was the abolition of censorship in 1989 which sparked off a publishing boom. New co-operatives joined the 300 state-owned publishing companies, printing massive editions (from 50,000 to 100,000 copies) of works by previously banned authors including Akhmatova, Tsvetayeva, Mandelstam, Berdyayev and Solovyev. Foreign literature publishing also took off, as large numbers of pirate editions were published, often of poor quality. The number of publishing companies rose to almost 6,000 in 1993, but so many of them were putting out the same works that the market was soon flooded.

The first years of the decade provided a foretaste of things to come. But perestroika did not really get into full swing until 1992, when the first publishing companies were privatized. The state did not relinquish control over the industry, but set up a kind of share-holding system in which it could pull strings while offloading some of its financial burden. When this happened, the myth of the flourishing Soviet publishing industry collapsed. Under the old regime, print runs of some titles were enormous and tiny for the rest; editorial decisions were made arbitrarily and party literature was given pride of place, automatically bought by the unions, sent free of charge to municipal and rural libraries and shipped to the people's republics of eastern Europe. Those days were over.

This first stage showed that publishing was in a shaky condition. It is true that lack of market experience and the new economic situation were obstacles to profitability. The sudden cuts in state subsidies, the break-up of the centralized distribution system, soaring costs of paper, production and shipping dealt a death-blow to the one-time giants of Soviet publishing such as Sovetsky Pisatel, Molodaya Gvardya, Progress and Detskaya Literatura, which specialized in books for young people. Between 1990 and 1993 the number of published titles plummeted from 41,000 to 29,000 and the number of copies printed fell from 1.5 billion to 950 million.

The new Russia tried to give publishing a second chance. A bill relating to publishers' and authors' rights was passed in 1993, and a federal law concerning aid to publishing and the media, which provided for privatization, tax breaks and other financial incentives, came into force on 1 January 1996. This legislation spurred on the private sector, which today produces nearly two-thirds of the books published in Russia—a total of 420 million copies and more than 36,000 titles.

An uphill job

But these figures are just one side of the coin. The Russian publishing industry is still beleaguered by a host of problems, often related to the drop in purchasing power. Russian citizens cannot afford to buy books, even school textbooks. What is more, many local publishers are not in a position to supply the fragmented market, so that there is a flagrant imbalance between the country's central regions and the outlying areas, especially Siberia and the Far East. In the central areas, the number of books available per inhabitant is in the hundreds. On the periphery, it is less than twenty. What's more, the January 1996 law is arbitrarily applied and publishers rarely benefit from the advantages it offers. Even public sector publishing companies are feeling the pinch. In 1996-97, only twenty-five books were published with state participation. And most of them were printed to commemorate Moscow's 850th anniversary.

For the most part, these aberrations penalize small- and medium-sized companies. Large firms are doing quite well, especially if they reach a wide public. Science fiction, thrillers and love stories, once almost impossible to find, are best-sellers today. Demand is rising, especially because these books cost between 12 and 15 roubles (from $2 to $2.50, as of 15 June)—the average salary in Moscow is 1,000 roubles a month ($164) and from 300 to 500 roubles ($49 to $82) a month elsewhere in Russia.

There is also a flourishing market for cookbooks, do-it-yourself books, health ▶

books and travel guides, with the private companies Eskimo, Olma-Press, AST press, Armada and Centrpoligraf in the lead. The best-selling university textbooks, which cost an average of 20 roubles,are on law, business, finance and information technology. The main publishing companies in this area, which include Infra-M, Spark, Financy i Statisika and Prior, are also in the private sector. These new leaders in mass publishing have also solved distribution problems. Most of them have their own warehouses, transportation and computerized sales management systems.

With print runs of 15,000 to 20,000 copies, Vagrius and Terra,the main literary publishers, are able to sell their books at competitive prices ranging from 20 to 30 roubles. They also work with wholesalers and have an extensive point of sale network in Moscow and the regions.

The situation is quite different for publishers such as Sabascnikov, whose print runs are 5,000 copies or less. It is hard for them to make a profit, especially since their books are produced in Italy and sold in Russia. At 50 roubles each, these publishers are having a hard time winning market share. Since their books sell poorly, they cannot start many new projects and have to make do with publishing three or four titles a year.

Rethinking the book industry

In addition to shipping costs and commissions skimmed off by wholesalers, small companies have to cope with the prohibitive borrowing terms laid down by Russian banks, which charge from 40 to 60 per cent interest a year. The 17 per cent interest rates of the European Bank for Reconstruction and Development are attractive, but those loans are hard to come by.

Authors are also going through hard times. There are no literary agencies in Russia, and writers have as much trouble finding a publisher as defending their rights. This is true even for successful authors like Alexander Marinina,who has been dubbed "king of the thriller". Beginners are even worse off. Literary awards such as the Bouker and Antibouker prizes usually go to established authors and publishers.

Where translation is concerned there is also a lot of catching up to do. Money is the decisive factor,and publishers favour classics because they cannot afford to pay copyright and promotional costs. Grants from the Soros Foundation and France's Pushkin programme have funded new translations of Pascal,Lautréamont,Walter Benjamin, Chateaubriand, Karl Jaspers, Roland Barthes, Fernand Braudel and others.

There is still a long way to go. In future, Russia's publishing industry, including the production and marketing sides, will have to be totally rethought. A fresh injection of aid is indispensable,especially for school textbooks, university textbooks and libraries. Sales and marketing strategies must be revamped. Marketing centres already exist, but aesthetically Russian books still leave much to be desired. The time has also come to consider co-editions with Western publishers. ■

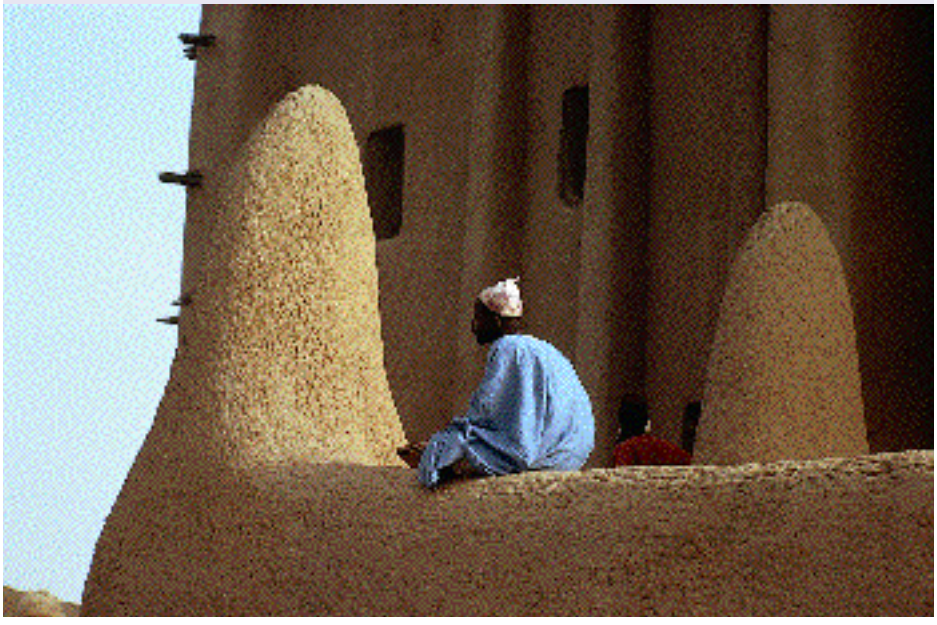
Maria Yakubovich

Togouna week in **Djenné**

The people of Djenné (Mali) will remember Heritage Week for a long time.From 12 to 18 May, decision makers, researchers and local representatives gathered in the ancient town, which has been on UNESCO's World Heritage List since 1988, to discuss ways of preserving its remarkable earthen architecture while taking the residents' needs into account."Togouna" week,named after a Dogon concept meaning a place for dialogue, thought and exchange, was organized by the ministry of culture, sponsored by Adam Ba Korané,wife of the chief of state and a historian,and chaired by the minister of culture,Aminata Dramane Traoré.According to Sirandou Bocoum,a representative of a Djenné women's group, "Difficult restoration rules are imposed on us. We are not allowed to change the present dimensions of our houses, but they are very small. Today we need spacious living rooms to entertain guests. The old entrance halls just won't do anymore. A little modernity won't make our architecture any less authentic," she says, adding that the rules are forcing the townspeople to live in a "perpetual ghetto". Papa Sy, chairman of an organization called Djenné-Patrimoine (Djenné-Heritage), shares her point of view. "The main thing," he says, "is to preserve the façades and other aspects of the appearance of our homes. The rest should be up to the owner to decide."

Heritage Week participants demanded that restoration projects underway be redesigned to satisfy the townspeople's needs. But above all, they asked to take part in future heritage management projects. Making cultural heritage profitable was also discussed during "Togouna" week. To spread the benefits among as many people as possible, it is necessary to promote local creativity and the development of economic activities linked to tourism, such as crafts.

Admittedly, that is a tall order. Meanwhile, Djenné's Heritage Week proved that people are more likely to accept a participatory approach to heritage management than the top-to-bottom decision-making that has been the rule until now. As the minister of culture said, the aim of preservation is to foster sustainable human development that combines economics with culture. **Bamba Kiabou** ■



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Lalibela's fragile churches

Modern tourism is a mixed blessing for an extraordinary complex of medieval churches hewn from the living rock of the Ethiopian highlands.

'A day's walk from Imbra-Chris there are buildings that to my mind are unlike any to be seen elswhere in the world and in such great number. There are churches hewn entirely out of the living rock, which is sculpted with great ingenuity." Francisco Alvarez, the chaplain of an early sixteenth-century Portuguese diplomatic mission to Abyssinia, hesitated to say more about the wonders he had beheld in Lalibela. Had he found the words, he thought, no one would have believed him.

Lalibela is a medieval monastic complex perched at an altitude of 2,700 metres, where the sky meets volcanic rock that solidified as it flowed down the mountainside. It is a holy city inspired by a dream, which may explain its airy grace and the awe visitors feel when they behold it. Legend has it that King Lalibela was born in Roha, on the site of the little town of 10,000 inhabitants which today bears his name, some 700 kilometres from Ethiopia's capital, Addis Ababa. At his birth, a swarm of bees enveloped him, thus giving rise to his name, which means "the bees know he will be great." During Lalibela's childhood the throne of Ethiopia was occupied by his brother who, fearing the oracle's words would come true, poisoned him. The young prince fell into a coma that lasted three days. This "near-death experience", as it would be called today, was regarded as a miracle. God had Lalibela brought up to heaven and ordered him to have churches hewn out of the living rock. In the early twelfth century, when Christians despaired at seeing Jerusalem fall into the hands of the Muslims, Lalibela came to the throne and had eleven monolithic churches carved out of the pink tufa.

1. Today known as Yemrehana-Krestos. *Editor*

French archaeologist Francis Anfray, who has spent thirty-two years in Ethiopia, says, "This imposing complex of churches is the only one of its kind in the world," which is one reason why Lalibela is on UNESCO's World Heritage List. Another is that it's a living site where 350 priests, 250 deacons, 450 monks and 400 students still work, study and worship. The religious services held there have not changed in 800 years. Ethiopia's Orthodox Christians consider it a second Holy Land. The local stream is even called the Jordan and there is a mountain named Mount Tabor. Ethiopia's leading pilgrimage site, Lalibela sometimes welcomes 20,000 to 50,000 believers at a time, especially during the peak Christmas, Epiphany and Easter seasons. Many of them trek to the complex on foot.

A deteriorating site

The churches have deteriorated over the centuries, but by and large they have withstood wars, invasions and the torrential rains that drench the highlands from June to September. But as the twentieth century draws to a close, Lalibela's rock churches face new threats. They will need the protection of Egzia Beher, the Ethiopian Christians' word for God, to survive the expected wave of tourists. "The government wants Lalibela to attract as many visitors as possible," says Jara Haile Mariam, director of cultural heritage at the culture and information ministry. The goal is to help offset the area's extreme poverty. Tarja Laine, of Finland, has carried out a detailed study of the site and co-ordinates a development project managed by the Finnida co-operation agency. "The environment is extremely eroded," she says. "It will not support any more forestry or farming. Tourism is the only way for the people to upgrade their living conditions."

Right now, most of the population lives below the poverty line and 97 per ▶

Priests and people of Lalibela wait for their churches to be restored.

cent suffers from malnutrition. The infant mortality rate is 153 per thousand and 68 per cent of the inhabitants can neither read nor write. One adult in three is unemployed and most of the rest eke out a living selling firewood or as day labourers. The churches are the town's only real source of wealth. In addition to the clergy and students associated with them, they provide work for those members of the community who live from the tourist trade. An entrance ticket costs 100 birrs ($12) for a non-Ethiopian, which is twice the monthly wage of half the inhabitants of Lalibela. A young guide can earn more in three hours than his father does in a month! But the site still only draws 10,000 tourists a year, who spend an average of two days there. They complain about poor sanitation infrastructures, rude and underqualified guides, harassment from beggars and high admission prices.

'In the long run tourism will kill Lalibela, just as it has killed Mont Saint-Michel in France. We must try to limit the damage.'

Still, medieval Lalibela is slowly but surely catching up with the twentieth century. Five years ago it was impossible to reach the medieval complex by road during the rainy season. A few kilometres from the centre, an acacia tree still cast its shade over the single, narrow, red clay airstrip. Since 1997 a new road has led to the town, which has a real airport and telephone service. A development plan drawn up in 1996 calls for the building of restaurants, souvenir shops, a museum, a parking lot, a crafts centre, a post office, a bank and other amenities. And electricity is on the way. "But the power plant was built too close to the churches, and the cables spoil the scenery," says Laine. "If the ministry of culture had been consulted, that mistake would have been avoided. The problem is, the ministry does not have enough influence to control development of the site." Haile Mariam says "there is a conflict between conservation and development" and that the government bodies in charge of tourism and planning should be more sensitive to the preservation of heritage.

"In the long run tourism will kill Lalibela the same way it killed Mont Saint Michel in France," says Anfray. "We must try to limit the damage." Pietro Laureano, an Italian architect working for UNESCO, adds, "I worked on the site of Petra in Jordan. It's a disaster. Hotels have been built helter-skelter, even though the traditional local villages could have accommodated tourists. Lalibela may develop in the same disorderly way if we don't give the inhabitants and tour operators guidelines for protecting the perimeter around the churches." Mariam is campaigning for the creation of "satellite villages" but acknowledges that Ethiopia is too poor to fund new infrastructures.

But the worst-case scenario can still be avoided. "No irreparable damage has been done," Laine says reassuringly. What's more, increased tourism could spur intelligent development of the site. According to a 1996 study conducted for Finnida, visitors are overwhelmingly in favour of protecting the perimeter around the churches, which they fear will turn into a "Holy Hollywood." Sixty per cent complained about the churches' poor condition and 83 per cent regret that they are covered by shelters—sheet metal and wooden structures that will, it is hoped, prevent leaks from further damaging the landmarks until a better solution is found. "They've been talking about restoring the churches for thirty years," Anfray says. "Work financed by an American foundation started under the auspices of UNES-

Will the rock-hewn churches weather the tourist flow?

CO in 1967. Then the war broke out. The government didn't ask for the restoration campaign to start up again until 1993."

Political instability and the top-to-bottom reorganization of the country after the Mengitsu regime fell in 1991 put preservation efforts on hold. Since then, projects have been designed but they remain on the drawing board. "Various Ethiopian authorities, the church, the European Union and UNESCO are all involved in restoration," says Anfray. "That adds up to a heck of a lot of people and organizations." Bureaucracy and the Ethiopian civil war have not been the only stumbling blocks. After decentralization measures were implemented in 1995 and 1996, heritage preservation fell to the federal ministry of culture, but carrying out the projects and local planning schemes are within the province of the region. There is also interference from the newly created municipality and the clergy, without whom nothing can be accomplished in Lalibela.

Moreover, UNESCO and the European Commission, both of which are involved in developing Lalibela, have conflicting preservation priorities. UNESCO cannot afford to restore the rock churches, and restoration falls outside the Commission's sphere. All the European Commission can do, says Anastase Zacharas, who is in charge of the dossier at the European Commission, is safeguard Ethiopia's tourist potential.

Conflicting priorities

Europe is going to funnel 4.7 million of the 200 million Ecus it has earmarked for development in Ethiopia between 1996 and 2000 largely into the construction of attractive high-tech shelters to cover the churches. The process is underway. Architecture firms around the world have been invited to tender bids, the winner will be announced in March 1999 and the shelters will be completed by December 2000. This will leave a million and a half Ecus, which will be used to carry out studies on the reasons why the churches and the trenches that once formed a water drainage network have deteriorated and to pay specialists. Meanwhile, UNESCO and the Ethiopian department of preservation of cultural heritage would like to see restoration work begin. Their experts have approved a pilot project calling for the use of traditional building methods and unsuccessfully tried to include it in the European Union's package. "We have a lot of money for the shelters but much less for conservation. There is no choice. It doesn't make sense. People have been waiting for years for the churches to be repaired. We have to produce something or we lose credibility," Haile Mariam says regretfully.

"Our bureaucratic systems are too rigid to fund small-scale operations like pilot projects," says Zacharas, who believes the shelters are a necessary but temporary evil. "They'll be able to protect the churches for ten years. Then Ethiopia will have to find the money to fund the work." In other words, it won't be starting tomorrow. But heaven can wait. . . . ■

Sophie Boukhari

Satellites for the South

Beaming multimedia radio by satellite to the four billion people living in the South is even more challenging than it sounds.

"If you want to eat an elephant, you can't do it in one mouthful," says Noah Samara. "You have to eat it bit by bit." For the past seven years, he has been using this little-by-little approach to spread digital radio by satellite around the world.

With an almost missionary zeal and dogged skill, Mr. Samara heads Worldspace, a company whose aim is to bring the rich man's radio to an audience of the poor. The project was initially designed for Africa but later expanded to include the more economically buoyant countries of the South.

Worldspace will provide a broad range of programmes transmitted digitally and by satellite, with CD-quality sound, to four billion people who live in developing countries. Each satellite will carry three groups of 100 frequencies, making it possible to transmit around 100 stereo channels. This is a revolution in regions where the choice is still very limited (one station for every 30,000 people in North America, compared to just one for every two million in the Third World). "We want to create a showcase for local cultures," says Samara, a forty-one-year-old American Muslim of Sudanese-Ethiopian origin. "Today the stations of the North dominate the South. But I'm sure amazing things are happening in Kenya which would interest people in Senegal, for example."

The programmes are picked up by small portable receivers with a tiny satellite antenna and, beginning in the year 2000, a colour screen for multimedia (words, pictures and sound). The receivers can be plugged into a personal computer and receive personal messages. Four major Japanese companies—Hitachi, Matsushita, Sanyo and Victor—recently signed deals to manufacture and sell the devices.

Washington-based Worldspace has raised $850 million from investors, whose identity is a closely-guarded secret, ordered three big satellites from the French firm Alcatel and signed launch contracts with Arianespace. The first satellite will go into orbit over Africa in October 1998 and the two others over Asia and Latin America in 1999.

"The appealing thing about Worldspace is that they really know how to sell their product," enthuses Arnaud Littardi, head of international affairs at Radio France International. "The combination of satellite and digital technology is where the future lies," says Littardi. "But there are three big question marks. First, we can't be sure of how good reception will be in urban areas. The signal can be blocked by buildings, tunnels and so on. Worldspace says there are solutions, such as earth-based retransmission of the signal." But this would make the system too expensive.

> 'The combination of satellite and digital technology is where the future lies'

The second, perhaps most important question, is whether people will buy the receivers. "It's a gamble because all new technology penetrates the market at the top, in the rich countries, and then spreads downwards, first to the elites in the poor countries, and then to the rest of the population," says Littardi. "Worldspace is trying to do the opposite. It will all depend on the selling price of the receivers."

Samara reckons that the consumer will have to pay about $200 to start with, "which is an astronomical sum for most Africans. But even if the price never drops, there are already 300 million households which can afford it in the area we're covering. And in five years, it should be selling for under $50."

Lastly, says Littardi, "how much are the broadcasters willing to pay? Renting space on all three satellites will cost us several million dollars a year. Such an investment will only pay off if we can resolve the first two questions. So we're waiting to see what happens."

They're not the only ones. Worldspace has already rented out frequencies to several national radio networks and signed partnership agreements with major media groups, but most broadcasters still have to be convinced. "We've negotiated less than a fifth of our capacity," says Samara. "We start turning a profit when we can rent out a frequency at $50 an hour. But we're also counting on income from things like agree-

Each of the three satellites covers three areas.

ments with broadcasters to share advertising revenue or from selling subscriptions to personalized services."

He also seems to be counting on backing from international donors, thanks to the Worldspace Foundation, created in 1997 with a $1.5-million corporate donation. The aim is to find partners to make five per cent of the frequencies available for educational and development programmes, starting in Africa.

"Worldspace, UNESCO and other international bodies, non-governmental organizations and governments are working to identify the best programmes to promote peace, health, and environmental concerns as well as the rights of women and children," says Samara. Easier said than done.

Bernard Loing, president of Atena, a distance education organization, cites the Olympus satellite experiment in Europe in the late 1980s. "We paid a lot of attention to what we were offering, but not much to the needs and wishes of our potential customers. We knew how to beam a second-year university chemistry course but we didn't know who would be interested in receiving it. We can't do that kind of thing again. Programming must be geared to demand."

This is why Worldspace is consulting education ministers in Africa, as well as experts and professionals in the communications industry. No one knows what the programme content will be yet, but the priorities have been set, including training teachers in remote areas and small communities and continuing vocational training, especially for women who want to set up small businesses. However, Worldspace has yet to finalize any financing agreements on renting frequencies or buying the receivers. . . . ■

Sophie Boukhari

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Noah Samara — a businessman with the missionary spirit

Forty-one-year-old Sudanese-Ethiopian businessman Noah Samara spent his childhood in Ethiopia,a country steeped in mysticism and the place where the idea of African unity took shape. "The most beautiful childhood memory I have dates back to the early 1960s, when I was seven. My father took me to the United Nations Economic Commission for Africa where the OAU (Organization of African Unity) was created. Addis Ababa was seething with excitement. Nasser, Nkrumah, Kenyatta, Senghor, all the giants were there. I remember them planting trees with Haile Selassie to symbolize African unity. It's incredible to think how much hope there was."

© Worldspace, Washington

But then disillusionment set in, and Samara left Ethiopia to study abroad. "I went to school in England and the United States and forgot everything." But he learned new things. "America taught me not to be afraid of dreams and that collective will begins with the individual." To cut a long story short,living in the United States helped him ally his desire for personal success with his childhood dreams. "Doing business is fantastic when you can combine it with doing something good for society. Many people are convinced that doing good is not compatible with making money. But I don't agree."

Samara had a career with the International Telecommunications Union before deciding to return to Africa to cure it "of a disease that is probably more serious than Aids"—the lack of infrastructures that would democratize access to information. "This situation is unacceptable and has created a vicious circle of dependence. I feel that an African Renaissance is going to happen and I am convinced that it will be caused by things like Worldspace. What we want to do is bring about a vertical globalization of information, affecting not just the elite but going all the way down to grassroots level. You need a critical mass to make a change. And how do you get a critical mass? Through mass media."

S. Bou. ■

Fiat Linux

A beacon in the world of free software, Linux is used by an estimated seven million people worldwide. Enthusiasts say this operating system is a refreshing alternative to commercial software.

When Linus Torvalds created a "free" *operating system* called Linux in 1991, little did the young Finnish student imagine he would become the standard-bearer of a crusade to preserve the openness and co-operative spirit that have been the basis of the Internet's and the World Wide Web's success, in the face of "big, bad Bill Gates's" schemes to make them part of his empire.

Defenders of the spirit of the networks, which grew out of public research, say information technology can and must be at least partly protected from market forces. At stake are the free movement of ideas and the dynamism of research. "Free software is an area of technical work, but above all, it is a matter of ethical philosophy," says Richard Stallman, an American computer pioneer and head of the Free Software Foundation.

"Computer programmes can be naturally duplicated to infinity, like theorems," says Bernard Lang of the French Institute for Computer and Automation Research (INRIA). "But nowadays the rules of the material world are being imposed on the immaterial. Research is controlled by a few software companies. They use proprietary *standards* and *formats*, which nobody understands, to cling to their monopoly. As a result, they are forced to constantly change their products before other companies figure out how they're made. This control over standards kills competition and fetters creativity, whereas freeware is a source of constant innovation."

> Freeware is a source of constant innovation

Linux proves the point. Available free of charge on the Internet, it is part of cyberhumanity's shared heritage. The programme uses public standards, is close to the Unix operating system and works equally well on a Mac or a PC and even on slower computers. Linux meets three freeware criteria. Its *source code* is available, so anyone can take part in developing it or can modify it to suit their needs; it can be freely copied and redistributed; and anyone can improve it, as long as they make the source code for the changes available to everyone.

"Linux isn't just one big entity," says Robert Young, president of Redhat Software, an American firm that distributes the product. "It's a collection of lots of little parts. Each has its own team of programmers on the Internet and a team leader who approves or rejects the alterations suggested. And the ultimate boss is Torvalds."

Linux enthusiasts, most of them engineers and science students, unanimously laud the product. "It's quick, compact and very secure—a huge asset if you want to create a patent data base or a secure payment system. It's a far cry from the Microsoft equivalent,Windows NT, which has security gaps," says Jean Roure of Acticiel, a French company that designs websites. "Personally, I'm not waging war on Microsoft," he adds. "I just want to give my customers the best of the Internet and Linux lets me do that. If a private firm came up with a better offer, I'd pay the price."

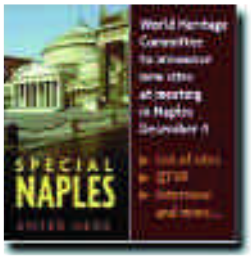
"We're fighting Microsoft, the most aggressive firm and the one best at marketing its products," says Young. "So why are

Website of the month

http://www.unesco.org/whc/accueil.htm

Le Patrimoine Mondial

(The World Heritage)



What do the Great Wall of China,Mont Saint Michel,the rice paddies and terraces of the Philippines, Timbuktu and the Grand Canyon have in common? They and other world heritage sites are waiting for you on UNESCO's website!

If you want to do more than just visit,the website will answer all your questions about this truly universal and changing concept,such as:what is the World Heritage List and how does a site get on it? what legal instruments help protect the sites? which sites are the most threatened, and why? As a bonus, you can view a superb on-line photo exhibition on nomads in Africa.Other new features include the classification of sites by topic (for example, cave art,industrial heritage, cultural landscapes) and a question and answer page.

companies turning to Linux? Because it doesn't crash and it works very well. And why is it so good? Because it has the world's biggest team of software engineers who are constantly improving it, just for the love of it." That's the spirit of the cyber-community. "Free software is a community project and everyone who depends on it ought to look for ways to contribute to building the community," says Stallman. People who work on it don't make money but they do earn a reputation—not such a bad deal. Torvalds was an unknown student in Helsinki. Because of Linux, every firm in Silicon Valley wanted to hire him when he graduated. Today he is working at Transmeta, a new American high-tech company.

Another big advantage Linux offers is efficient "after-giveaway service." "If you have a problem," says Roure, "you log on to a discussion group and even at two in the morning you'll always find someone who knows someone who has an answer. It's free and takes 20 minutes. If there's a hacker attack, for example, the group will tell you 'here's how to defend yourself.' It's invaluable. With commercial software, you're completely at the company's mercy and it may be weeks before you get an answer."

Another fan is Lectra-Systèmes, the world's leading computer-assisted textile manufacturer, which recently started using Linux. "The system is generally popular with our customers," says Pierre Ficheux, a senior executive with the company, "especially the ones who don't know anything about computers and think it's Windows!" With no head office, no stock exchange quotation and no advertising visibility, Linux makes some people feel uneasy. "We don't use Microsoft much, but we've kept it to reassure our customers," says Roure. "People think anything that's free must be irresponsible."

Linux's main drawback is its complexity. "Most computer-illiterate people don't know how to use it, although installation is getting easier and the number of simple, automated office-type applications is on the rise," according to Roure. "It's still primarily used for complex applications like setting up network servers or for simulation. By the way, it was used to create most of the special effects in *Titanic*."

Young explains, "Most companies want a specific application—for example a firm of architects wants a drawing programme—and only afterwards bother about what operating system it uses. Linux has far fewer applications than Windows and that's the main problem. But it's only been in professional use since 1995 and things are changing very quickly."

The outlook for Linux is bright. A number of private firms are starting to live off it. They are prospering and creating jobs by offering Linux users services for a fee. A case in point is Redhat Software, with 40 employees and a $6 million turnover in 1997, a figure expected to rise to $10 million this year. Founded in 1995, Redhat specializes in custom-made systems and sells Linux on a CD-ROM updated every six months. "We're playing with 450 programmes," says Young, "including commercial software compatible with Linux. We put it together according to our customers' needs and set an overall framework. In 1997 we had 150,000 customers, 80,000 of them in the U.S. and 50,000 in Europe. Our CD-ROM costs $50, or nothing if you download it from the Internet, which is what most of our two million or so users do."

> Linux's major selling point: efficient 'after-givea way' service

So why pay? "It's like asking people who buy bottled water why they don't drink it out of the tap. The answer is that they don't trust it. We're also selling simple installation as well as trouble-shooting in case of a problem."

Young is keeping a cool head under his red hat. The battle against the Microsoft empire has not been won yet. "So far they haven't caused us any trouble," he says. "That's a bad sign. They see us as an interesting, but not very threatening experiment. We get far more new customers from Unix than from Microsoft. We're also expanding the software market by cutting the cost of technology." ■

Sophie Boukhari

On the Web

You can find the playful Penguin family, Linux's mascot, frolicking on the Web. With a cheerful gleam in his eye, the favourite son (right of title) is the most commonly used logo.
http://www.tele.dtu.dk/~riis/linux/logo/penguin/images.html

Linux on the Web:
http://www.linux.org/
http://www.eklektix.com/lwn/
http://www.ssc.com/
http://www.linux-france.com/

Glossary

Format: a way of arranging the characters and "bits" which make up a computer language.

Free software (also called *freeware*): computer programmes that can be downloaded from the Internet free of charge.

Operating system: software essential to the operation of every computer, which enables it to perform basic tasks such as file management, display, input and connecting to a network.

Source code: lines written in computer language which enable software to be written. Commercial programmers do not reveal their source code, but turn it into an "executable" code which only the computer can understand.

Standard: a computer language norm that can be protected by copyright (proprietary standard) or be in the public domain (public standard).

Youssou N'Dour
Africa's world musician

The rise of a star

With his round face, slender physique and deceptively adolescent appearance, 39-year-old Youssou N'Dour seems younger than his age.

Even though his mother was a singer, a future as a star of "world music" was hardly on the cards for a boy born in a poor district of Dakar, Senegal.His dream was to become a footballer.

His father, a mechanic, gave him a strict upbringing and wanted young Youssou to be a model child,like his 20 brothers and sisters. N'Dour, whose schooling went as far as secondary level, managed to convince him that it was possible to be a musician without becoming a juvenile delinquent. In 1979, when he was 20, he formed his own group, l'Etoile de Dakar (which became Le Super Etoile in 1981) and created his own style of music, Mbalax, from the name of a traditional Wolof dance.

It took him 15 years to win international recognition. This came in 1986 when he caught the attention of Peter Gabriel. Through Gabriel,N'Dour got to know a number of famous English-language singers who introduced him to the state-of-the-art technology of the major recording studios.

In 1989 N'Dour really reached the top in world music with his album *The Lion*, and then went on to work with pop stars like Neneh Cherry, with whom he shared a gold disc in 1994 for their song *Seven Seconds*.

Twenty-six years after he started singing, N'Dour is the author of 115 songs. His fame spread even wider when his song *La Cour des Grands* was chosen as the official anthem for the 1998 World Cup. But he has always kept his feet on the ground and keeps a cool head even when talking about issues like racism, drugs or poverty. He discusses them with the same gentleness found in his songs.

S. A. O. ■

A leading figure in World Music, Senegal's Youssou N'Dour wants to use his success to aid humanitarian causes and encourage the development of talented young African musicians.

■ **You're a star of African music. But is there such a thing as African music?**

There are countless kinds of music in Africa. Every region has its own traditional sounds. Then there's modern African music, which combines local and foreign influences, and that's what I'm part of. The two currents inspire each other. Traditional music is more vibrant when modern performers make use of its potential and variety.

■ **What does music mean to you?**

It's a kind of natural force. Especially in Africa, where there's something musical in the air, in people's bodies, in the way they move. Africans don't read much. They listen. And they listen with their bodies. The first thing about a song is its rhythm. But you can use its power to convey a message, to express commitment or to make people happy.

■ **How do you write your songs?**

Fifteen or twenty of my compositions came naturally. The rest I had to work on. To write them, I shut myself away and concentrate on a single topic. Today I must say that Africa has never been so ready to assert itself on the world stage. The head of the United Nations is an African. African culture is like a moving train. Its locomotive is music which can produce universal melodies.

■ **How did you come to World Music?**

Gradually. I started out when I was thirteen, singing with friends. Then I was in a more modern group, which played traditional music on modern instruments. That way I got to play in nightclubs in Dakar. Then my music took off. It started travelling and I was invited to follow it.As I listened to other kinds of sounds, through meeting stars like Peter Gabriel, I came up with a new form of expression.

■ **What obstacles have you encountered in the course of your career?**

At first my father was against it. He said people looked down on musicians and he was afraid that might rub off on him. He didn't want to see me drinking or taking drugs. In my country, the relationship between parents and children is heavily influenced by tradition and Islam. Even after the age of twenty, children must obey their fathers. I was very young and I did a deal with mine: I'd behave myself totally as long he let me be a musician. I also thank God and my father for giving me good health and enabling me to be a role model for young people. But I don't condemn people who drink or smoke dope. Some of them are very talented.

■ **Many African musicians live in Western countries, but you don't. What keeps you in Senegal?**

My family, in the broadest sense of the word. Not just my wife and children. A family is really something. I've agreed to take over from my father and keep an eye on everything and everyone.That's what

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keeps me at home. Performers leave Senegal because there's nothing there to help them fulfil their potential. This has made me want to change things. But I can go whenever I want to. There's an airport in Dakar and you don't need an exit visa to leave.

■ **You bring the people around you into your creative universe. How do you reconcile loyalty to friends with the need for quality?**

I started from nothing. Just me and a few musicians. I really had to talk them into forming a group. At the time, everyone was afraid people would look down on them. Relatives and friends were the first people to join me. Then other people did. But first and foremost I'm a professional. When someone has to be fired I don't hesitate, whether it's a member of my family or not. It's all in the way you go about it. For example, if someone in my studio isn't getting anywhere, I tell them to go and work with the sound technicians. They soon get fed up and leave of their own accord.

■ **What are you doing to encourage artistic creativity in Senegal?**

I started a record label, Gololi, which in Wolof means the bells which horses have round their necks. It works with the studio I have in Dakar, called Xipi ("open eyes" in Wolof). The label produces seven artists a year and their work is distributed in Senegal and internationally through our partners, foreign record companies which have faith in us. That's how Cheikh Lo, a Senegalese musician I produced, was launched. The critics have given him rave reviews, and World Circuit is distributing him successfully. I'm also working so that one day Senegalese can take over the recording and technical side of their music. At the moment, we're 90-per-cent dependent on Westerners. That's not a bad thing in itself but local professionals can do better because they know the language and understand our music more quickly. So I organize training sessions, sometimes pay for courses in Paris and take young people on tour abroad. About 80 per cent of the professional performers in Dakar today started out with me.

■ **Do you think governments should help encourage artistic creation?**

The state should protect the rights of artists but let creativity develop freely. Pirating is a plague in Africa. Performers can't make a living from their own work. At least half my songs are copied in Senegal and up to 80 per cent elsewhere in Africa. Governments should fight that by strengthening and enforcing copyright

A child of the Medina

10:30.a.m., the Medina. Men and women sit chatting under the shade of the neem trees lining 15th Street, the sound of their voices occasionally drowned out by children's cries. All along the street, vendors sit under big parasols with their wares—a jumble of school textbooks, Koranic pamphlets, second-hand clothing and assorted potions—spread out on the ground in front of them. The wall of a seashore Muslim cemetery closed decades ago after it became full, is at the far end. The house where Youssou N'dour was born is just across the street.

It wasn't hard to find. "Youssou N'Dour's house? Straight on, at the end. When you get there, ask again and anyone will show you which one it is." The building where the famous singer lived until he was a teenager is having work done on it and is for the moment uninhabited.

A childhood friend, A.N., says: "Youssou N'Dour is from here. As a child, all he knew was the Medina." With a hint of nostalgia in his voice, he recalls long hours spent drinking tea together, playing football or performing with the Khandrang Jazz band,formed at the end of the 1960s with a group of friends whom the future star introduced to singing. They accompanied him on castanets.

Hardly anything is left of those days. As he became famous, the singer stopped seeing his "real" friends of old,says A.N.,hastening to add that this is because "You",N'Dour's nickname in these parts, has "bad advisers." But,he says, "he's a good guy and if he came by in his car, he'd stop and say hello to me."

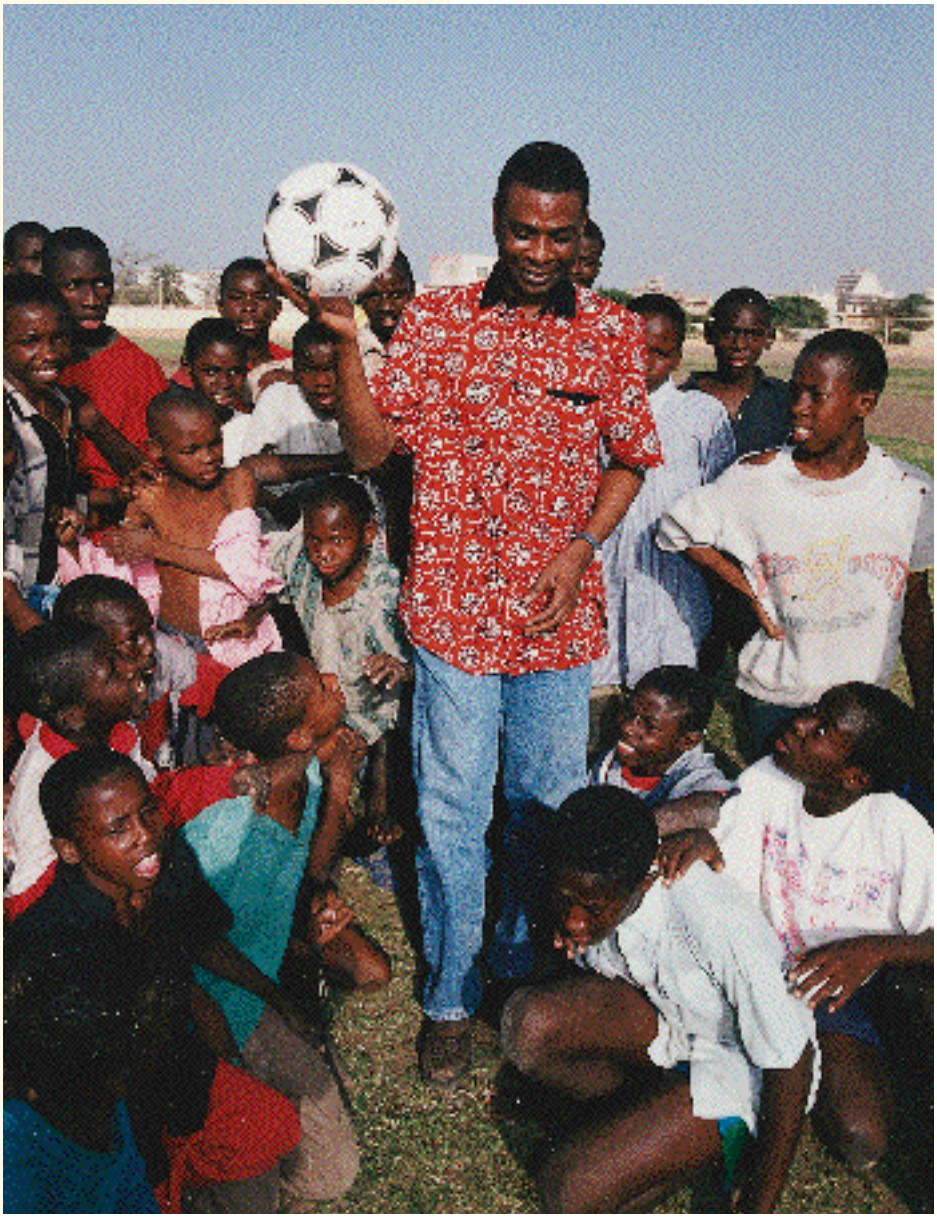
Neighbours say "You" is seldom seen these days on 15th Street. He lives in the classy suburb of Almadies, near Yoff airport. "But we'd love it if he dropped by," says one woman,obviously proud of the singer's success.

Another local, Aziz, says that if "You" was more visible, the fans would not run after him so much. Aziz, who has a degree in management from a European university and was a playmate of N'Dour's, says the singer is warm-hearted, but complains that he has not used his wealth to do anything to help relieve the Medina's chronic youth unemployment problem.

Abdoulaye Camara is permanent secretary of "Harmony and Initiative in the Medina" (Cime), an association set up last year after a suggestion made by N'Dour, its president. He sees things quite differently. "He comes to three-quarters of our meetings and if he can't make it he always lets us know," he says. Camara is proud that many people are keen to fund the activities of "You's" association. The singer, his hero, is "manna for the Medina," he says.

An onlooker adds that everyone in the Medina is fond of N'dour because of his "modesty, efficiency, kindness and sense of friendship." True or false? Aziz the young professional who wants "You" to do something specific,had never heard of the association and says when asked about its impact that he'll "believe it when he sees it."

C. T. N. ■



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laws. At the moment, if a guy is caught bringing an illegal truckload of pirated cassettes into Senegal, weeks go by before they can be confiscated. By that time, he's sold them.

■ **Why aren't you involved in distribution?**

You can't do everything—write, produce, manufacture and distribute as well. The traditional outlets are there, especially in the markets. They shouldn't be destroyed but built up with organization.

■ **Do you promote new talent by working with other African stars to co-ordinate efforts across the continent?**

Indirectly. But there isn't much co-operation. Performers can only help by finding backers at government level. Then it's a

matter for ministers of culture, who have to push through laws and make sure they're in line with regulations set up by international bodies such as the Organization of African Unity. There's no point in passing a law in Senegal if there isn't one in Mali.

■ **Is there a balanced relationship between artists from countries of the South and the labels in the North?**

Even though I'm with Sony, I think major record companies have failed, in spite of the big investments they've made in African music over the past decade. They interfere with the creative process by trying to push modern songs instead of helping artists to do their creative best. They're like banks—if you're not profitable, they drop you. I learned that lesson the hard way when Virgin dumped me. They expected me to sell as well as Peter Gabriel or Phil Collins, two of their stars. I sold a quarter of a million discs but it wasn't enough. They wanted a million.

■ **Is there an alternative to this system?**

We have to create African recording labels. Bob Marley reached the whole world because he got help at home, in Jamaica. Our music must be created in Africa, but we musn't stop travelling, meeting other artists and listening to other sounds. My dream is to change the system. When my contract with Sony expires in about five years time, after I've made the three albums I owe them, I'll come back to my own label and cut a sales deal with Sony. Whatever happens, you have to stick with an international label if you want to get distributed.

■ **You campaign for humanitarian causes, including the fight against poverty. Where do you start in Africa?**

By communicating. Everyone must have the right to voice an opinion—the poor, the rich, the middle class. They don't know each other and their paths never cross. I want to use my music to bring them together. I perform everywhere—from city suburbs to the poorest villages. When there's no electricity, we make do with a generator to try and put on as good a show as we would in Paris. Artists have power and should use it to get their messages across.

■ **Which is more important, working at the grassroots or at the international level?**

They go together. At first, I was encouraged to work with organizations like UNICEF, for which I'm a "goodwill ambassador," and Amnesty International. They opened my eyes. You see your own country clearer when you're far away. Working with these organizations gave me the idea of setting up an association in the neighbourhood where I was born, the Medina, a wonderful ragbag of contradictions. Like my music.

■ **But you left to live in a smarter part of town.**

I live in Almadies, but my heart's still in the Medina. I go back there very often, my best friends live there and there's no reason to think I won't return to live there one day.

■ **How does your organization work?**

I contribute 250,000 CFA francs (about $420) a year. We started out with an exhibition to help young people to get to know the neighbourhood's history and problems. We'd like to see the local architecture more in line with the Medina's

needs. Meanwhile, we're tackling the rubbish problem by organizing *set setal* days, when everyone joins in cleaning up—sweeping up and painting bright murals over anti-government graffiti.

■ **You're a political fireman, then. Don't you think opposition is necessary?**

Neighbourhood walls aren't the best place to protest against the government. It's better to do that through politics.

■ **You even endorsed Ibrahim Bare Mainassara's January 1996 coup in Niger by giving a concert there two months later. Why?**

I wanted to help calm things down, to make the people of Niger smile again. I'm dead against any kind of violence. It's better to have an illegal government than civil war.

■ **You campaign for human rights, yet you're in favour of polygamy. Isn't there a contradiction there?**

I'm a practising Muslim and Islam allows polygamy. Anyway, is it really a denial of human rights?

■ **It's against equality between the sexes. Are you in favour of polyandry?**

No. Anyway, for the moment I've only got one wife. But I believe religion comes before all else.

■ **Even human rights?**

Yes and no. Polygamy aside, I'm in favour of human rights. I'm against female circumcision and believe in the emancipation of women. But I also think women should remain the guardians of African values, like family harmony.

■ **People say you're a multi-millionaire. Is that in CFA francs or dollars?**

I've worked hard.But I don't measure my success in terms of money. Instead I try to make it an example for other Africans to follow. I reinvest some of my fortune to help them along that path. The World Cup song will bring in a lot of money. Some of it can be used to fund a large-scale humanitarian effort in Africa. Several associations are working on that. Nothing's decided yet, but I'd like to extend my activities to this kind of thing in Africa. We need it, don't you think? ■

Interview by Sophie Boukhari and Seydou Amadou Oumarou

Birth of a myth

Youssou N'Dour's talent and charisma are not enough to explain his international success. His breakthrough on the pop scene, which took place at the same time as World Music was catching on in the West during the 1980s, is partly the result of a non-stop communications effort. "His press attachés have succeeded in positioning him in the place he deserves," says François Belorgey, former director of the French cultural centre in Dakar. "He was already tremendously popular at home."

The singer soon "realized how necessary it is to cultivate a commitment compatible with his artistic intelligence," says Senegalese university teacher Ousmane Diakhaté. He was inspired by musicians like Peter Gabriel, a human rights activist. His sensibility did the rest. His appeal is based on the "sincerity" of his humanitarianism, says Mr. Belorgey.

His attachment to his country's culture and his climb to the top of the charts have made him a role model for local young people, adds Mr. Belorgey. They can identity with the soft-spoken native of the Medina, a poor Dakar neighbourhood. That is explained, Mr. Diakhaté says, by "the need for a myth" which appears in times of crisis, when people want to be reassured. **S. A. O.** ■

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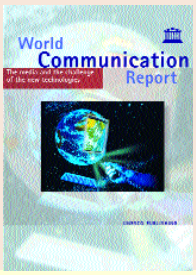

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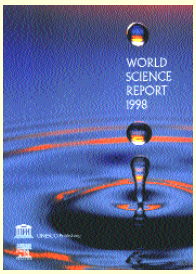

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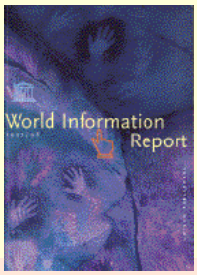

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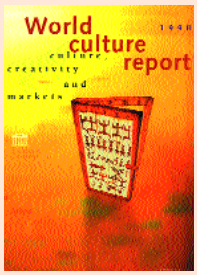

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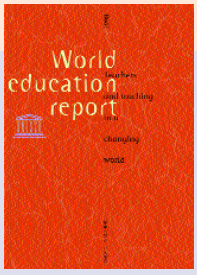

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