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Folder Title:
Ozone - Chile

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Volume 217,150,000 shares. Dow
strials 3262.75, up 11.08; transpor-
9.70, up 1.41; utilities 218.64, up

Lehman Brothers Treasury index
) 14.92.

odities: Oil $18.78 a barrel, off 10
w. Jones futures index 123.81, off
index 123.48, up 1.33.
: 125.15 yen, off 0.20; 1.6330 marks,

retaliate. (Related article on Page A10)

A spokesman for Clinton said the president-elect "stands four-square with President Bush" in refusing to tolerate Iraqi violations of U.N. resolutions.

* * *

Serbian President Milosevic offered his support for an international plan to settle the Bosnia conflict, calling on the three warring factions to make the blueprint a basis for peace. The plan calls for a sovereign Bosnia divided into 10 autonomous provinces. Milosevic was making his first appearance at Geneva peace talks that resumed Sunday.

* * *

U.S. Marines swept through Somalia's biggest arms market and confiscated weapons ranging from antiaircraft guns to assault rifles. The raid in Mogadishu — involving 900 Marines backed by tanks and helicopters — indicated that U.S. forces are broadening their mission, which initially focused on guarding food shipments.

* * *

Ross Perot launched a nationwide membership drive for his grass-roots political organization, pledging to make it a watchdog group that would monitor the performance of Clinton and Congress in cutting the federal deficit. The Dallas billionaire garnered nearly 20% of the vote in his bid for president in November.

* * *

The Supreme Court rejected an Oklahoma antiabortion group's appeal of a ruling that removed from state ballots a proposed law outlawing most abortions. In a victory for abortion-rights advocates, the justices let stand last year's decision by the Oklahoma Supreme Court that the initiative was unconstitutional.

The court left intact a $4.3 million judgment against Soldier of Fortune magazine won by two sons of a Georgia man killed after his business partner hired an assassin through a personal ad. The court also let stand a jail term for a former Florida newspaperman who refused to disclose the source of a report in a child custody case.

* * *

The U.S. government is quietly studying whether a fungus commonly found in Midwest cornfields is contaminating food with a suspected carcinogen. The FDA plans to collect samples of popcorn, corn chips, corn flakes and other corn-based products from food stores and screen them for the toxin. (Article on Page A4)

* * *

PLO Chairman Arafat declared his organization had suspended Mideast talks until Israel allows the return of over 400 Palestinians it expelled to Lebanon. According to Reuter news agency, Arafat made the statement after a meeting of Islamic states in Senegal. Arab ministers were also meeting in Cairo to discuss the expulsions.

* * *

Stormy seas battered a tanker grounded off the Shetland Islands, renewing fears that much of the vessel's 25 million gallons of crude oil will be dumped. At least seven of the ship's 12 storage tanks were "open to the sea," a salvage official said. Oil gushed 20 feet in the air as sea water forced the crude out of the tanker. (Article on Page A10)

* * *

Thousands of Muslims jammed a railway station in Bombay waiting to flee the city, where six days of Hindu-Muslim riots have killed at least 137 people. Police said 15 areas have been placed under curfew, and about 2,800 people have been arrested amid widespread looting and arson.

* * *

The State Department urged Arab nations to sign a treaty banning chemical weapons. The appeal was issued as Secretary of State Eagleburger prepared to leave for Paris, where he will join officials of about 120 countries in signing the pact. Arab states have refused to sign the treaty as long as Israel retains nuclear weapons.

* * *

The National Commission on AIDS said that almost half the people in the U.S. with AIDS are black or Hispanic, and that the epidemic must be addressed as a racial issue. A report by the panel cited racism, poverty and lack of health services as factors undercutting efforts to halt the rapid spread of the virus among racial minorities.

trading day in November.

Sheep and Trees Are Acting Strangely At 'End of the World'

* * *

People at Southern Tip of Chile Blame Thin Ozone Layer And Reach for the Sunblock

WSJ 12 Jan

By THOMAS KAMM

Staff Reporter of THE WALL STREET JOURNAL

PUNTA ARENAS, Chile — The end of the world is near in Punta Arenas. But that isn't as ominous as it sounds — or wasn't until recently.

The 125,000 residents of Chile's southernmost city, at the tip of Patagonia, have long joked about living at the world's end. But a spate of doomsday phenomena last year sometimes made the joke seem a bit too literal, and is starting to make some scientists think there might be something new under the sun here.

Two weeks after gardening barechested for half an hour, artist Rodolfo Mansilla still bears the marks of a sunburn so severe that it felt "like I'd been to Hawaii." Earlier last year, half of Radovan Vilicic's herd of 1,200 cattle were so blinded by conjunctivitis that they crashed into each other like bumper cars, and five starved because they couldn't find their feed. Jose Barria's tan horse broke out in Bambi-like white spots. "I've been a shepherd 18 years, and I've never seen anything like this," he says. "It's scary."

Sick Trees

Meanwhile, Veronica trees at Ricardo Borquez Schultz's nursery wilted and died. "It seems like a sorcerer has cast a spell," says Hernan Valdenegro, a local agriculture-ministry official.

It may be something like that — or just one big coincidence. But some here wonder: Could the world's end be seeing the beginning of what an ozone hole can do?

The odd happenings coincide with the first satellite observations that a huge hole in the stratospheric ozone layer, which normally blocks most of the sun's ultraviolet radiation, lingered over the inhabited tip of South America for a few days until the wind kicked up. "In October, we registered the lowest levels of ozone yet measured," says Felix Zamorano, a member of the Atmospheric Studies Group at the local University of Magallanes. "The ozone layer thinned to about half of what is normal for three days and fell below what's considered dangerous levels."

In fact, residents of Punta Arenas usually get less exposure to ultraviolet radiation than do your regular beach bunnies. But last fall, the people here got extraordinarily sudden variation in exposure. "What's happening here is something totally new in the world," contends Jaime Abarca, a local dermatologist. "It's as unusual as Martians landing."

A Surge in Popularity

And it is helping make cold, windswept Punta Arenas a hot place for studying ozone depletion — partly caused by chlorofluorocarbons from air conditioners and refrigerators — and how the consequent higher ultraviolet radiation affects man, animals and plants. Those effects can include skin cancer and cataracts, plus trouble for phytoplankton, the base of the marine food chain.

Intrigued by the Twilight Zone-like tales, a six-member team of U.S. scientists visited here recently. Norwegians and Russians are showing interest, too. At the University of Magallanes, a Brewer Ozone Spectrophotometer and a Robertson Berger Sunburn Meter have been installed. "Soon, we'll have more measuring equipment than red lights," says Roque Tomas Scarpa, the region's governor.

So far, many scientists aren't much concerned. Although the U.S. team noted

Please Turn to Page A8, Column 1

ways to stimulate
An increased minimum wage would hurt
says. Monsanto Co. fears greater regula
and hopes its "voluntary initiatives"
family leave and employee training
stave off additional mandated changes.

*Harry Conaway, who runs consultan
William Mercer, sees Capitol Hill
the bigger worry for business: There
"a lot of pent-up demand in Congress."*

THE OUTLOOK APPEARS MIXE
health-care hiring.

Industry employment jumped 4.1% a
ally in the 1980s, providing one of ever
jobs created. Prime Medical Servic
Austin, Texas, plans double-digit hirir
creases. Horizon Healthcare, Albuque
N.M., will recruit physical therapists.
plex Group figures to add 1,000 emplo
off from 1,700 last year. As long as A
cans have "lousy health habits," says
Mautone of Helian Health Group, M
rey, Calif., "this is a growth industry."

Overall hospital employment pr
won't grow at the same rate as sp
facilities. The Massachusetts Hospita
ciation expects total hospital emplo
for 1993 to inch up less than 2%. Tech
cal advances also slow some hiring.
ven of Tacoma, Wash., plans trimn
some areas due to productivity gains.

THE PLATE IS FULL on Capitol H

The family and medical-leave b
the first bill to be introduced in the
this year and is a shoo-in to pas
chambers, possibly in early Februar
kering is expected in the Senate,
version that emerges from Congress
to be a near carbon-copy of the bill Pr
Bush vetoed. Clinton has vowed to sig

Other measures are in the wing
revamping OSHA will get significar
tion, as Democrats and unions want
to have more input into compan
rules. Job-training programs also
focus but probably will await a revie
Labor Department's muddle of
grams. A bill to ban permanent
replacement gets strong union back
faces pressure from Senate Republi

*Republicans turn their sights
ducing waste in training progra
making sure worker-manager tea
legal.*

GOING IT ALONE: The 2,500 r
defunct Uniroyal Plastics Inc. of In
direct their own health-insurance
agreement, to stay in place until r
remain, will be managed by a b
arose from the bankruptcy pr
Local hospitals have agreed to t
care rates, says Randall Light of
Crowe Chisek, which helped creat

OOPS, NEVER MIND: The Cli
inaugural parade committee as
ated Builders and Contractors
construction workers to ride
depicting a home being built. Bu
mittee rescinds the offer two
when it finds out the "open sh
isn't solely made up of union work

UNIONS FUME over Bush's
naming of Gregory Walden to th
Commerce Commission. Mr. W
fills a vacant seat, is a cou
president. Walter Shea, presi
Transportation Trades Depart
the move "unbecoming of an
ministration" and asks Clinto
Mr. Walden.

THE TEAMSTERS' CAMPA
Diamond Walnut grows.

The 16-month-old walkout
nation's biggest walnut coope
support when Archibald Candy
of Fannie May and Fanny Fa
not to buy nuts from the c
year. "We're trying to keep o
with the union," says purcha
Randolph Schmidt. "We'll try
nuts from other sources" until
resolved.

Union members, angered
ton, Calif., company's wage
cuts, issue "Cooking Witho
featuring pecans and almonds
choice. The union pickets hol

TODAY'S CONTENTS

specifically on future hub service, although American, a unit of AMR Corp., acknowledges that it may eliminate some smaller hubs.

Passengers who live in small spoke

turboprops aren't as safe as jets, but some passengers feel queasy about flying smaller planes, particularly in heavy winds. Michael Berger, owner of All Points Travel Agency in Sioux City, says some

more delays," says John Nelson, vice president of marketing for Continental. The big, complex fortress hubs, he says, are "less consumer-friendly."

Sheep and Trees Are Acting Strangely After a Hole Opens in Ozone at 'End of the World' in South Chile

Continued From First Page

several cases of eye diseases in animals and sunburn, it found no conclusive links to increased radiation, says Oliver Schein, an ophthalmologist from Johns Hopkins University and the team leader. But, he adds, "important effects will probably take 15 to 20 years to develop."

Consequently, many here say the time to worry is now, before it's too late. "What's happening here is like AIDS from the sky," says Bedrich Magas, a professor in the University of Magallanes electrical engineering department and an environmental activist.

Mr. Schultz needs no convincing. In his greenhouse, he shows some cactus plants that are grown under double-glazed glass; they're green and healthy-looking. Then he shows cactuses that are exposed to the sun; they're red and shriveled. The same thing is happening to his Veronica trees and several varieties of flowers. And the leaves on his eucalyptus tree suddenly yellowed and dried. "This tree's been here for 25 years, and it's the first time this happened," he says. How does he explain it? "It's got to be radiation," he answers. "There's no other reason."

Blinded Sheep

Jose Bahamonde tells a similar tale. His ranch, 125 kilometers from here, offers a magnificent view of the Strait of Magellan, but many of his 4,300 sheep can't see it, or much else. About 10% of them are being treated for eye infections, and 200 of his flock went blind last year. Usually, he says, he had only a few infected animals each year, and always during the dry season. "But now it affects many more animals of all ages and happens even during the wet months," he says. "It's almost a contagious epidemic. The animals' conduct changes radically: They walk erratically, get scared, crash into each other or trees."

His explanation? "I think it's linked to the ozone layer." Local veterinarians don't know, but say the rancher's theory isn't impossible, because ultraviolet light can weaken the immune system and increase susceptibility to infection.

Back in town, Dr. Abarca says his patients with benign skin problems have suffered greater flare-ups in the past two Southern-hemisphere springs, and he has been treating a flurry of sunburn cases for the first time. "This coincided exactly with the days in which we received the greatest ultraviolet radiation," he says. The number of new skin-cancer cases is staying at 10 to 12 a year, but 25% of them are the more dangerous melanoma cancer – five times the normal proportion. "I'm personally convinced there's a relationship" with increased ultraviolet radiation, he says, "but to conclude this scientifically would take greater methodology."

Local authorities don't want to draw conclusions based on a few strange happenings. "I don't deny the facts, but I can't tolerate people making categorical statements without scientific basis," Gov. Scarpa says. Anyway, he adds, there's little he can do, because Chile's CFC emissions are minimal and a recent 87-nation accord to phase out CFCs by 1996 does nothing about those already in the atmosphere. "What do you want to do?" the governor asks. "We can't put the whole region under a roof."

Playing It Cautious

Nevertheless, no one here is taking unnecessary chances. The Cruz del Sur pharmacy is selling 40% more sunblock than last year, especially the very protective factor 25 type despite its $15-a-tube cost. "People don't care about the price," says Claudia Diaz, a saleswoman. At Optica Magallanes, sales of sunglasses rose 30% last year. "Customers want the darkest glasses possible, with UV protection," says Dora Trinanes, a saleswoman. A local farmer is trying to design sunglasses for sheep.

Mr. Magas has set up a "sunburn hot line" that gives callers the latest ultraviolet readings; three local radio stations beam them, too. Some schools advise students to wear a hat, sunblock and sunglasses. The Rev. Francisco Petek, who heads the local meteorological observatory, recommends "going outside early and late in the day and remaining indoors at other hours."

There's something odd about a town known for its cold, windy weather doing all this. "For us, the sun is something rare, so seeing it as a risk is torture," says Patricia Stambuk, the director of a local radio station.

But there's no reason to overdo it, local authorities contend. As the university's Mr. Zamorano notes, "When we talk of Punta Arenas as the end of the world, we mean it geographically, not demographically."

Stewart Enterprises Offering

METAIRIE, La. – **Stewart Enterprises** Inc. said it filed a registration statement with the Securities and Exchange Commission for a proposed offering of 2.1 million shares of Class A common stock.

The shares, including 300,000 shares to be offered by a principal shareholder, will be sold through an underwriting syndicate co-managed by Bear, Stearns & Co. and Johnson Rice & Co. The shareholder wasn't identified.

There are 9.1 million Class A shares outstanding and 790,000 Class B shares outstanding. The rights of the Class B shares include 10-for-1 voting rights and they are not convertible to Class A shares, which carry 1-for-1 voting rights.

Stewart owns and operates 50 funeral homes and 44 cemeteries in 10 states.

How Much Cream in Ice Cream?

It's cold and creamy like ice cream but contains little or no cream. Does the less fatty frozen dessert nonetheless deserve to be called ice cream? This question now confronts the Food and Drug Administration as it begins to rethink its "standards of identity" for common food products in light of growing concerns about diet and health.

The standards, which define mandatory ingredients for hundreds of products, were devised to protect consumers against cheating by manufacturers who might, say, skimp on the cherries in cherry pie. The idea still has value in protecting the integrity of the food supply. But some of the old definitions now inhibit the marketing of healthier foods because manufacturers aren't permitted to use familiar product names.

In a welcome first step toward updating, the F.D.A. is now considering a proposal offered jointly by the consumer group Public Voice and ice cream manufacturers. It would create new standards of identity for ice cream — a term now reserved exclusively for products that contain a minimum of 10 percent milk fat. There would be new definitions, and new labels, for reduced fat, low-fat and nonfat ice cream — to replace mysterious and unappealing terms like "ice milk" and "frozen dairy dessert."

The new categories of ice cream would help encourage better nutrition. But the proposal could be improved. To protect consumers from having to pay more for less, manufacturers who reduce fat by mixing in more air or water, for example, ought to be required to say so on the label.

NYT 3/19/91 OPED

Encouraging Success in Chile

Until last year, Chile was South America's great exception — the continent's last remaining military dictatorship. Chile, which has just celebrated the first anniversary of restored democratic rule, is still exceptional — but in a positive sense. It has done more than any of its neighbors to merge democracy and market economics.

That achievement deserves U.S. encouragement. A successful Chile can be a model for a struggling region.

Gen. Augusto Pinochet's dictatorship left a legacy of human rights abuses, social inequality and private enrichment. But unlike other Latin American military regimes, it loosened the grip of special interests choking economic growth.

The Pinochet regime privatized state holdings, restricted union power and invigorated trade with new competition. Many of its changes were carried out crudely and unfairly, particularly the campaign against the unions. But the result was that a free market became a reality in Chile while remaining only a wishful slogan elsewhere. Argentina, Brazil and Mexico have yet to catch up.

The democratic Government that took office last March made a commitment to market freedom but sought to mitigate inequalities through tax reform and other means. President Patricio Aylwin's administration has restored union rights, increased social expenditures and promised compensation to victims of repression. Meanwhile, the new Government has skillfully managed relations with the military and kept inflation down. This sensible course has built support for market policies and kept faith with the poor.

Big challenges remain. General Pinochet's undemocratic Constitution needs amendment. Judicial independence needs to be secured. And some way has to be found to establish accountability for the dictatorship's crimes.

Chile will find it easier to overcome these challenges if strong economic growth can be sustained. That depends on the diversification of exports away from copper; developing new exports, in turn, requires access to world markets and investment resources.

The best way for foreign well-wishers to encourage Chile's success is to press for a revival of the faltering Uruguay Round talks on international trade. President Bush's alternative idea of a hemispheric free trade zone is second best; in the long run, it could impede access to European and Asian markets.

Chile today stands out as a notable success in a bleak neighborhood. If the developed world is now prepared to reciprocate Chile's faith in open markets, the resulting gains could inspire the neighbors.

Translators," Science Times, March 5). But any suggestion that interlingual methods linked to artificial intelligence represent a major breakthrough is certainly premature.

You mention the Tradux Corporation system as possibly proving such a point, but at the company's recent presentation in New York City, a large group of stockbrokers, journalists, translators and United Nations personnel saw no real system demonstrated at all. What those attending saw was an unused work station on a table, although some had come with disks and technical questions to test its performance.

Figures such as an 85 percent accuracy rate for translations (claims of 95 percent or even 98 percent are also heard) are misleading. Even a 98 percent accuracy rate will insure that

punctuation, these may well
errors of meaning.

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that this will prove possible
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doubtedly deserve. ALE
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New York, Marc

Treated Mosquito Nets May Offer Be

To the Editor:

Re "Outwitted by Malaria, Desperate Doctors Seek New Remedies" (Science Times, Feb. 12): The world public health community is greatly concerned with the spread of this deadly disease and with the difficulty in providing effective treatment in endemic areas at a cost that can be borne locally. The new drugs you mention cost far more than chloroquine and cannot be distributed through the primary health care network. Thus they cannot be considered part of the armamentarium to attack this disease in most endemic areas.

An important approach that you do not mention is being tested by research workers from the United States and other countries. This is to develop a community-based intervention to attack the anopheline mosquito, the main source of infection. The method is based on new, s
throid insecticides, which c
to treat nylon mosquito nets
then become effective in k
repelling mosquitoes.

Research in Africa and o
of the world over the last e
suggests the method will b
and inexpensive. The nets,
for $3 to $4 each, provide
as well as killing the mosq
cost of insecticide is abou
for a treatment that will
six months.

The Times welcomes letters from readers. Letters must include the writer's name, address and telephone number. We regret that we cannot acknowledge or return unpublished letters. Those selected for publication may be shortened for space reasons.

NYT

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229 West 43d St., N.Y.

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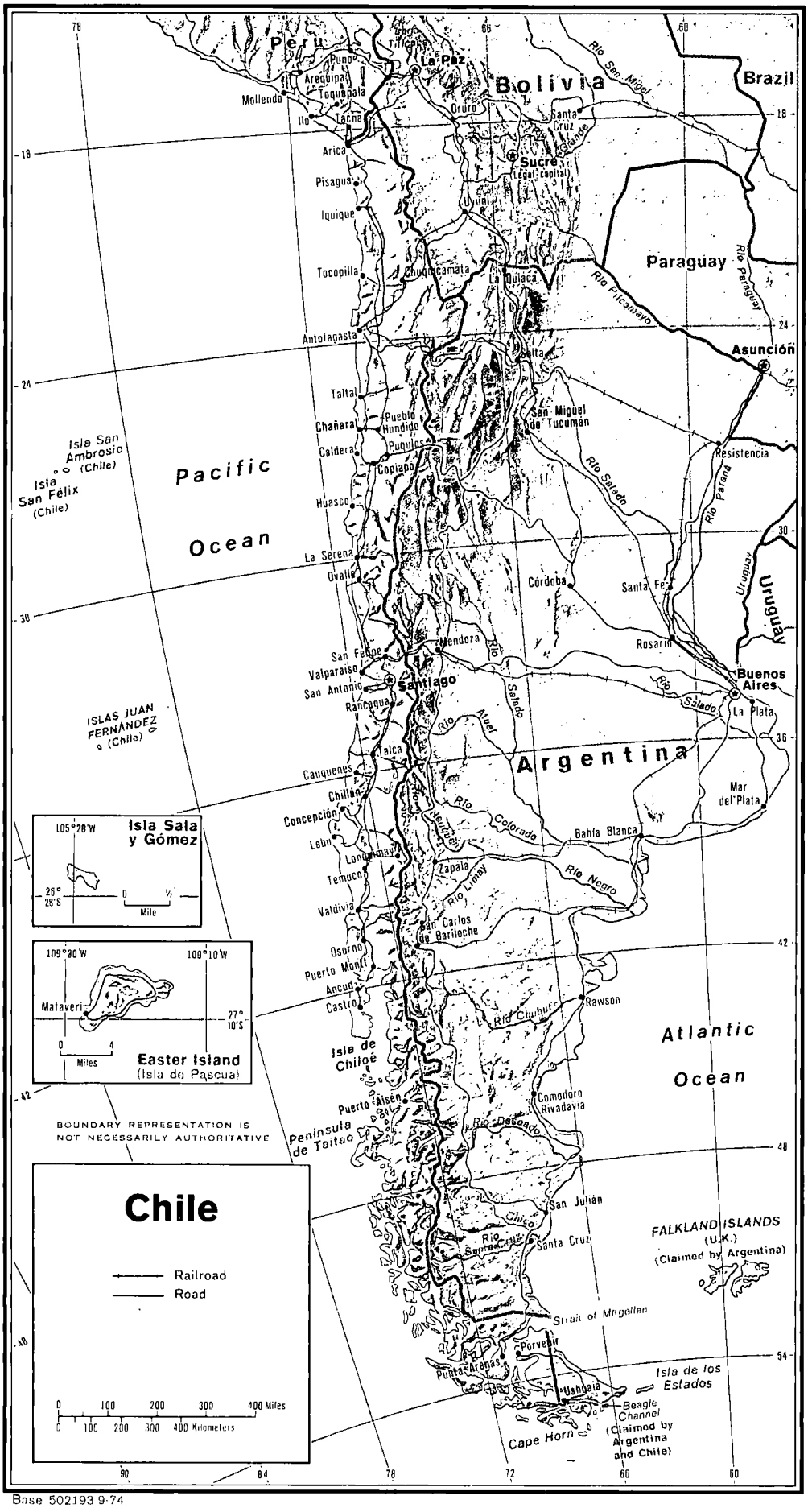
and Chief Financial O
MICHAEL E. RYAN, Senior V



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CHILE DATA SHEET

GNP 1988 (millions)	$17,308	Annual GNP Growth	5.7%
GNP 1989 (millions)	$18,295	GNP per Capita	$1,370
Life Expectancy (M)	64.0 years	Infant Mortality	19.5/1000
Life Expectancy (F)	70.0 years	Population/Physician	2,229
Literacy Rate	94%		

GOVERNMENT

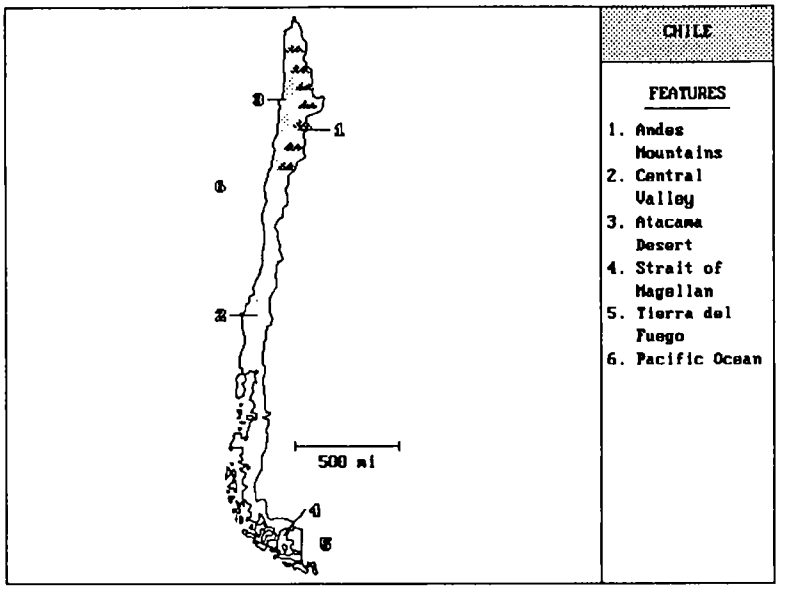
Type of Government	Republic	
Government Leaders	PRESIDENT Patricio AYLWIN (1990)	
Major Parties	National Renovation	
	Radical Party	
	Social Democratic Party	
	Christian Democratic Party	
	Party for Democracy	
	Socialist Party	
Ethnic Groups	Eur. & Mestizo	95%
	Native American	3%
	Other	2%
Religions	Catholic	89%
	Protestant & Other	11%

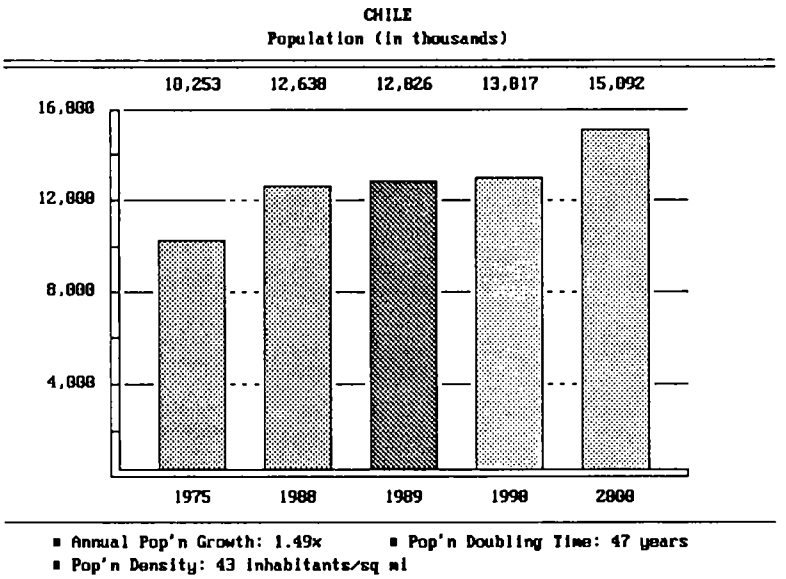
CULTURE & TOURISM

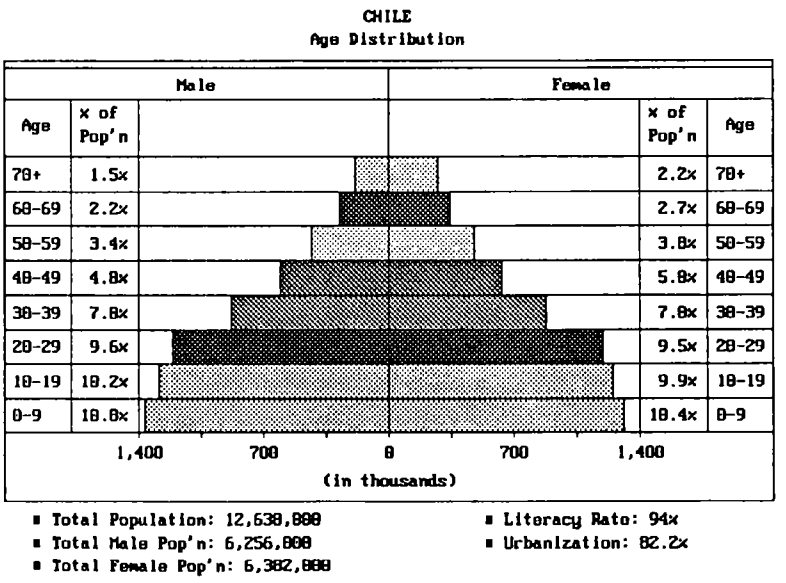
- Official Language: Spanish. English common in cities.
- Visa: Not required of US citizens staying up to 3 months.
- Health: Smog prevalent in Santiago. Conditions generally good. Tapwater potable, fruits and vegetables should be washed. No immunizations necessary.
- Sights: Santiago, Easter Island, Tierra del Fuego archipelago, Valparaiso, Chilean Lake Country, the Andes.
- Climate: Varies greatly with latitude. Sweaters and woolens recommended Apr-Nov. Topcoat or lined raincoat useful during winter. Seasons reversed from N. Hemisphere.

Currency: Chilean peso (Oct. 1990: 326.62 = $1US).
Tourist Statistics:

Arrivals (1000s)	547	Receipts (million $)	172







Source: Data taken primarily from PC Globe, Tempe, Ariz., 1989.

CHILE

In 1989 the U.S. trade surplus with Chile was $103 million, compared to a $116 million trade deficit in 1988. U.S. merchandise exports to Chile were $1.4 billion, rising $345 million or 32.4 percent compared to 1988. Chile was the United States' 34th largest export market in 1989. U.S. imports from Chile totaled $1.3 billion in 1989 or 10.7 percent higher than in 1988.

The stock of U.S. foreign direct investment in Chile was $731 million in 1988, up $388 million from 1987. U.S. direct investment in Chile is largely concentrated in banking and finance.

1. IMPORT POLICIES

Chile generally follows liberal trade and investment policies. Chile's tariff regime includes a uniform 15 percent ad valorem tariff. All tariffs are GATT bound at 35 percent ad valorem. Chile's tariff rates are low compared to virtually all developing countries. The United States will encourage Chile to reduce tariff rates further as part of the Uruguay Round.

2. EXPORT SUBSIDIES

In general, Chile does not subsidize exports. However, since 1985 Chile has instituted several new export promotion measures to help nontraditional exports which represent about 5 percent of all Chilean exports. These measures primarily intend to speed up and simplify the paper work involved in the export process.

One of these measures lets exporters defer import duties on imported capital equipment or receive an equivalent subsidy for domestically produced capital goods.

Quantitative estimates of the impact of Chilean export promotion measures are difficult to ascertain. There is no data on the promotion's impact upon Chilean exports' aggregate level compared to other Chilean economic policies.

A U.S. countervailing duty case on miniature carnations from Chile found that two of the programs exporters use combined to form a subsidy amount of 12.25 percent ad valorem.

Before Chile's new promotion plan went into effect, the United States held consultations to dissuade Chile from providing export subsidies. The United States continues to monitor the impact of export promotion programs. The United States also monitors Chile's compliance with its GATT subsidies code commitments.

3. LACK OF INTELLECTUAL PROPERTY PROTECTION

Pharmaceutical sales in Chile totaled some $150 million in 1987. Laboratorios Chile, which was privatized in 1987, has increased its market share from 12 percent in 1981 to 25 percent in 1987.

Research-based U.S. pharmaceutical companies operating in Chile indicate they are being pushed out of the market due to the lack of patent protection. Two U.S. pharmaceutical firms have left Chile. One closed its factory and four have reduced operations since 1982.

In 1986 the United States initiated negotiations to improve patent protection in Chile. The U.S. pharmaceutical industry also filed a section 301 petition in February 1988. Following additional discussions, Chile indicated it would provide patent protection for pharmaceuticals in 1989. The section 301 petition was therefore withdrawn.

Chile is in the process of enacting a new patent law that will provide product patent protection for pharmaceuticals. Deficiencies in protection including too short a term of protection, parallel impact provisions, and pricing provisions remain.

In addition, Chile's copyright law does not measure up to current Berne convention standards. The term of protection in Chile is the author's life plus 30 years, whereas the Berne standard is life plus 50 years. Video and audio tapes have been protected by Chilean law within the last few years.

The United States continues to pursue this issue with Chile. Chile was placed on the "watch list" under the "special 301" provision of the 1988 Trade Act in May 1989.

U.S. exports to Chile

U.S. agricultural exports to Chile in 1988 totaled $53 million, of which $5 million was food aid. The principal exports were corn, $22 million; wheat, $4 million; oilseeds and products, $3 million; rice, $2 million; nonfat dry milk, $2 million; and tallow, $1 million.

Chilean exports

In 1988, Chile's agricultural exports totaled $969.6 million, nearly half of which went to the United States. The principal exports were fruits and vegetables, $714.8 million (fresh grapes, $315.1 million; fresh apples, $129.1 million; fresh peaches and nectarines, $39.7 million; fresh pears, $28.9 million; various processed fruits and vegetables and juice, $202.0 million); dry beans, $28.2 million; wool, $26.1 million; lentils, $2.5 million; and wine, $22.9 million.

Chilean agricultural policy objectives

Chile's basic agricultural policy objectives are to expand exports and replace imports with domestic production. Most exports are relatively efficient; few incentives are necessary. Import substitution has been most pronounced for wheat, sugar, vegetable oils, and dairy products. The most severe impact on U.S. exports has been for wheat. In 1983 the United States exported to Chile over 1 million tons of wheat, valued at $159 million; in 1986 the United States shipped 68,000 tons valued at less than $17 million.

Government efforts to promote investment are also likely to be targeted to export industries or those that compete with imports. In particular, the irrigation law enacted in 1986 gives preference to fruit and vegetable production.

Import policy

Chilean wheat, sugar, and vegetable oil production receive protection from the import price band policy. A government corporation, COTRISA, buys domestic production to the extent necessary to guarantee a minimum producer price. Floor and ceiling prices are set for imports and related to a 5-year moving average of representative international prices. The floor level has declined in recent years. For example, for Marketing Year (MY) 1985/86 (December/November) the floor level was $218 per metric ton; for 1986/87, $211; for 1987/88, $186; and for 1988/89 the Government reduced the price to $180. However, as long as the band remains far higher than current international prices, the Chilean wheat farmer enjoys a margin of protection provided by a levy to bring the price of imports up to the floor.

Since 1983, when this import price band policy was reinstituted for wheat, wheat production has expanded from less than 600,000 tons per year to 1,800,000 tons in 1986/87, while imports, most of which were from the United States, dropped from 1,158,000 tons to a level of less than 50,000 tons. The import price band policy applies also to sugar and to vegetable oils.

All products are subject to a 15-percent ad valorem customs duty. Beef imports are subject to minimum customs values in order to offset alleged dumping. Dairy products, like all imported goods, have a customs reference price to avoid underpricing by the importer. Some products are also subject to discretionary import licensing. Preferential duty rates apply to imports from the 10 other Latin American countries which are members (in addition to Chile) of the regional economic association (ALADI).

All commodities imported or produced domestically are subject to a value-added tax of 16 percent.

Export policies

Chile has used progressive devaluation of the peso as a means to promote exports generally. There is also a 10-percent drawback on exports valued at up to $8.0 million per year and a 5-percent drawback on exports valued at $8.0 million to $12.10 million. Various other programs to facilitate exports may be made available to individual enterprises, but an intensive analysis of individual company records would be required to determine whether they are being utilized. For example, the U.S. Department of Commerce, after a comprehensive investigation of U.S. allegations of export subsidies for the cut flower industry, found that subsidies were provided to flower producers or exporters through two programs: the Stamp and Seal Tax Exemption for exporters (SST) and the Export Rebate (Simplified Drawback).

Forest products

Chile is becoming a major competitor with U.S. exports of certain forest products, especially structural wood products. The Government provides a 75-percent subsidy for tree planting, pruning, trimming, and administrative costs. From 1974 to 1985, the Government contributed a total of $58.8 million for these activities. Government support in 1988 was estimated at $6.5 million. Radiata pine is the dominant tree planted, and is already competing with U.S. exports to the Caribbean and Asia. Chilean exports will increase when trees mature in 1995.

Government Support for Exports

Commodity	Nature of Support	1988 Exports (US$ Million)
Nontraditional export products, i.e., those for which exports averaged $2.5 million or less in 1983/84	10% tax drawback on up to $8.0 million in exports; 5% drawback on exports from $8.0 million to $2.10 million	209
Sawlogs, pulp-logs, wood chips, lumber, and panel products	75% subsidy on planting, pruning, trimming, and administrative costs (estimated subsidy in 1986: $7.0 million)	311
Cereals (mainly corn)	State trading; production incentives	n.a.
Textile fiber (mainly cotton)	Same as above	n.a.

n.a. = not available

Trade Practices Impeding Imports From the United States

Commodity	Policy or Practice	Reason for the Barrier	1988 Imports From the U.S. (US$ Million)
Wheat	Import price band and levies	To promote domestic production and save foreign exchange	4.3*
Vegetable Oils	Same as above; also preferential import duties for ALADI member countries	Same as above; trade agreement	1.3
Cotton	Same as above	Same as above	0.8*

* See p. 2 for explanation.

Market Opportunities

Commodity	Constraint to Trade	1988 Imports From the U.S. (US$ Million)
Corn for feed	Lack of foreign exchange; domestic and foreign competition; slow income growth; periodic licensing/plant quarantine problems	22.3
Rice	Same as above	1.7*
Beef, pork, Offals, animal fats	Same as above	1.1
Breeding chicks, animals, embryos, semen	Same as above; periodic animal health problems	1.1
Flavoring-syrups and extracts, beverage bases	Lack of foreign exchange; slow income growth	8.7

* See p. 2 for explanation.
Note: Trade data are U.S. export statistics; Chilean trade data unavailable

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background notes

Chile

United States Department of State
Bureau of Public Affairs

September 1988

Official Name: Republic of Chile

PROFILE

Geography

Area: 756,945 sq. km. (302,778 sq. mi.); nearly twice the size of California. **Cities:** *Capital*—Santiago (1987, metropolitan area pop. 4.7 million). *Other cities* (metropolitan areas, 1987)—Vina del Mar–Valparaiso (580,000), Concepcion–Talcahuano (529,000), Temuco (220,000), Antofagasta (206,000). **Terrain:** Desert in north; fertile central valley; volcanoes and lakes toward the south, giving way to fjords, inlets, canals, twisting peninsulas, and islands; Andes Mountains on the eastern border. **Climate:** Desert in north, Mediterranean in center, cool and damp in south.

People

Nationality: *Noun and adjective*—Chilean(s). **Population** (1987): 12.5 million. **Annual growth rate:** 1.6%. **Ethnic groups:** Spanish-Indian (mestizo), European, Indian. **Religions:** Predominantly Roman Catholic, Protestant, small Jewish population. **Language:** Spanish. **Education:** *Years compulsory*—8. *Attendance* (1986)—3,274,491. *Literacy*—92.3%. **Health** (1986): *Infant mortality rate*—18.1/1,000. *Life expectancy*—68.2 yrs. **Work force**(4,366,800, Jan. 1988): *Agriculture, forestry, and fishing*—21.1%. *Industry and commerce*—32.4%. *Services (including government,* 12.0%)—27.7%. *Mining*—2.0%. *Construction*—5.3%.

Government

Type: Republic. **Independence:** September 18, 1810. **Constitution:** 1981.

Branches: *Executive*—president. *Legislative*—military junta, to be replaced by partially elected legislature in 1990. *Judicial*—Supreme Court, courts of appeal, military courts.

Administrative subdivisions: 12 numbered regions, plus Santiago metropolitan region, administered by intendants. Regions are divided into provinces, administered by governors, and provinces into municipalities, administered by mayors.

Political parties: National Party; National Renovation; Democratic Radical Party; Humanist Party; National Advance; Liberal Party; Green Party; Christian Democratic; Social Democratic; Party for Democracy; Radical Party; Party of the South. The Communist Party is prohibited by the constitution.

Suffrage: Everyone 18 and over, including foreigners who have been legally resident for more than 5 years. No elections since 1973; last national vote was September 1980 plebiscite to approve new constitution; 5 million have registered so far for 1988 plebiscite.

Central government budget (1988): $5.7 billion.

Defense (1988): $0.7 billion or 3.6% of GDP.

Flag: Divided in half horizontally—the upper left third blue with a white star; the upper right two-thirds white; the lower half red.

Economy

GDP (1987): $18.4 billion. **Annual real growth rate** (1987): 5.4%. **Per capita GDP** (1987): $1,465. **Avg. inflation rate** (1987): 21.5%.

Natural resources: Copper, timber, fish, iron ore, nitrates, precious metals, molybdenum.

Agriculture (10% of GDP): *Products*—wheat, potatoes, corn, sugar beets, onions, beans, fruits, livestock. *Arable land*—6.6%. *Cultivated land*—2.5%.

Industry (21% of GDP): *Types*—textiles, metal manufacturing, food processing, fish processing, pulp, paper, wood products.

Trade (1987): *Exports*—(f.o.b.) $5.2 billion: copper, molybdenum, iron ore, fishmeal, fruits, forestry products. *Major markets*—US 21%, Japan 10%, FRG 9%, Brazil 9%. *Imports*—(c.i.f.) $4.4 billion: petroleum, machinery, vehicles, electronic equipment, consumer durables. *Major suppliers*—US 19%, Japan 10%, Brazil 9%, FRG 8%, Argentina 4%.

Fiscal year: Calendar year.

Official exchange rate (adjusted daily according to inflation): 245 Chilean pesos = US$1 (April 1988).

Economic aid received (grants and loans, 1949–87): *Total*—$3.5 billion, of which only small amounts for disaster relief and surplus food in recent years.

Membership in International Organizations

UN and several of its specialized and related agencies, Organization of American States (OAS), Organization of Copper Exporting Countries (CIPEC), Group of 77, Latin American Integration Association (ALADI), Economic System for Latin America (SELA).

CHILE - ECONOMIC TRENDS

INDEX

Embassy of the United States
Santiago, Chile
May, 1990

Prepared by Christopher Lynch

KEY ECONOMIC INDICATORS

In millions of U.S. dollars unless noted

	1987	1988	1989
Domestic Economy			
Population (thousands) (*)	12,527	12,730	12,900
Population growth (%)	1.6	1.6	1.6
GDP in dollars (billions)	18.4	22.1	25.5
Per capita GDP, current dollars	1,465	1,750	1,979
GDP (CH$ billion in 1977 Prices)	398	428	470
% change	5.7	7.4	10.0
Consumer Price Index (% change)	21.5	12.7	21.4
Production and Employment			
Labor force (thousands) (*)	4,355	4,550	4,675
Unemployment (*)	7.9	5.9	5.3
Industrial production (% change)	6.4	7.0	10.0
Govt. deficit as % of GDP	0.8**	0.3**	0.1**
Balance of Payments			
Exports (F.O.B.)	5,224	7,052	8,080
Imports (F.O.B.)	3,994	4,833	6,502
Trade balance (F.O.B.)	1,230	2,219	1,578
Current-account balance	-750	242	-905
Foreign direct investment±	497	117	262
Foreign debt	19,000	17,900	17,400
Debt payments	2,130	2,167	2,766
Debt payments as % of merchandise exports	40.8	30.7	34.2
Foreign exchange reserves	1,871	2,550	2,943
Average exchange rate for year	220	245	267
Foreign Investment			
Total authorized ±±	563	1,950	2,959
U.S. share (%)±±	82.5	45.0	53.4
Total materialized ±±	497	787	898
U.S. - Chile Trade ±±±			
U.S. exports to Chile (F.A.S.)	796.0	1.002	1,411
U.S. imports from Chile (C.I.F.)	1,104.0	1,393	1,308
Trade balance	-308.0	-391	103
U.S. share of Chilean exports (%)	21.1	20.0	16.2
U.S. share of Chilean imports (%)	19.9	21.0	21.7

Principal U.S. exports (1989): Mining machinery, fertilizers, computers.
Principal U.S. imports (1989): Copper, fresh fruits, gold.

Sources: Central Bank, National Institute of Statistics, and Embassy estimates. (*) Year-end values (**) IMF definition (±) BOP: includes fresh capital only, (±±) Also includes associated capitalized credits. (±±±) U.S. Department of Commerce data.

SUMMARY AND OVERVIEW

President Aylwin assumed office on March 11 under generally favorable economic conditions. The structural reforms implemented by the military government resulted in a growing vibrant economy during the second half of the 1980's as opposed to what was a "lost" decade for most of the rest of Latin America. The smooth transition to a democratically elected government appears at this early stage to have bolstered confidence in the economy.

During the campaign, President Aylwin committed himself and the parties that supported him to maintaining responsible economic policies while improving social programs. That commitment has already seen concrete expression in the agreement naming the independent Central Bank governing board, proposed changes to the labor regulations, and tax reforms to pay for increased social spending. President Aylwin has also named an excellent team of economic advisors, led by Finance Minister Alejandro Foxley and Economics Minister Carlos Ominami.

The major near-term challenge is dealing with higher levels of inflation and increased imports as a result of excessively expansionary policies carried out by the Pinochet government before the 1988 plebiscite and 1989 elections, apparently in an attempt to influence the outcome of those elections. The first major decision of the newly independent Central Bank was to raise interest rates to slow demand and take liquidity out of the economy. Both inflation and imports have begun to show signs of slowing as a result of the adjustment measures, although the "monetary adjustment" will have to be managed carefully to avoid an unintended peso revaluation and an excessive build-up of short-term foreign debt. The current adjustment may slow growth for the year to the 4-5 percent range.

In the longer term, Chile's balance of payments situation will set an upper bound to the country's potential growth. Although foreign debt levels have fallen, resumption of amortization payments in 1991 has led the Chilean authorities to begin discussions with foreign creditor banks on some $5 billion in debt. Throughout the early 1990's, the authorities will need to restrain import growth and seek out additional foreign investment.

Another challenge will be improving the health of the banking system and the Central Bank. The system has improved over the past few years, but bad debts purchased by the Central Bank remain a burden on that institution's balance sheet, limiting future monetary policy options.

PART I: CURRENT ECONOMIC SITUATION AND TRENDS

The Policy Context

A broad agreement on economic policy before the December 1989 election led to a very positive investment climate, setting the stage for continued solid growth of the economy. However, monetary, fiscal, and foreign exchange rate policies in 1989 were highly expansionary. The extra stimulus quickly led to an increase in inflation and a sharp increase in imports, forcing the newly independent Central Bank and the newly elected Aylwin government to take contractionary measures.

Political Environment: Chile successfully made the crucial step towards democracy by holding free and competitive elections on December 14, 1989. The potential uncertainty associated with such a change scarcely had an effect on the economy. As was noted in the October 1989 Economic Trends, the political parties had substantially narrowed their differences on economic policy before the elections. All of the major parties supported maintaining the export-led market-oriented growth strategy. At the same time there was the recognition that neglected social programs needed to be rehabilitated, consistent with available tax revenues. The parties differed on tax policy and the role of the state in promoting economic growth and providing social services. The convergence on economic policy led to a favorable investment climate, allowing continued growth despite the uncertainties associated with such a significant transition.

There were also two key political compromises before the election that demonstrated the ability of the political parties to cooperate on matters of national interest. The first was the agreement on constitutional reforms, which were overwhelming approved by the voters in a July 31, 1989 referendum.

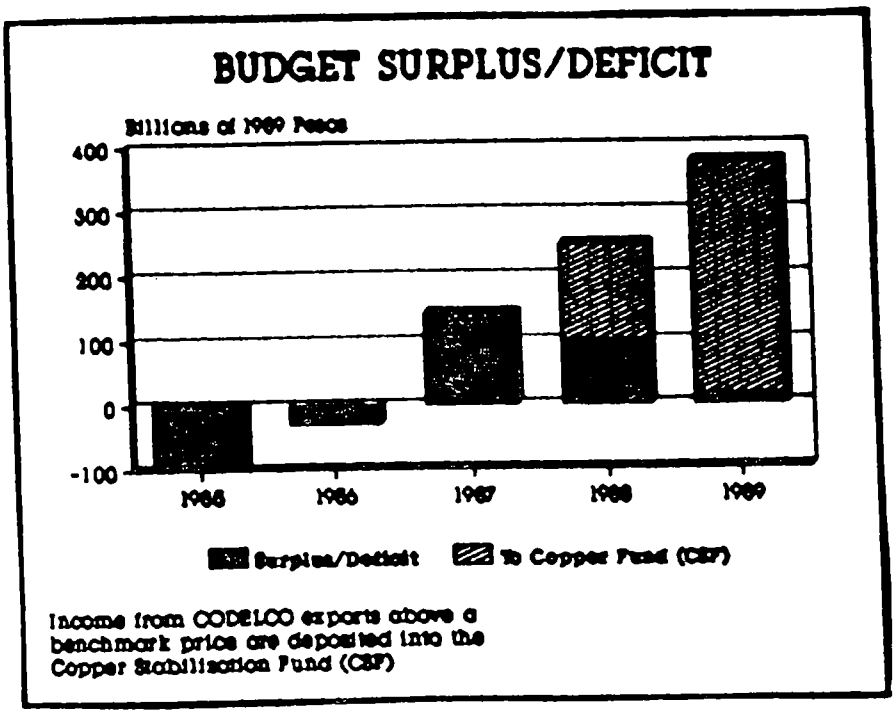
The second key compromise was the nomination of five Counselors to a the first governing board of the newly autonomous Central Bank. The 1980 Constitution provided for such an institution but a law was not formally passed until August 1989. Current Finance Minister Alejandro Foxley and then Interior Minister Caceres worked out just days before the election an arrangement whereby President Pinochet would name two counselors and the Aylwin coalition two. Both mutually agreed on independent Andres Bianchi to be President for a two year term.

Once in office, President Aylwin and his team moved quickly to demonstrate their commitment to sound economic management. One initial step was to move on tax policy

(discussed under fiscal policy). Another step was to continue the process of bringing Chile into greater accord with international standards of treatment of intellectual property rights. The Pinochet government passed in January a bill to bring pharmaceuticals under Chilean patent protection. The implementing regulations could improve a number of deficiencies in the law, and the Aylwin government has committed itself to the principle of effective intellectual property protection.

The Aylwin team also supported a business-labor dialogue on ammending the labor code. Both sides agreed on a series of changes to permit greater freedom for unions to organize and strike. At the same time, both sides agreed to boost the minimum wage from 18,000 to 26,000 pesos monthly and to increase family allowances.

Fiscal Policy: Because of record high copper prices in 1989, the government ran a significant budget surplus of $1.259 billion, or some 5.0 percent of GDP. The World Bank Structural adjustment loans require that amounts over a benchmark price be placed in the Copper Stabilization Fund (CSF) which can be drawn on if copper prices should fall below the benchmark price. In 1989, some $1.203 billion was deposited into the CSF. The remaining surplus of $56 million was smaller than the $405 million recorded in 1988 (again after taking out contributions to the Copper Stabilization Fund). The 1989 budget also included some $643 million from the sale of assets, primarily one-time receipts from privatizations.



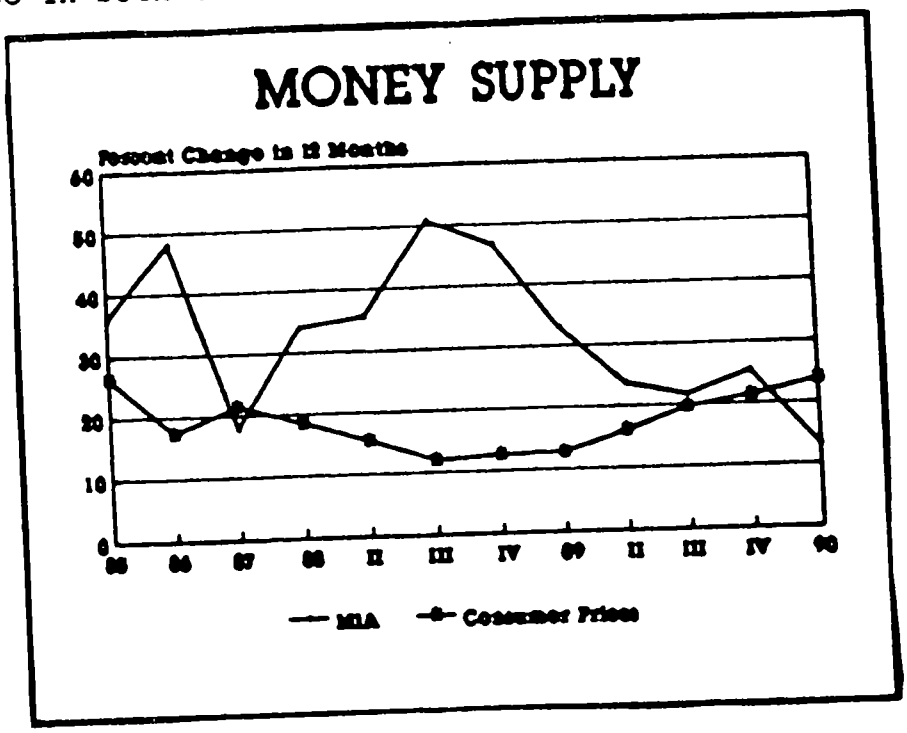
The 1990 budget, passed by the Pinochet government, provided for a 12 percent real increase in expenditures, primarily to cover debt service on money owed to the Central Bank. Social programs received a three percent after inflation increase in budget, but the bulk of the increase was directed towards funding an 11 percent increase in housing programs. Soon after the Congress formally convened, it became apparent that the budget for the Congress did not include money for travel, per-diem, or staff for the elected representatives. On the income side, the budget was prepared with an unrealistic estimate of a 21 percent increase in taxes, based on only 4.5 percent GDP growth. The budget also assumed $427 million in income from privatizations, which have been suspended by the Aylwin government pending a review of the program. Finance Minister Foxley estimates the shortfall at $380 million, or 1.4 percent of GDP.

To cover the deficit, Finance Minister Foxley and Economic Minister Ominami reached an agreement with the key opposition party on a tax reform package to finance increased expenditure on social programs. The package calls for an increase in the tax on undistributed corporate profits from 10 to 15 percent, and increase in the value added tax from 16 to 18 percent, and a change in the tax assessment scheme for certain kinds of partnerships in agriculture, mining, and transportation. By official estimates, the package should raise some $600 million annually. In addition, the government is negotiating with the Word Bank and Inter-american Development Bank for funds to cover increased social spending until the tax reform takes full effect.

Monetary Policy: The first half of 1989 was spent in reducing the overhang from the rapid increase in the money supply preceding the 1988 plebiscite. By using open market operations, the Central Bank gradually reduced M1A growth from a 55 percent rate in October of 1988 to 22 percent in July 1989. The Central Bank also boosted rates on its paper both in March and June. The use of the usual monetary tools ran into trouble in July when rates on commercial paper rose significantly above what the Central Bank was paying. The Central Bank was not able to place its long term paper, and thus was forced to rely on placements of short-term notes and foreign exchange operations to control money supply aggregates. The Central Bank raised its rates slightly in September, but failed to match commercial rates. These policies could not handle the usual pre-Christmas demand for cash, and thus, in December, M1A rose 18.1 percent.

The Central Bank started off 1990 by announcing a sharp increase in interest rates it would pay on its paper.

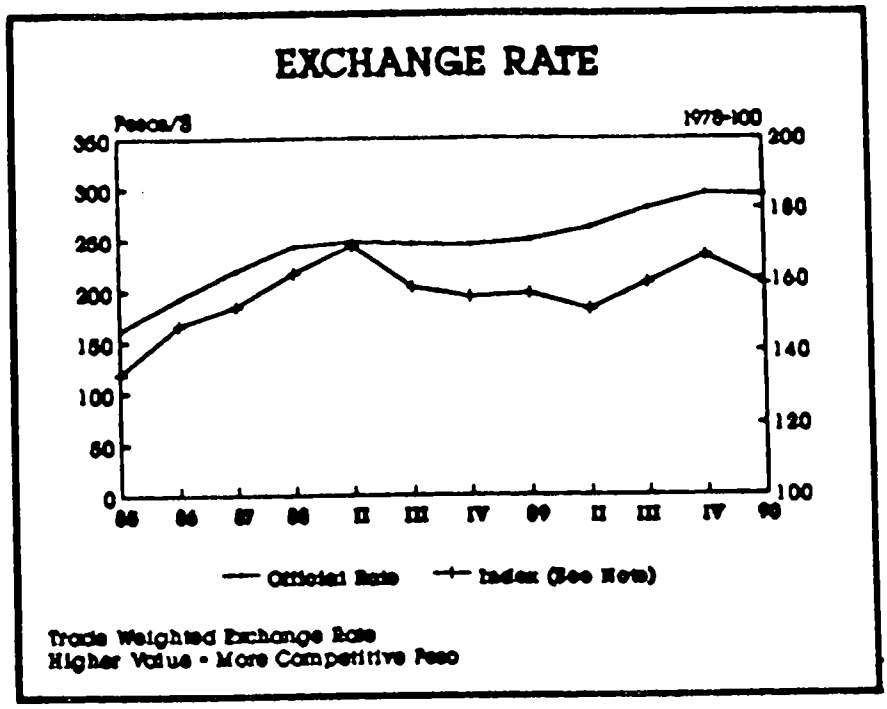
This enabled the Central Bank to place its ten-year notes through mid-March, sharply reducing M1A. However, in mid-March the pension funds (the main market for long-term Central Bank paper) reached legal limits on the amount of such paper they could hold. Future actions will have to be concentrated on short-term placements unless the Central Bank is able to make a market for its long term notes by raising interest rates substantially. As before, commercial paper yields rose several points above that of the Central Bank. The increase in interest rates made dollar investments less attractive, and thus in the move to get into peso investments, there was a revaluation of the peso in both the official and parallel markets.



The bulk of the Central Bank paper came due during the first quarter of the year, and thus controlling the growth of monetary aggregates will be easier for the rest of 1990. Nevertheless, there will still be money creation from foreign exchange operations as the current short-term dollar overhang (associated with the very attractive peso interest rates) is unwound. The Counselors of the Bank are fully aware of the problem, and are committed to controlling inflation.

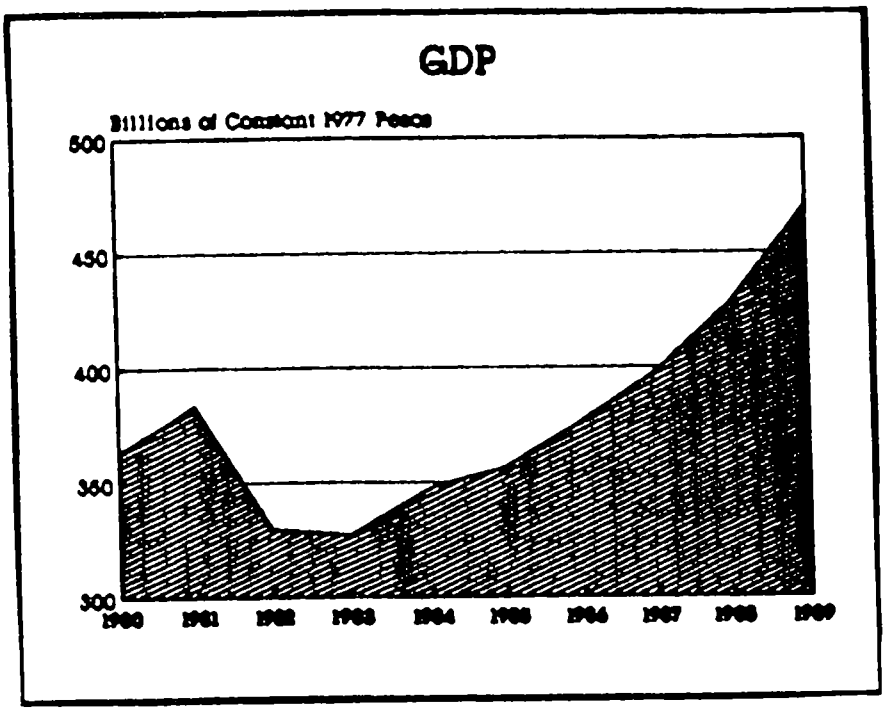
Foreign Exchange Policy: In January 1988, former Finance Minister Buchi announced that the Central Bank would not fully index for inflation in computing the crawling peg exchange rate. Buchi indicated he wanted to use the exchange to put keep down consumer price increases. Between January and June, the exchange rate was revalued some five percent (i.e. exports were less competitive and imports cheaper).

The Central Bank in June 1989 resumed the crawling peg formula, and by January 1990, the peso had again reached the same competitive level as the previous peak in mid-1988. The interest rate hike in January led investors to move out of dollars into more attractive pesos, which led to a revaluation of the currency.



The Economy in 1989 and First Quarter 1990

Economic Growth: The Chilean economy grew 10.0 percent in 1989, up substantially from the 7.4 percent registered the previous year, as a result of the expansionary fiscal, monetary, and exchange rate policies previously detailed. Overall, the country had one of the best accumulated growth rates in Latin America during the 1980's, and at year's end per-capita GDP was 1,979 dollars.



In looking at the economy by sectors, manufacturing grew 10.0 percent led primarily by an increase of goods destined for the domestic market. Of the 26 subsectors measured by the Central Bank, 24 registered increases. The subsectors with the greatest growth were glass (40 percent), autos/trucks (25 percent), chemicals (25 percent), leather (25 percent), and non-electrical machinery (24 percent).

Mining output increased 8.4 percent. Chile produced 1,645,000 metric tons of copper in 1989, an increase of 11.7 percent over the previous year. Of this amount, 1,243,000 tons, or 75 percent, was produced by the Chilean State Copper Corporation (CODELCO). Although CODELCO's production reached a record level in 1989, its production is expected to decline to 1,200,000 tons in 1990, and will thereafter begin a slow, but steady decline in future years. CODELCO's declining production will be more than offset by greater production by the private mining sector, as non-Codelco production is expected to increase from 402,000 tons in 1989 to over 1,000,000 tons by the mid-1990's.

Iron output was up 14.6 percent. Coal production declined slightly. Production of gold, silver, iodine, nitrates increased marginally.

Chile's state petroleum company (ENAP) produced 1,282,000 cubic meters of petroleum in 1989, a decrease of 9.7 percent over the previous year. Due to declining domestic production and increasing demand, crude oil imports now represent over 80 percent of total petroleum consumption. As these trends continue, Chile's petroleum import bill is expected to increase from $635 million in 1989 to as much as U.S. $1 billion in the early 1990's. Over the past year there has been extensive exploration in geologically promising areas in the Salar de Atacama and the Straits of Magellan.

The agricultural sector continued its pattern of slow growth (3.0 percent). The increase was due to a 5.0 percent increase in livestock production and a 4.0 increase in fruit and grain output. Logging fell 11 percent reflecting lower demand by paper mills, which were down part of the year for major expansion projects.

The fishing sector, which accounts for about one percent of GDP, expanded 22.1 percent, primarily due to increased production and higher prices for fishmeal. According to informed observers, the fishmeal industry is maturing and may be now showing signs of overfishing.

Construction had its best year in the past decade with an 12.7 percent increase. The Pinochet government boosted the number of housing subsidies for low and middle income families by 25 percent. There was also a significant increase in construction of apartments and houses for high-income groups which have had several years of exceptional personal income growth.

The strength of the growth in the productive sectors led to a 14.4 percent increase in the transport and telecommunications. Air transport was up 24 percent, and sea traffic 20 percent. Telecommunications grew 17 percent.

Utilities grew only 4.7 percent. The small increase was due to rationing of electricity during a prolonged drought during the first half of 1989.

Due to the overall strength of the economy and rising family incomes, retail sales shot up 14.0 percent following on 9.8 percent growth in 1988. Services also went up 8.8 percent.

On a national accounts basis, the foreign trade sector

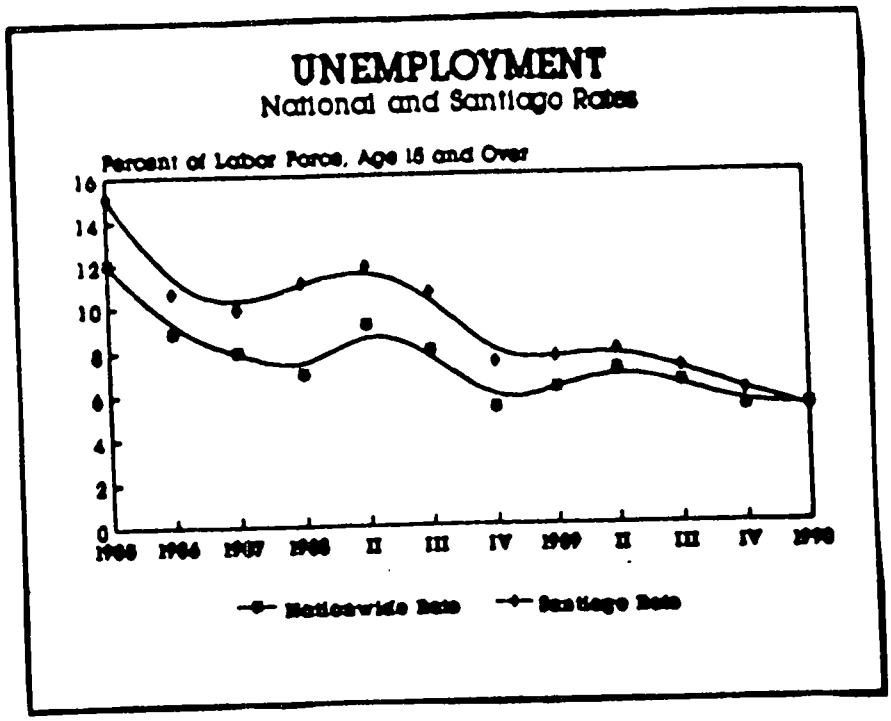
increased dramatically. These estimates hold copper prices constant, and thus reflect real growth of exports. The overheated economy quickly sucked in imports.

One very positive note is that fixed capital formation increased significantly. This measure of the investment rate has risen steadily over the past five years, allowing the economy to continue its expansion.

Private consumption was up 8.3 percent, reflecting the increase in family incomes. The higher level of consumption could have crowded out investment, were it not for the small (0.9 percent) increase in the government sector (as opposed to 10.0 percent growth for the entire economy). Because of the privatization efforts of the previous government, the government share of the economy has steadily decreased over the past five years.

EMPLOYMENT: Although the employment picture has improved with the continuing expansion of the economy, progress was much slower in 1989. The number of employed increased only 3.7 percent, and almost all of the additional workers were women reentering the work force. The labor force participation rate has gone from 47.0 percent in 1985 to 53.2 percent at the end of 1989. More families today have two incomes, which is one explanation for the increase in consumption.

Unemployment in the 1989-90 austral summer bottomed out at 5.0 percent of the workforce, down from 5.9 percent the previous year. The reduction was largely due to a decrease in unemployment in the Santiago Metropolitan region, which for the first time in many years recorded a rate below the national average. Unemployment in the agricultural regions was up slightly compared to the previous year. Farmers hired fewer temporary workers as a result of their experiences during the 1989 fruit crisis and a concern that new labor laws might make such temporary workers permanent.



Only about 10 percent of the labor force belongs to unions, down from a high of 30 percent in 1975. There are currently 6,000 unions, federations, and confederations in Chile with a total membership of about 400,000 workers. Union membership is greatest in mining and energy where a few large state enterprises such as CODELCO, ENAP, and ENAMI account for most of the production and employment.

Because of concern over the labor climate in Chile, the United States in December 1987 suspended Chile from participation in the Generalized System of Preferences which allows duty free import of certain products, and from issuance of new insurance from the Overseas Private Investment Corporation (OPIC). The U.S. Trade Representative is studying a petition by the Government of Chile for reinstatement of GSP and OPIC following the country's return to democracy. Another factor in determining whether GSP and OPIC can be restored will be if the implementing regulations for pharmaceutical patents provide a sufficient degree of protection.

Prices: The extra liquidity put into the economy by the Pinochet government's expansionary policies resulted in a bidding up of prices (i.e. increased inflation). On the year, consumer prices went up 21.4 percent, compared to a 12.7 percent increase in 1988. The greatest increase was in the food category (25.7 percent), reflecting greater family purchasing power. The food category has only a small imported component, and with minimal foreign

competition, increased family incomes bid up prices in the sector.

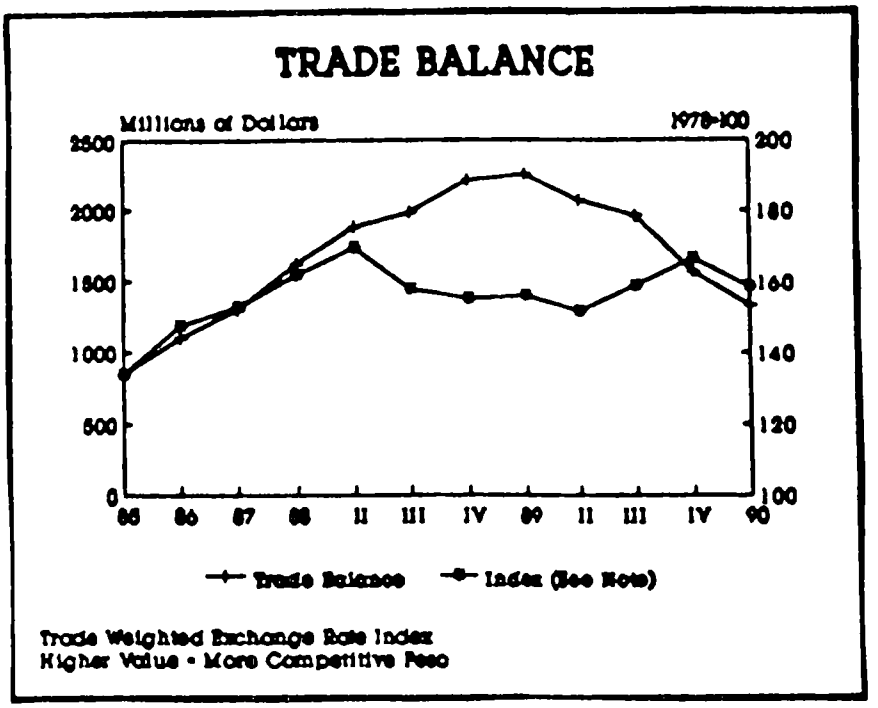
The effects of the measures to cool the economy first began to be seen in wholesale prices. The category peaked in November, and the index has experienced slower increases since that period. Similar to the consumer price index agricultural goods pushed up prices by registering a 29.6 percent increase on the year, while imports went up only 17.0 percent.

Wages: Wages again outpaced inflation, registering a 3.1 percent real increase. This was the result of the end-of-year salary hikes. While all categories experienced wage hikes (except for sales which registered a slight decline), the greatest increase was in construction, where the boom led to a shortage of both skilled and unskilled workers. Real wages have finally surpassed 1981 levels, the height of the previous boom.

Balance of Payments: Chile enjoyed another year of record high copper prices. Copper average for the $1.29 per pound, versus $1.18 in 1988. The higher prices resulted in $4.02 billion of copper exports, up 17.7 percent over 1988 levels.

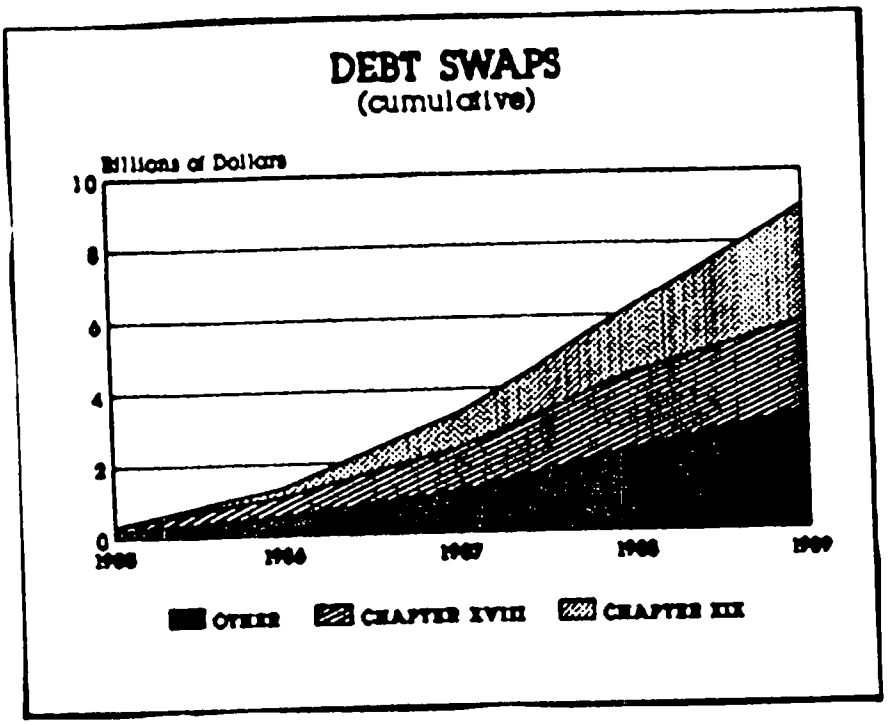
The nominal value of non-copper exports increased by only 11.2 percent. Expansion of paper mills limited cellulose shipments, and the March fruit crisis resulted in flat fresh fruit sales. On an encouraging note, non-traditional exports (i.e. other than mining, forestry, fruit, or fishing) grew 18.5 percent.

The expansionary fiscal, monetary, and exchange rate policies carried out in 1988 and 1989 were one of the principal factors in the 34 percent increase in the dollar amount of imports during 1989. Imports of consumer goods were up almost 40 percent. Another factor in the increase was the initiation of large mining and forestry projects which required large amounts of capital goods. Imports in that category were up almost 43 percent.

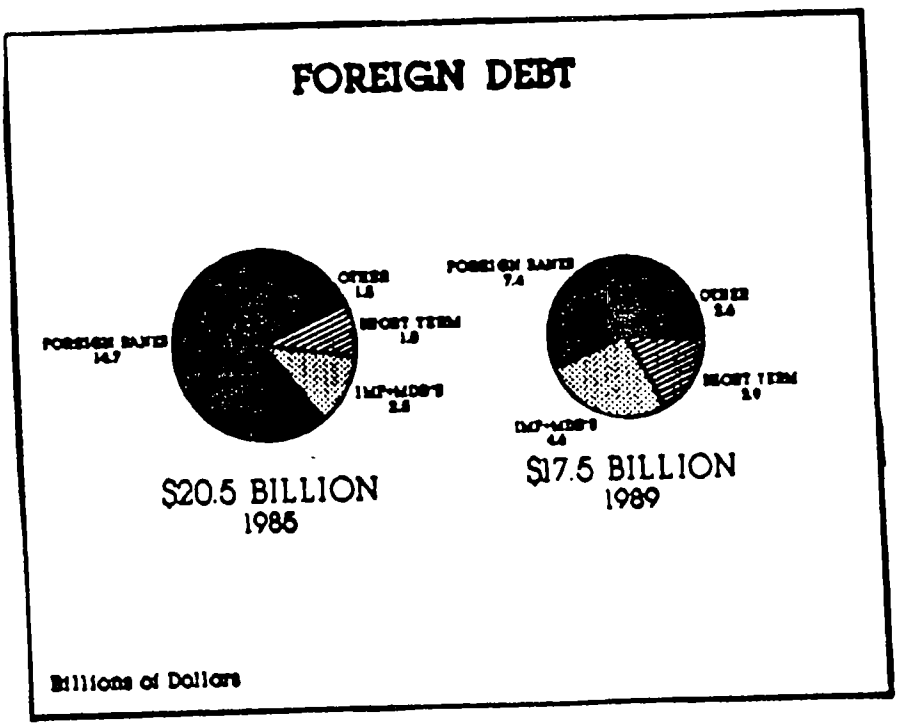


On the year, the balance of payments registered a surplus of $437.4 million. In doing so, the Central Bank exceeded the I.M.F. goal on reserve accumulation.

Foreign Debt: The Central Bank in 1989 continued the rapid pace of debt-swap conversions. Swaps by foreign investors (Chapter XIX) exceeded $1.3 billion with major investments in forestry, tourism, and investment funds. The Chapter XVIII option for Chileans (used primarily by banks to repurchase their debt) registered less than half the activity of the previous year. Following the fruit crisis, Chilean fruit growers were authorized to use debt swaps as compensation for losses.



With the continued debt-swap program, overall Chilean foreign debt (including that owed to the IMF) fell to $17.4 billion from $18.96 billion at the end of 1988. Since 1985, the debt has fallen from 128 percent of GDP to the current level of 68 percent.

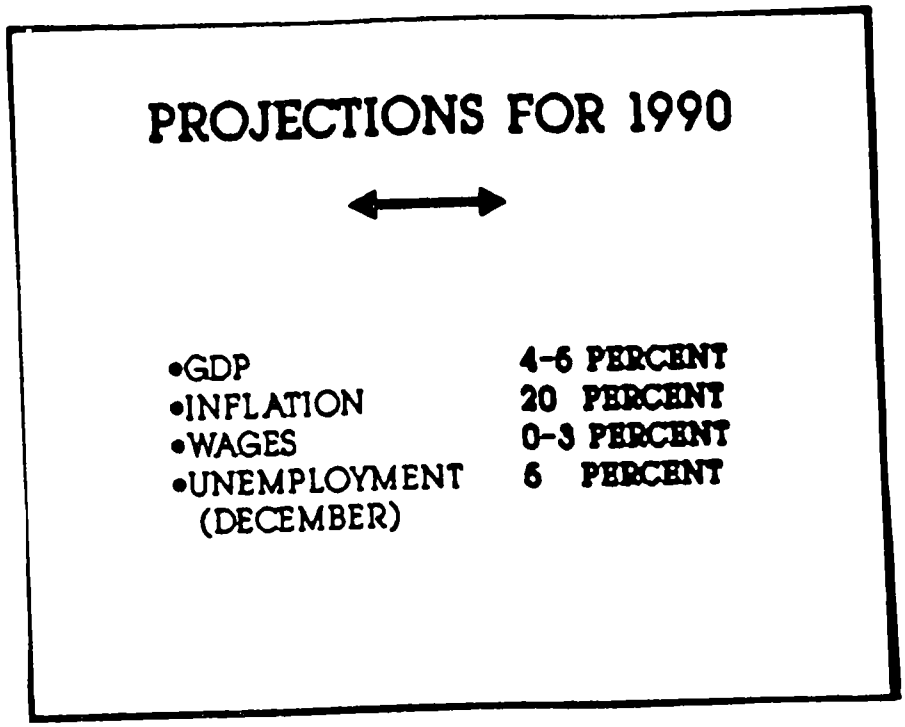


Financial System: During 1989, the banking system again registered good growth, with profits after taxes up 10.0 percent in real terms over 1988 levels. A good portion of the profit was due to fees for debt-swap operations. The inflation adjusted earnings of the Banco del Estado fell by almost 40% due to higher operating costs. All but two foreign banks (and all of the U.S. owned banks) registered profits.

The private Chilean banks all registered profits for 1989. The Central Bank still holds some $3.2 billion in bad debts purchased from private Chilean banks after the 1982 crash. One bank (BICE) never sold any debt to the Central bank, and two other banks have already repurchased all of their debts. Most of the other banks should be able to do likewise within the next few years. However, the three largest banks (Banco de Chile, Santiago, and Concepcion) account for over 75% of the outstanding balance and will take significantly longer. The bad debts, together with some $5.6 billion in IOU's from the Chilean Treasury constitute about half of the Central Bank's assets and earn significantly less than market rates, creating a drain on the central Bank's balance sheet and limiting Central Bank options on monetary policy.

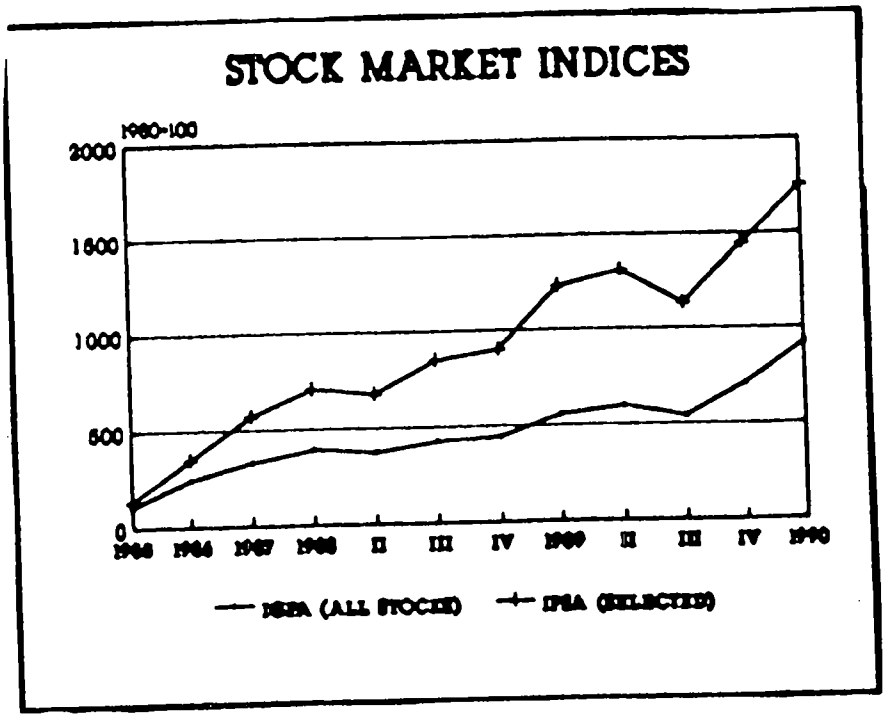
Stock Market The stock market went up 39 percent during 1989. The strong performance reflected record profits in Chilean industries as well as increased demand. During the year, several debt-equity and direct foreign investment country funds began operating in the Chilean market. In addition, pension funds were given the authority to invest a greater part of their portfolio in the stock market. Given the limited size of the market and increased demand by institutional investors, the Chilean stock market should continue solid growth over the next few years.

in the absence of other fiscal or monetary stimuli, that should underlay lower inflation for consumer goods. For 1990 as a whole, the consumer price index should increase around 20%.



The foreign investment boom over the past few years (both in direct DL 600 projects and Chapter XIX debt-equity swaps) has been concentrated in the export sector. As such, export volumes should increase 10-15 percent annually for the next few years. The increase in exports, however, will be offset by increases in amortization payments and profit remittances. The year 1990 should result in a slight increase in reserves in the balance of payments. However, the extra amortization payments and remittances will complicate the BOP outlook in the mid-1990's. Chile can increase its maneuvering room by attracting additional foreign investment and keeping import demand in check.

In 1991, Chile is scheduled to begin amortizing some $2.4 billion dollars owed to private banks corresponding to the "new money" packages in 1985 and 1987. This will result in a first year amortization payment of $510 million, declining by $100 million per year until 1995. The Chilean authorities have begun discussions with the Bank Steering Committee on this debt. At a minimum, Chile should be able to negotiate a rollover of the debt, and a creative solution may enable Chile to fully service this debt.



Projections for 1990 and Beyond

The adjustment measures have already begun to slow wholesale prices, and the economy should grow at a slower (4-5 percent) rate. Within the economy, export oriented sectors, which are less sensitive to domestic credit, should continue to experience good growth. The construction industry will be hit first and hardest by the high interest rate policies. Retail sales will slow with tighter credit and reduced personal incomes as a result of the tax hike. In addition, the tax hike should slow investment slightly in the second half. Once the adjustment has been made, the economy should be able to produce 5-7 percent annual growth in the mid-1990's.

Employment growth will probably slow in the second half, reflecting reduced economic growth and higher labor costs from the labor reform package. Overall unemployment, however, probably will not rise above 1989 levels, since first time job entrants will be limited by demographic factors. The composition of the labor force will change with more and more workers entering the formal economy, away from the informal services sector. This should allow a continued moderate increase in real wages over the next few years.

The inflation rate should gradually decrease as the adjustment measures have their effect on the economy. Wholesale prices are growing at a markedly lower rate, and

There is also about $2.5 billion in debt with maturities in 1993. This debt is being rapidly swapped, and at current rates the amount of paper available for such operations should be exhausted by the end of 1991. If this is the case, the debt swap programs will have incorporated virtually all of the pre-1982 foreign debt in inward foreign investment and capital repatriation, leaving only the "new money" package to be discussed with the bank steering committee.

In sum, the Aylwin government has a near-term problem of lowering inflation and import demand, which it has taken steps to address. In the longer-term, the structural reforms in the 1970's and 1980's have laid the base for continued economic growth, and the incoming administration has worked hard to support the favorable investment climate. The result is an auspicious beginning for President Aylwin's goal of combining democracy with economic growth.

PART B - IMPLICATIONS FOR THE UNITED STATES

In general, Chile is the most open market in Latin America for U.S. exports and investment. Imports are subject to a 15 percent across the board tariff. A limited number of products (e.g. automobiles, textiles, tires, inner tubes) are subject to surcharges ranging from 5 to 15 percent. The free market policies of Chile and its relatively simple import procedures make it an ideal market for new-to-export companies.

The United States is Chile's principal trading partner, accounting for about 16 percent of Chile's total imports and absorbing 22 percent of Chile's exports. According to official U.S. Department of Commerce data, in 1989, U.S. exports to Chile amounted to 1.4 billion dollars while U.S. imports from Chile totalled 1.3 billion.

Key Embassy Contacts for U.S. Businessmen

ECONOMIC COUNSELOR: Glen Rose

COMMERCIAL COUNSELOR: Richard Ades

AGRICULTURAL ATTACHE: Robert Curtis

Phone: (56-2) 710-133
FAX: (56-2) 699-1141

Export Opportunities: The best prospects for U.S. sales in the Chilean market include equipment and machinery for mining, earthmoving, food processing and packaging, agriculture, chemicals, forestry, woodworking, pulp and paper. In addition, there are good prospects for sales of computers and peripherals, medical instruments and supplies, air conditioning and industrial refrigeration equipment, safety and security instruments and textile machinery.

The U.S. Export-Import Bank offers a full range of financing and credit insurance programs for exports to the Chilean market. EXIM recently lowered its fees charged for the Chilean market, making EXIM more competitive in the Chilean market. The U.S. Trade Development Program (TDP) offers financing grants for major project pre-feasibility studies in order to enhance the competitiveness of U.S. bidders.

The U.S. Foreign Commercial Service (USFCS) in Santiago conducts a broad trade promotion program to increase the sale of U.S. products. This year a special effort will be made to expand the market share of mining, forestry, and aviation equipment. The first Latin American Mining Exposition (EXPOMIN), sponsored by the U.S. Department of Commerce, the International Trade Fair of Santiago (FISA), and the U.S. Embassy, will be held May 15-20 1990. The Embassy will also organize U.S. pavilions at the Santiago International Trade Fair (FISA) in October 1990. U.S.

firms interested in information on exporting to Chile can contact either USFCS in Santiago or the nearest Commerce Field Office.

The Foreign Agricultural Service (FAS/USDA) through the Agricultural Attache office in Santiago promotes the export of U.S. agricultural commodities and food products in Chile. The GSM-102 Credit Guarantee program for wheat and coarse grains is also administered through this offices. FAS provides the following free services: 1) a weekly publication listing U.S. commodity and food products offered for export on an FOB basis; 2) resolution of contract non-compliance and/or phytosanitary problems with agricultural imports from the United States; and 3) export price quotes for specific quantities or qualities of U.S. agricultural commodities for Chilean buyers or importers.

Investment Opportunities: In 1989, direct foreign investment (including associated capitalized credits) totalled 898 million dollars. Debt equity swaps accounted for another 1.367 billion dollars. Chile has an attractive foreign investment law, with liberal capital transfer rules. About 2.5 billion dollars of such investment has flowed into the country since 1985 out of a total $6.1 billion authorized. The Embassy's Economic Section can provide potential investors with further information on the economic climate.

TABLE I: GDP BY SECTOR 1980-88
(billions of constant 1977 pesos)

	1985	1986	1987	1988	1989
Agriculture	31	33	35	37	38
Fishing	3	4	4	4	5
Mining	31	32	32	33	36
Industry	73	78	82	90	99
Utilities	9	10	11	11	12
Construction	21	21	23	24	27
Retail	60	63	67	74	85
Transport & Communications	20	22	23	26	30
Services	109	114	121	128	139
Total	357	377	398	427	470

Source: Banco Central de Chile

TABLE II: GDP BY EXPENDITURE
(billions of constant 1977 Pesos)

	1985	1986	1987	1988	1989
Private Consumption	241	253	264	290	314
Government Consumption	43	42	41	43	44
Gross Fixed Capital Formation	53	56	66	77	87
Variations in Stocks	-3	-	6	5	14
Exports	94	104	112	119	138
Imports	-72	-78	-92	-103	-129
Total	357	377	398	427	470

Source: Banco Central de Chile

TABLE III: EMPLOYMENT AND UNEMPLOYMENT
(Thousands of Workers - Aged 15 and Over)

	NATIONAL			SANTIAGO		
	EMPLOYED	UNEMPLOYED	PERCENT	EMPLOYED	UNEMPLOYED	PERCENT
1985	3537.0	481.0	12.0	1461.0	259.0	15.1
1986	3895.7	374.3	8.8	1571.5	187.5	10.7
1987	4010.8	343.6	7.9	1615.5	176.9	9.9
1988	4040.8	371.8	8.3	1600.9	200.0	11.1
II	4051.4	405.5	9.1	1623.9	216.9	11.8
III	4092.3	391.6	7.9	1645.6	195.1	10.6
IV	4424.8	249.8	5.3	1729.6	138.9	7.4
1989	4295.5	283.6	6.2	1725.1	140.9	7.6
II	4262.1	318.9	7.0	1742.6	149.5	7.9
III	4288.8	294.8	6.4	1777.7	135.5	7.1
IV	4424.8	249.8	5.3	1827.4	117.6	6.0
1990	4439.9	248.6	5.3	1834.6	100.8	5.3

Source: National Statistical Institute (INE)
1985-87 Oct-Dec. Average 1988-90 Quarter Average

TABLE IV: CONSUMER PRICES
(INDEX: April 1989=100)

YEAR	INDEX	PERCENT CHANGE	BY SECTOR: FOOD	HOUSING	CLOTHING	TRANS-PORT/COMMUN.	OTHER
1985	54.74	26.4	51.01	58.63	50.66	-	57.76
1986	65.40	17.4	63.20	66.02	61.37	-	68.61
1987	78.41	21.5	78.44	76.29	75.75	-	80.30
1988	87.69	18.6	87.43	86.55	83.51	-	89.65
II	89.32	15.5	85.71	91.25	90.56	-	92.30
III	91.01	12.0	89.04	91.44	90.79		93.21
IV	95.93	12.7	97.35	94.57	95.63	-	95.10
1989	98.97	12.9	99.06	99.30	97.40	-	98.97
II	103.76	16.2	104.69	103.54	102.40	105.22	101.41
III	108.98	19.8	112.31	107.41	101.13	111.18	106.43
IV	116.47	21.4	122.42	112.82	108.37	119.65	110.95
1990	122.62	23.9	122.24	122.03	108.19	130.58	123.49

Source: National Statistical Institute (INE)

TABLE V: WHOLESALE PRICES
(INDEX: 1978=100)

YEAR	INDEX	PERCENT CHANGE	BY SUBGROUP: AGRIC.	MINING	MANUFACT.	IMPORTS
1985	16470	30.3	16818	20139	15914	16040
1986	19731	18.2	22891	20508	19124	17195
1987	23524	17.1	22282	23551	23141	19024
1988	24299	12.1	24699	25796	25721	20613
II	25088	8.6	26257	24874	26634	20840
III	25245	0.4	27966	24286	26082	20909
IV	25493	3.3	27346	26616	26869	20723
1989	26701	9.9	28966	27334	27802	21855
II	28355	12.9	31577	29574	29079	22928
III	30105	19.2	34962	30608	30782	23275
IV	31305	22.8	35466	31732	32479	24294
1990	31918	19.5	33852	33459	34040	25159

Source: National Statistical Institute (INE)

TABLE VI: WAGES
(INDEX: December 1982=100)

YEAR	INDEX	PERCENT 12 MONTHS		BY OCCUPATIONAL CATEGORY							
		NOMINAL	REAL	MANAGERS	TECHNICIANS	ADMINISTRATIVE	SALES	SPECIALIZED WHITE COLLAR	SPECIALIZED BLUE COLLAR	UNSKILLED LABORERS	SERVICES
1985	162.6	28.8	1.9	169.9	162.2	157.4	156.1	174.6	166.2	161.1	154.4
1986	198.3	19.8	2.1	221.0	194.6	188.9	195.9	213.4	204.1	197.7	181.0
1987	237.2	22.1	0.5	270.0	229.2	225.9	233.8	258.7	264.1	235.1	215.7
1988	275.9	23.6	4.5	339.4	264.8	260.2	276.4	296.4	282.8	276.5	246.7
II	291.5	24.6	7.9	353.0	283.4	274.1	293.4	310.1	298.8	291.0	267.2
III	299.5	21.2	8.2	369.9	288.5	281.6	301.8	318.2	308.1	300.5	274.2
IV	309.0	17.5	4.3	382.4	297.1	291.2	314.8	327.0	320.7	307.3	282.4
1989	324.0	17.4	4.1	408.8	312.7	306.2	321.6	337.9	336.2	318.7	299.4
II	341.8	17.2	0.9	429.4	325.2	320.9	336.1	364.8	363.9	337.7	313.7
III	357.2	19.3	-0.4	451.0	336.7	331.9	350.4	388.7	382.6	357.6	328.6
IV	387.0	25.2	3.1	482.0	367.9	360.5	378.3	420.3	413.6	380.8	358.7
1990	407.6	25.8	1.5	525.29	383.8	379.0	395.3	441.4	438.4	408.4	375.5

Source: National Statistical Institute (INE)
1985-87 December Average/ 1988-90 Last Month of Quarter

TABLE VII: PUBLIC SECTOR REVENUES AND EXPENDITURES
(Thousands of 1989 Constant Pesos)

YEAR	INCOME	EXPENDITURES	SURPLUS (DEFICIT)
1980	1,835,208	1,518,637	316,571
1981	1,904,805	1,731,781	173,023
1982	1,719,923	1,841,601	(121,678)
1983	1,440,048	1,609,571	(169,523)
1984	1,515,095	1,653,602	(138,506)
1985	1,563,531	1,659,586	(96,055)
1986	1,716,497	1,745,073	(28,576)
1987	1,876,332	1,735,332	141,000
1988	2,194,107	1,946,685	247,421
1989	2,247,702	1,873,856	373,845

Source: Comptroller General

TABLE VIII, MONEY SUPPLY

	M1A	M7	M1A	M7	CONSUMER PRICES
	(000'S OF PESOS)		--PERCENT CHANGE IN 12 MONTHS--		
1985	167238	1137510	36.1	50.5	26.4
1986	247468	1543870	48.0	35.7	17.4
1987	291773	2157450	17.9	39.7	21.5
1988	347557	2336740	34.1	37.3	18.6
II	357489	2481370	35.7	34.6	15.5
III	394659	2630460	50.8	34.4	12.0
IV	427633	2809600	46.6	30.2	12.7
1989	463869	311250	32.9	33.1	12.9
II	442263	3339640	23.7	34.6	16.2
III	480188	3649470	21.7	38.7	19.8
IV	535860	4065700	25.3	44.7	21.4
1990	538800	4475300	16.2	43.8	23.9

M1A: Currency, demand deposits (pesos and dollars)
M7: M1A plus time deposits, Central Bank and Treasury paper and letters of credit

Source: Banco Central de Chile

TABLE IX: EXCHANGE RATE

YEAR	Official Exchange	Trade Weighted Competitiveness Index
1985	160.86	133.93
1986	192.93	147.40
1987	219.41	152.75
1988	243.33	161.82
II	248.31	169.63
III	245.67	157.99
IV	244.63	155.34
1989	249.64	156.18
II	261.66	151.79
III	280.15	159.10
IV	294.59	166.62
1990	292.46	158.62

Note: A higher number on Index indicates a more competitive peso against the dollar

Source: Banco Central de Chile

TABLE X: BALANCE OF PAYMENTS
(Millions of Dollars)

	1985	1986	1987	1988	1989
CURRENT ACCOUNT	-1329	-1137	-808	-167	-905
TRADE	849	1100	1229	2219	1578
EXPORTS	3804	4199	5223	7052	8080
IMPORTS	-2955	-3099	-3994	-4833	6502
NON-FINANCIAL SERVICES	-338	-434	-463	-643	-773
FINANCIAL SERVICES	-1901	-1887	-1700	-1920	-1950
TRANSFERS	61	84	126	177	240
CAPITAL ACCOUNT	1233	822	945	948	1395
FOREIGN INVESTMENT	66	32	97	49	262
AMORTIZATION	-479	-431	-310	-648	-816
MEDIUM AND LONG TERM					1446
-MDB'S	565	208	296	495	-
-FOREIGN GOV'T	29	24	14	253	-
-SUPPLIER	132	158	197.	1239	-
-DL.600 FLOWS	126	124	253	380	-
-OTHER M&LT	-7	58	69	67	-
SHORT TERM	383	129	147	-345	1115
ERRORS/OMISSIONS	-3	88	-91	-110	-53
NET CHANGE IN RESERVES	-99	-228	45	732	437

Source: Banco Central de Chile

TABLE XI: Debt Swaps 1985-9
(Millions of Dollars)

	Chapter XIX	Chapter XVIII	OTHER	TOTAL
1985	32.3	115.2	182.7	330.2
1986	213.5	410.6	359.4	983.5
1987	707.3	685.8	585.6	1978.7
1988	885.9	909.3	1132.9	2928.1
1989	1321.8	409.8	1035.2	2766.8
TOTAL	3160.8	2530.7	3295.8	8987.3

Source: Banco Central de Chile

TABLE XII: CHILEAN FOREIGN DEBT
(Millions of Dollars)

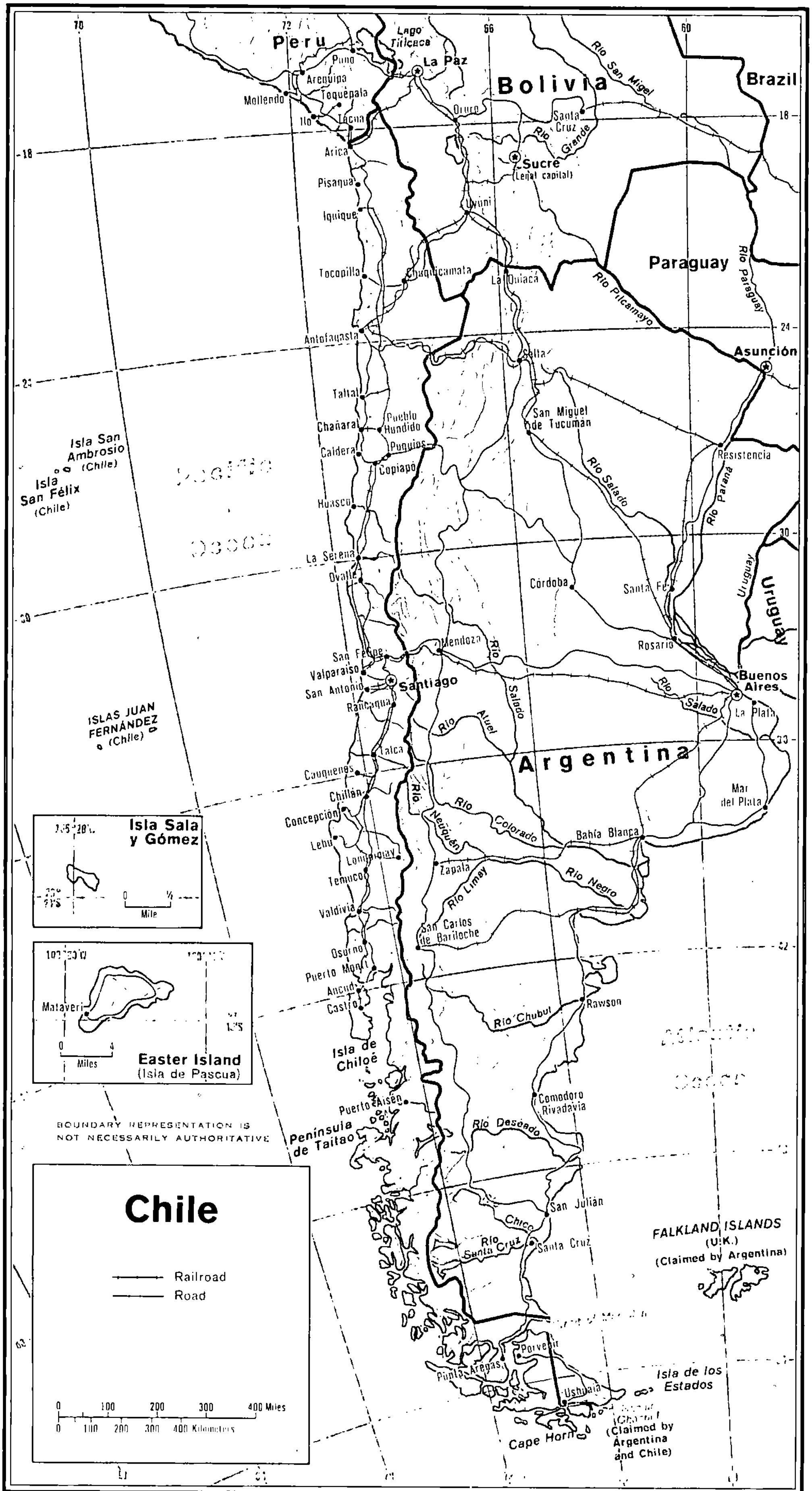
	TOTAL	IMF	SHORT TERM	WORLD BANK IDB	GOVT TO GOVT	FOREIGN BANKS	SUPPLIERS	OTHER
1985	20529	1085	1794	1444	638	14714	381	472
1986	20829	1328	1687	1928	797	14128	525	463
1987	20660	1452	2017	2493	722	12668	739	570
1988	18971	1322	2202	2921	986	10148	754	638
1989	18043	1268	2973	2996	1031	8616	766	673

Source: Banco Central de Chile

TABLE XIII: CHILEAN STOCK MARKET INDICES
(INDEX, 1980=100)

YEAR	BANKING FINANCE	AGRICULTURE FORESTRY	MINING	MANUFACTURES	SERVICES	(IGPA) OVERALL INDEX	(IGPA) REAL INDEX	(IPSA) BLUE CHIP INDEX
1985	62.12	58.04	22.02	109.47	119.77	109.40	38.34	133.55
1986	71.42	615.29	32.73	257.00	251.55	243.54	62.91	350.03
1987	58.75	918.00	56.86	373.06	324.99	329.99	95.71	569.04
1988	58.64	1327.63	65.13	480.48	366.20	392.40	105.56	708.32
II	56.88	1613.04	59.96	477.78	333.17	372.83	98.47	676.28
III	68.83	1648.67	72.03	575.85	362.09	426.52	110.56	846.99
IV	68.41	1531.28	72.59	615.81	369.56	443.88	109.15	899.41
1989	74.55	1525.88	89.47	769.95	468.48	555.45	132.39	1228.90
II	79.93	1819.58	78.89	793.50	529.28	596.34	135.57	1303.88
III	83.7	1738.16	74.23	738.40	539.72	602.44	116.82	1134.68
IV	113.89	2006.60	87.26	1042.10	560.23	704.23	152.73	1446.81
1990	127.74	2486.04	94.30	1355.60	746.99	921.08	N/A	1749.33

Source: Bolsa de Comercio



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Charles A. Gillespie, Jr.
United States Ambassador to Chile

On October 14, 1988, the United States Senate confirmed the appointment of Charles A. Gillespie, Jr., to be Ambassador of the United States of America to Chile. Ambassador Gillespie took the oath of office on November 9, 1988.

From August 1985 until September 1988, Gillespie served as Ambassador of the United States of America to the Republic of Colombia, where he headed a United States Mission comprising the Embassy in Bogota and a Consulate in Barranquilla. With a staff of over 700, the Mission is one of the largest in Latin America.

From August 1983 until he was named Ambassador to Colombia, Gillespie served as Deputy Assistant Secretary of State for the Caribbean and Deputy for Operations in the State Department's Bureau of Inter-American Affairs. In that position he was responsible for formulating and implementing United States policy in the Caribbean region and for execution of United States policy throughout Latin America and the Caribbean.

On October 24, 1983, the President named Gillespie Ambassador and Chief of Mission in Grenada, concurrent with his other duties, and instructed him to head the United States Mission on that island as of the time United States forces landed on October 25. Ambassador Gillespie established the first United States Embassy on Grenada, which was officially inaugurated on February 7, 1984. Gillespie returned to his Washington duties in March 1984.

Ambassador Gillespie is a career Foreign Service Officer, with rank of Minister-Counselor. Since he entered the Service in 1965, he has served at Embassies in Manila, Djakarta, Brussels, Mexico City and Managua, at the United States Mission to the North Atlantic Treaty Organization, and at the State Department in Washington, D.C.

A native of California, Ambassador Gillespie graduated from the University of California at Los Angeles. Before joining the Foreign Service, he served as a commissioned officer in the United States Army overseas. He has done graduate work in public administration at Syracuse University's Maxwell School of Public Affairs and is a graduate of the National War College in Washington, D.C. Ambassador Gillespie is married and has two grown children.

November, 1988

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BRIEFING NOTES

CHILE: MARKETING ORDERS

The farm bill recently passed by Congress extends marketing orders to imported kiwis, nectarines, plums and apples. (Marketing orders for table grapes--a major Chilean export to the United States--have been in effect for several years.) Chilean exporters objected strenuously to additional orders and lobbied extensively on the Hill against their inclusion in the bill. They claimed they were a non-tariff barrier and ran counter to the principles of free trade endorsed by President Bush's Enterprise for the Americas Initiative. However, the Administration believes marketing orders to be GATT-consistent.

These inspection standards do not now have a significant negative economic impact on Chilean exports to the U.S., but the Chileans fear future encroachment. The Chileans were considerably mollified by the Gibbons amendment to the bill, approved by the conference committee, that requires USDA to get the "advice and concurrence" of USTR before it can subject additional imported commodities to quality inspections.

In a related development, the USDA has responded favorably to the request made by Deputy Secretary Eagleburger that USDA help train Chileans in inspection standards, the idea being that such training would reduce the likelihood of Chilean fruit being rejected at port of entry during periods when marketing orders are in effect. USDA has sent an informal proposal to the Chileans whereby if they send a group of Chileans to Arizona, the AMS will train the group in general inspection and sampling procedures for the following commodities: grapes, kiwi fruit, plums, nectarines, and onions.

It is understood that the Chileans would pay the costs of the program. We have not yet received a response from the Chilean government, but expect the response to be positive. Such a program should have the effect of alleviating some of their concerns about being discriminated against because their produce has such a long distance to travel before reaching U.S. ports. It should be noted that for this program to succeed in the long run, the Chilean will have to cooperate in setting up their own system of quality control.

BRIEFING NOTES

CHILE: POISONED GRAPES INCIDENT (COMPENSATION)

Chilean fruit exporters sustained losses in 1989 as a result of a temporary FDA embargo on grape imports when several poisoned grapes were discovered in a shipment from Chile. This has been a sore point with the exporters ever since. They are now exploring the possibility of a class action lawsuit against the USG for compensation for their losses, claimed to amount to $333 million. We had hoped that release of the GAO report on the incident commissioned by Senator Helms would have a detere t effect. The report finds that the FDA followed appropriate procedures in its labs and that the Administration acted responsibly to protect the health of the American consumer. However, the most vociferous advocates of legal action claim that the report is inadequate in its findings. The Administration position is that if they believe they have sufficient evidence to warrant filing suit, they should do so in U.S. courts.

Until August, the Chilean government had not taken a position on the issue. However, pressure from the fruit growers and exporters and their "evidence" of possible FDA negligence and/or conspiracy against Chilean imports was sufficient to cause the Consejo de Defensa del Estado (Council for the Defense of the State which plays a role akin to that of the U.S. Solicitor General) to initiate an inquiry into what their legal options might realistically be. We do not know what the GOC may ultimately decide to do in this regard, but suspect that they may op to be part of a class action suit should private sector interests decide to pursue legal action against the USG.

It is important to note that part of their alleged case rests on the findings of an independent study carried out by a University of California, Davis faculty member and senior researcher. However, GAO officials have discovered that this individual did not submit his findings to peer review. Moreover, it appears he failed to replicate procedures followed by the FDA labs when they analyzed the grapes for evidence of cyanide. This alone suggests that the Chilean exporters may not have a very strong case. Regardless, we can expect the poisoned grapes issue and claims for compensation to be with us for the foreseeable future.

BRIEFING NOTES

CHILE: GSP BENEFITS

As a result of worker rights abuses committed under the Pinochet regime, Generalized System of Preferences (GSP) benefits to Chile were suspended in 1987. In addition to the worker rights issue, USTR has made intellectual property rights (IPR) one of the criteria for restoration of benefits. USTR specifically seeks passage of pharmaceutical patent protection legislation before agreeing to Chile's reinstatement. A preliminary finding on the worker rights issue permitted the reinstatement of OPIC benefits on October 2. President Aylwin sent an IPR bill to Congress last July which met the basic demands of the Pharmaceutical Manufacturers Association (PMA) in regard to patent protection, even though it did not include transition protection for patents, i.e. a "pipeline" provision. However, the bill that passed the Chamber of Deputies and the Senate in September contains amendments that are unacceptable to the PMA.

USTR and the PMA object to the following:

-- Article 39 (term of patent protection). The amendments resulted in a shorter patent protection term. Changes made in both houses reduced the effective patent term from 18 to 15 years from the date of application for a new patent.

-- Article 51, a-e (compulsory licensing). (NOTE: When the government imposes compulsory licensing, it denies a patent holder exclusive rights to manufacture a product and obliges him to let another party make the product and accept from him a set fee for the right to do so.) The present bill makes compulsory licensing a possibility when domestic demand is not satisfied in terms of quantity, quality or price, when the domestic price for a product is higher than the price at which it is sold in other countries, and when a patent holder engages in restrictive (i.e. monopolistic) business practices.

-- Implementation Period. The Senate added an article that gives the GOC up to a year to implement the law once the bill has finally passed Congress. The original expectation was that it would take 90 days.

The outlook for resolution of these points of disagreement is mixed. There appears to be limited flexibility in what can be done to remed the above amendments. In the case of Article 51, President Aylwin could use a line-item veto. It would be his first veto of a piece of legislation that he himself introduced. In the case of Article 39, there is less room for maneuver because Deputies accepted the version passed by the Senate and therefore, it cannot go to a conference committee vote. The Executive can shorten to 180 days or less the time frame for implementation.

I-SEARCH (tm) V1.24W Retrieved Documents Listing on 11/17/92 at 21:04:57.
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WORLDVIEW - CHILE: GETTING PERSONAL
-text-

After completing studies with a team of medical experts from Johns Hopkins U., Juan Honeyman, chief of dermatology at the University of Chile Medical Center, said Chile faced "no added health risk" from the shrinking ozone layer (Santiago's EL MERCURIO). Honeyman: "It is my impression that ... there is a greater risk to health [of people] in the northern regions, even when the ozone layer is denser." Health risks, he says, are more related to personal habits than the density of the ozone layer. Honeyman: "The type of bathing suits used today as compared with those in style ~~20 years ago~~ expose people to greater danger from radiation." Beatriz Munoz, an epidemiologist from Johns Hopkins U., "cautions ~~that the results~~ of the investigation are not definitive. Rather, the study was intended to establish a base for future long-term collaboration and to set up a scientific system for monitoring the situation" (11/12).

Ron

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------End Document Listing------
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proposal to EPA
→ went to Chile

Dr. Oliver Schain (head of team)
410 955 8179 *Alice
pilot study, just now working on data

ENVIRONMENTAL INFORMATION NETWORKS FRIDAY, NOVEMBER 20, 1992

OZONE DEPLETION NETWORK ONLINE TODAY

A Daily Executive Summary Covering World News on Stratospheric Ozone Depletion

SCIENCE & TECHNOLOGY REPORT

SURPRISE STUDY FINDS CO2 MAY CREATE OZONE HOLE OVER ARCTIC

British researchers have reached the alarming conclusion that the expected buildup of carbon dioxide in the stratosphere over the next few decades may open a "hole" over the Arctic in Earth's protective ozone layer similar to the "hole" over Antarctica blamed on CFCs. While it has long been recognized as a greenhouse gas, CO2 has not been thought harmful to the ozone layer until the release of the UK study.

Basing their comments on computer models, John Austin and Neal Butchart of the Meteorological Office in Bracknell, England and Keith Shine of the University of Reading found that a doubling of CO2 in the stratosphere given current chlorine levels, would cause a hole during very cold Arctic winters. The scientists say the paucity of their simulations did not allow determination of a threshold CO2 concentration that would create the condition.

The report, published in the British journal NATURE, reported that as CO2 levels rise, it is expected that the lower stratosphere would cool and help form the polar stratospheric clouds that are key to ozone destruction, while the falling ozone levels would in turn reinforce the CO2's cooling effect.

Jerry Mahlman of Princeton University wrote in an accompanying article, "The threat of an ozone hole over the heavily populated Northern Hemisphere will undoubtedly stimulate a lot of concern, probably more than the already present Antarctic hole." A key issue at this week's Copenhagen conference on the ozone layer will be how to advance the phase-out date for CFCs from the year 2000 to 1995. CFCs, used in refrigerants, insulation and aerosols are blamed for the Antarctic ozone hole.

(REUTERS: 11/18)

JOHNS HOPKINS TEAM INVESTIGATES OZONE DEPLETION HEALTH CLAIMS IN CHILE

Measurements of the ozone hole have alarmed scientists this austral spring as the opening in the protective ozone layer grew and extended over the southern tip of South America. Punta Arenas, Chile is the recipient of unwanted ultraviolet rays and controversy rages over the damage being done. Livestock and wild rabbits have shown increased incidence of cataracts and eye disease while others worry that the exposure harms the human immune systems rendering people less resistant to disease.

Enter the research team from Johns Hopkins University in Baltimore, which arrived early this month in Punta Arenas to study all aspects of the ultraviolet bombardment. The team is composed of dermatologists, optical physicists, ophthalmologists, epidemiologists and immunologists who will look into all reports to determine whether the complaints are in fact linked to the increased radiation.

Because the effects of UV-B exposure accumulate as do the effects of x-rays, the researchers hope to establish long-term studies as well. There is actually less radiation hitting Punta Arenas than is received at the Equator, but the team wants to see whether the sharp increase in UV-B levels on individuals and animals who aren't accustomed to it can cause the reported health problems.

In addition to the U.S. Environmental Protection Agency, the studies are being sponsored by the Chilean Health Ministry and University of Chile.

(LONDON FINANCIAL TIMES: 11/18, p.12)

REGULATORY REPORT

UNDER PRESSURE FROM LAW SUIT, EPA WILL ANNOUNCE OZONE REGULATIONS

Under pressure from a law suit filed by the Sierra Club Legal Defense Fund, the EPA has agreed to announce its regulations affecting ozone depleting chemicals by the end of this month. Regulations will be finalized by April 23, 1993.

"With today's consent decree, EPA now is bound to take the first steps to prevent future emissions of ozone-depleting substances," said Fern Shepard, an attorney with the Sierra Club Legal Defense Fund. According to Shepard, the consent decree, filed in federal district court outlines the timetable on the regulations. Already, EPA has ruled that as of November 15th only trained individuals can purchase CFC-containing air conditioning coolants, thereby preventing accidental leaks.

(UPI: 11/17)

EDITORIALS, REVIEWS AND ASIDES

ENVIRO-POLICY SHOULD COME FROM SCIENTISTS, NOT POLITICIANS, SAYS LETTER

The following excerpts are from a letter written to the Washington Times by John E. Reinbolt of Banco, Virginia. The letter appeared in the November 17 Washington Times:

"Allow me to respond to President-elect Bill Clinton's Nov. 8 Commentary article, 'Nature on the business balance sheet.'

"Far too many of such environmental 'solutions' are for problems that don't exist or, where they do exist, are based on pseudoscience or no science at all. As evidence of this, recall the Alar scare, during which congressional testimony was given by such 'experts' as Meryl Streep, and the most recent amendments to the Clean Air Act, which show that the National Acid Precipitation Assessment Program went largely ignored by Congress. There is this nonsense over the 'ozone depletion' effect of chlorofluorocarbons. And 'global warming' is pure hyperbole.

"All environmental problems and solutions should be under the purview of panels or commissions of accredited scientific institutions and/or scientists instead of politicians, whose environmental assertions are never subjected to scientific peer review.

"For openers, Mr. Clinton might consider the United States' status as a signatory to the Montreal Accord, which will be a multi-billion-dollar drain on our economy."

(WASHINGTON TIMES: 11/17, p.F2)

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Dana Center for Preventive Ophthalmology
Cornea and Anterior Segment Service

Oliver D. Schein, M.D., M.P.H.

December 4, 1992

Mr. Trey Lindseth
393 Russell Senate Office Building
Washington, DC 20510

Dear Mr. Lindseth:

Thank you for your helpful suggestions, your request for further information on our project on ultraviolet light exposure and human health effects associated with the ozone hole over southern Chile and Argentina, and your offer to alert Ms. Katy McGinty to this project.

As I am sure your office is aware, decreases in stratospheric ozone have been documented since the late 1970s over Antarctica. Thinning of the ozone layer is associated with excess exposure of the earth's surface to ultraviolet light. In October, 1991, the annual Antarctic springtime ozone hole enlarged, exposing a large human population in the southern tip of South America. The location involved with the greatest population density was the city of Punta Arenas in southern Chile. In the context of that exposure, numerous lay reports were generated associating this exposure with acute ocular and dermatologic disease in both humans and animals. I have attached some of these lay reports to give you the flavor.

I work at a unit of The Wilmer Eye Institute at Johns Hopkins Hospital called the Dana Center for Preventive Ophthalmology. There has been a sustained interest in the relationship between ultraviolet light and eye and skin disease in this unit for a decade. Specifically, we have studied in depth a population of Chesapeake Bay Watermen and have associated cumulative ultraviolet exposure with cataract. Given this background, I was fascinated to read about the exposure in southern Chile. I put together a proposal for a pilot study and was able to obtain funding for it project through the United States Environmental Protection Agency.

This pilot project had two major aims:

1. To assess the relationship of acute ocular and dermatologic disease in humans and animals from ozone-related ultraviolet exposure.
2. To assess the feasibility and rationale for performing a prospective study of chronic human and animal health effects related to ultraviolet light exposure in Punta Arenas and environs.

I assembled a scientific team which consisted of myself, two epidemiologists, a dermatologist, a radiation scientist, and a veterinary ophthalmologist. We established professional working relationships with colleagues in Chile and spent the first three weeks of November, 1992, in Chile performing field work relating to the two principal goals. As you may be aware, a large hole in the ozone layer again developed in that region this fall associated with several days of high ultraviolet spikes at ground level in Punta Arenas and environs.

We hope to have a report on this pilot study early in 1993 and will send you a copy. In the interim, however, I wanted to bring this project to your attention for several reasons. First, human and animal exposure to excess ultraviolet light as a result of ozone depletion is not only of great concern to those individuals living at the tip of the world but is almost certain to become an environmental issue in the northern hemisphere. Second, although the United States has taken a lead position in the monitoring of stratospheric ozone, support for research and programs aimed at potential health effects on the earth's surface have lagged significantly. The recent development of the ozone hole over southern Chile presents an ideal opportunity for the United States to collaborate internationally on a common goal.

Sincerely,

Oliver D. Schein, M.D.

af

INTERNATIONAL

Life Under the Ozone Hole

In Chile, the mystery of the bug-eyed bunnies

Walter Ulloa had no idea he lived in the Twilight Zone. He was too busy herding cattle on the southernmost spit of land in South America to have heard about the blind salmon caught in Tierra del Fuego. Or the pack of rabbits so myopic that hunters plucked them up by their ears. Or the thousands of sheep blinded by temporary cataracts. None of that much mattered—until unusual things started happening to Ulloa himself. After long days on an upper pasture, the 28-year-old ranch hand found that his arms burned "like boiling water," he said. His eyes, swollen and irritated, clouded over; his left one is now completely blind. Another ranch hand was also affected: focusing on objects now makes him weep uncontrollably.

Examining the symptoms, Chilean doctors said the two men were probably hit by excessive ultraviolet-B radiation. They suggested UV-resistant sunglasses. "I can't afford glasses," says Ulloa, gazing over the grassy tundra. "Besides, they would look strange out here."

Strange, indeed. But strange things are becoming commonplace around the Chilean port of Punta Arenas, the largest town (population: 115,000) to be located on the cusp of an ozone hole. Every year from late August to early December, the hole over Antarctica expands northward. Its outer reaches now cover the tip of South America, exposing flora, fauna and people like Ulloa to increased doses of ultraviolet radiation. The U.S. National Aeronautics and Space Administration recently found that the ozone hole has grown much faster than had been anticipated; it is now four times larger than the United States. Several Chilean scientists estimate that levels of the carcinogenic ultraviolet-B radiation jumped more than 1,000 percent in Punta Arenas on peak days last year. "This has never happened to a human population at any time in history," says Jaime Abarca, the region's lone dermatologist. "It's as if Martians had landed."

Residents lose no time in telling visitors about the otherworldly phenomena—from wilder-than-normal climatic gyrations to shifting reproductive patterns in birds, wild llamas and even cabbage. Nursery owner Ana Maria Schultz shows off two Veronica plants, one lush and green after a year in a greenhouse, the other yellow and sickly after being burned, she says, by radiation. Skipper Robert Mahler says his yacht's dacron sails now become brittle and deteriorate nine years before their 10-year guarantee is up. Veterinarian Vladimir Mazlov claims that a small but increasing number of the region's 2.4 million sheep are being struck by temporary blindness. But nothing is more troubling than the possible effects of UV-B radiation on human beings: skin cancer, cataracts, even a weakened immune system. "It's like AIDS from the sky," says Bedrich Magas, an electrical engineer who has waged an aggressive campaign to attract public interest—and research funds. "We get one dose every spring."

BROOK LARMER

Taking no chances: *Ulloa at work—and wearing a baseball cap for protection*

Skeptics say Magas is acting less like Galileo than Chicken Little. To date, very little direct evidence exists of a link between the freak occurrences in southern Chile and excess UV radiation. There are only sparse data—and spirited debate—about the intensity of UV rays in Punta Arenas. Some scientists claim that sun worshipers in Miami and Acapulco are bombarded by more ultraviolet rays than residents of southern Chile, partly because the subarctic climate and oblique sunlight give residents little incentive to put on string bikinis. The blinded sheep, according to some farmers and veterinarians, may simply have contracted a virus unrelated to UV radiation. And the bug-eyed bunnies? They may have been the victims of a virus first spread 20 years ago to thin out an overpopulation of rabbits that threatened ranching. "Blindness," Magas concedes, "is one of the dark spots of radiation research."

Skin cancer: But not the only one. So far, most studies have looked at the effects of radiation on plankton and other spineless creatures that form the basis of the marine food chain, not on human beings. In Punta Arenas, a living laboratory for human reactions to radiation, there is a startling lack of basic research on the problem.

Abarca, the dermatologist, has noticed a high incidence of melanomic skin cancer (four times its average rate) and an increase in cases of skin burns and blotches. But he is cautious about blaming ultraviolet radiation. "We need more instruments and information," Abarca says. Neither is forthcoming. A three-year University of Chile project to study the effects of the ozone hole has foundered. The team of scientists has been unable to raise the last $11,000 needed to buy a spectral radiometer, which measures radiation levels. "We are paying the bill for industrialized countries that are depleting the ozone," says Rodolfo Mansilla, who lost 80 sheep to blindness last year. "They have to take an interest."

The Chilean government was dragged into the fray last month. Manuel Baquedano, head of the Institute of Political Ecology, demanded that the government remove 17 children living on a Chilean air base in Antarctica, directly under the ozone hole. Air Force chief Ramon Vega Hidalgo said there was no immediate danger but conceded that the problem should be studied more vigorously and with better instrumentation. Meanwhile, back in Punta Arenas, sunglasses are selling briskly and sunscreen is being stocked in pharmacies for the first time. It is a cold and cloudy afternoon, but Lionel Morales is wearing sunglasses, a wide-brim hat and sun block (factor 15). "I may look silly," he said, "but at least I'm safe." In the Twilight Zone, looking silly may be the only sensible thing to do.

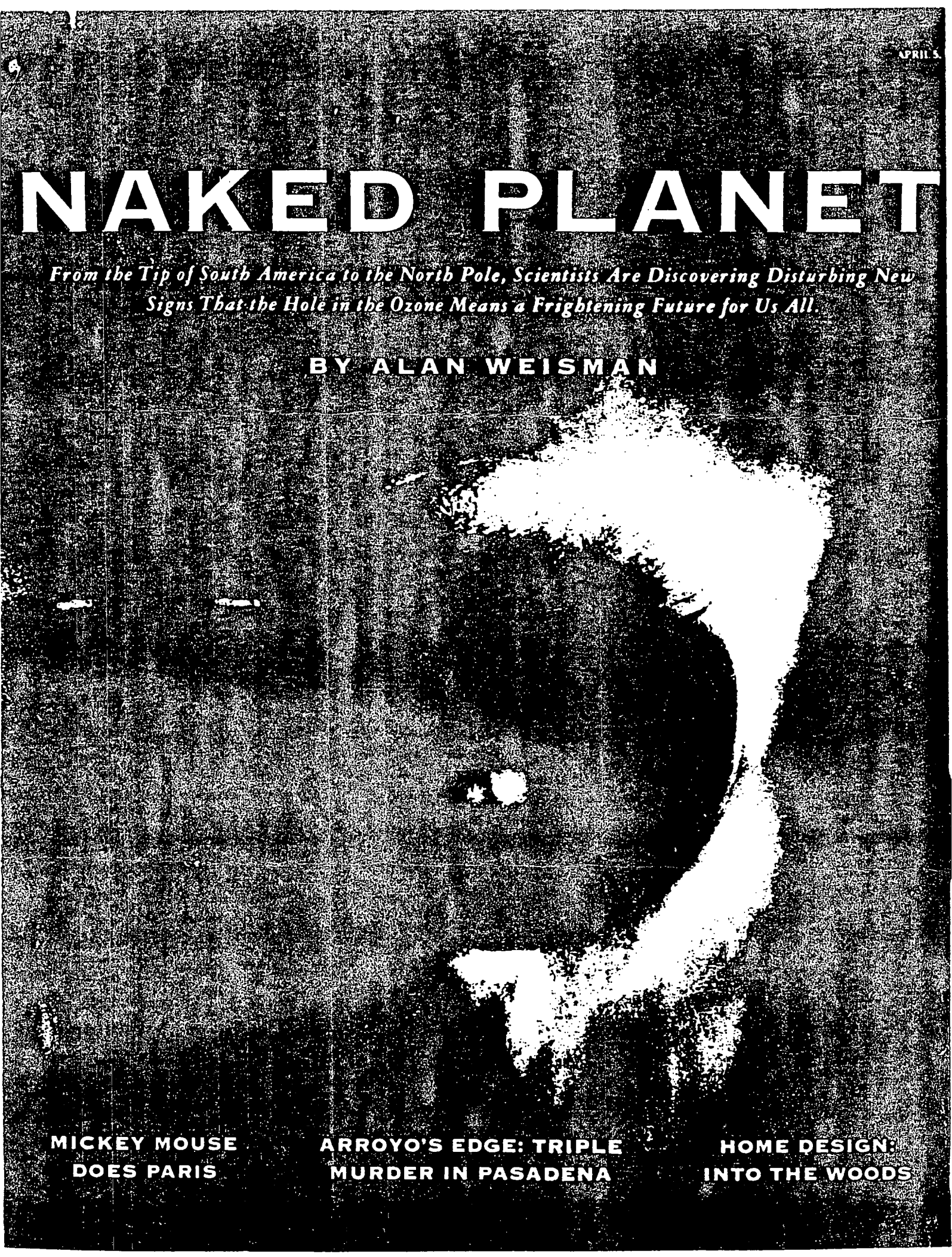
BROOK LARMER *in Punta Arenas*

APRIL 5,

NAKED PLANET

From the Tip of South America to the North Pole, Scientists Are Discovering Disturbing New Signs That the Hole in the Ozone Means a Frightening Future for Us All.

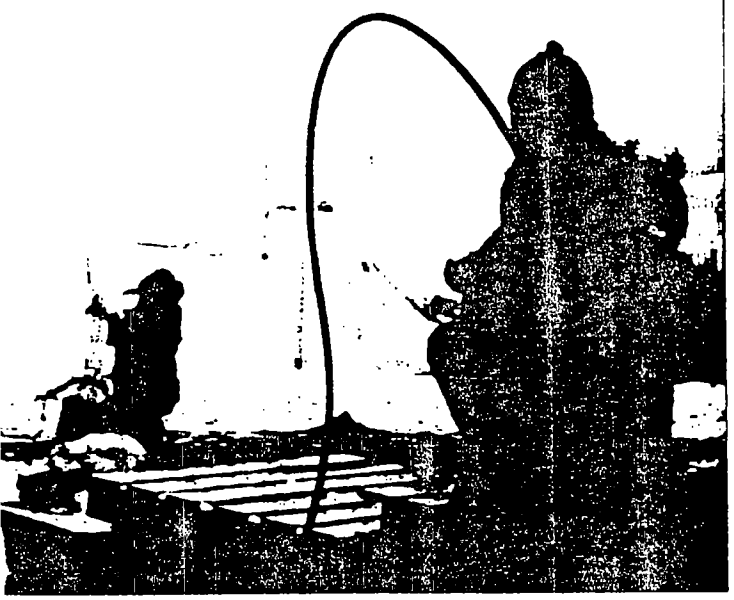
BY ALAN WEISMAN



MICKEY MOUSE DOES PARIS

ARROYO'S EDGE: TRIPLE MURDER IN PASADENA

HOME DESIGN: INTO THE WOODS



...ntarctica, balloons are fitted with instruments to measure ozone and temperature.

NAKE

From the Tip of South America to the Nort

New Signs of the Deadly Effects of Oz

HE STEEL TOWER STANDS IN A GROVE OF BEECH TREES, overlooking a turquoise lake in southern Chile. Every 10 days, Carlos Rodriguez, a curly-haired man with a nub of a red mustache, dons his quilted forest ranger's jacket and hikes up the slope, where he unlocks the box perched atop the tower's galvanized legs. Inside is a compact, stainless-steel air pump. Using sterile rubber gloves, Rodriguez detaches the mechanism's white mesh filter and seals it in a clear plastic envelope.

Eventually, 8,000 miles away in Idaho Falls, Ida., a chemist will analyze the filter for residues of cadmium, copper, zinc, lead and aluminum. But Rodriguez already knows what the results will be: As usual, the used filter is as spotless as when he installed it. After 10 days anywhere else, the membranes on UNESCO's air monitors are invariably stained brown. ...here, in Chile's exquisite Torres del Paine National Park, the only thing that pene...s the flawless atmosphere is the lilt of nesting thrushes.

...n the gleaming lake below, wild swans drift across reflections of mountain spires hung with glaciers whose startling blue hues—*pame* in the language of Chile's Tehuelche Indians—give the park its name. From this hillside, Rodriguez can see herds of tan guanacos, the giant llamas of the southern Andes, foraging in meadows among flocks of rheas, the South American ostrich. Enormous hares bound past them, pursued by silver foxes. High overhead, Andean condors spiral around the sun.

To Rodriguez, who spent his boyhood fishing for trout in Torres del Paine's streams, defining this place in terms of some absent industrial molecules seems slightly absurd. Yet he is proud that the monitor shows that this is the cleanest air in the inhabited world—a world in which, he has heard, there is precious little clean air left. Here, nearly at the bottom of the Americas, in Chile's Ultima Esperanza ("Last Hope") province, where this slender country fractures into a jumble of craggy fjords and where the only road north must detour through 1,000 empty miles of Argentine pampas, Rodriguez has felt safe from the scourge of so-called progress defiling the rest of the planet.

Until now. Something has changed in this isolated haven where, legend says, God stored all the beauty left over from Creation. Lately, there are hints that nature's biological clock is overwound. Flamingos arrive a season early; geese breed in autumn instead of spring; egrets lose their migratory bearings altogether and flap erratically around the pampas. Especially puzzling to Rodriguez are the glaciers: Instead of advancing, Torres del Paine's ice sheets are now receding—40 yards per year, a quarter-mile over the past decade.

No one knows why. Logical explanations have been offered for these and other peculiar phenomena, such as shriveled roses in house gardens or the wave of blindness recently affecting local sheep and rabbits, but scientists say there have not been any proper studies. Yet people in southern Chile increasingly suspect that they're all connected to a single bleak fact: Human beings who live north of the equator—supposedly among the most intelligent and advanced in history—somehow reached far south and inadvertently ripped a hole in the stratosphere.

"We are paying for something we didn't cause," Rodriguez declares glumly, watching Paine's indigo peaks turn copper under a waning sun he now has begun to fear. Maybe, he says, the inflamed sheep corneas and rabbit cataracts have nothing

Mark Muller/NASA

D PLANET

to do with the ozone hole, as agriculture ministry officials assure them. And maybe the reason it barely snows anymore is really due to global warming, which, he understands, is a different pending disaster altogether. But no one really denies anymore that something actually is new under the sun in this once pristine sanctuary, and the full extent of the damage is still unfolding.

Scientists who have been peering up into the hole since it was discovered seven years ago now generally agree that the atmospheric havoc caused by supposedly friendly chemicals, whose use in air conditioners, spray cans and plastic foam redefined modern life, will take nearly a century to repair. What they can't yet predict is exactly what will happen during that time to crops, forests, animals and people. In the Earth's southern oceans, the first warnings already have appeared. Each spring,

le, Scientists Are Discovering Disturbing Depletion

BY ALAN WEISMAN

quantities of dangerous ultraviolet radiation that haven't reached through the atmosphere to the water's surface since Creation itself have begun to leak in. It is now clear that life has begun to leak out—specifically, the lives of watery organisms that form the primary link in the food chain that binds us all. Soon, scientists say, this ill fortune will be followed by skin cancers and eye cataracts in humans.

The saga of the disappearing ozone layer now stretches from polar research bases below Chile to Washington, D.C., and New England and on to the North Pole. Even as policy makers attempt to arrest the destruction, new studies keep revealing more evidence of ozone loss—this time, over the densely populated developed world. People with ringside seats at the Antarctic ozone hole have long joked about living at the end of the earth. Now, as they contemplate that phrase's grim double entendre, it is scant comfort to know that they are not alone.

TWO HUNDRED AND FIFTY MILES BELOW TORRES DEL PAINE, THE road reaches Punta Arenas, the world's southernmost city. The gabled houses, poplar-lined streets and generally fair-skinned population frequently remind northerners of Maine or Nova Scotia. The single hint of Spanish heritage is the cypress-shaded central plaza with its bronze statue of Ferdinand Magellan, who passed here in 1520 en route to proving he could circumnavigate the world.

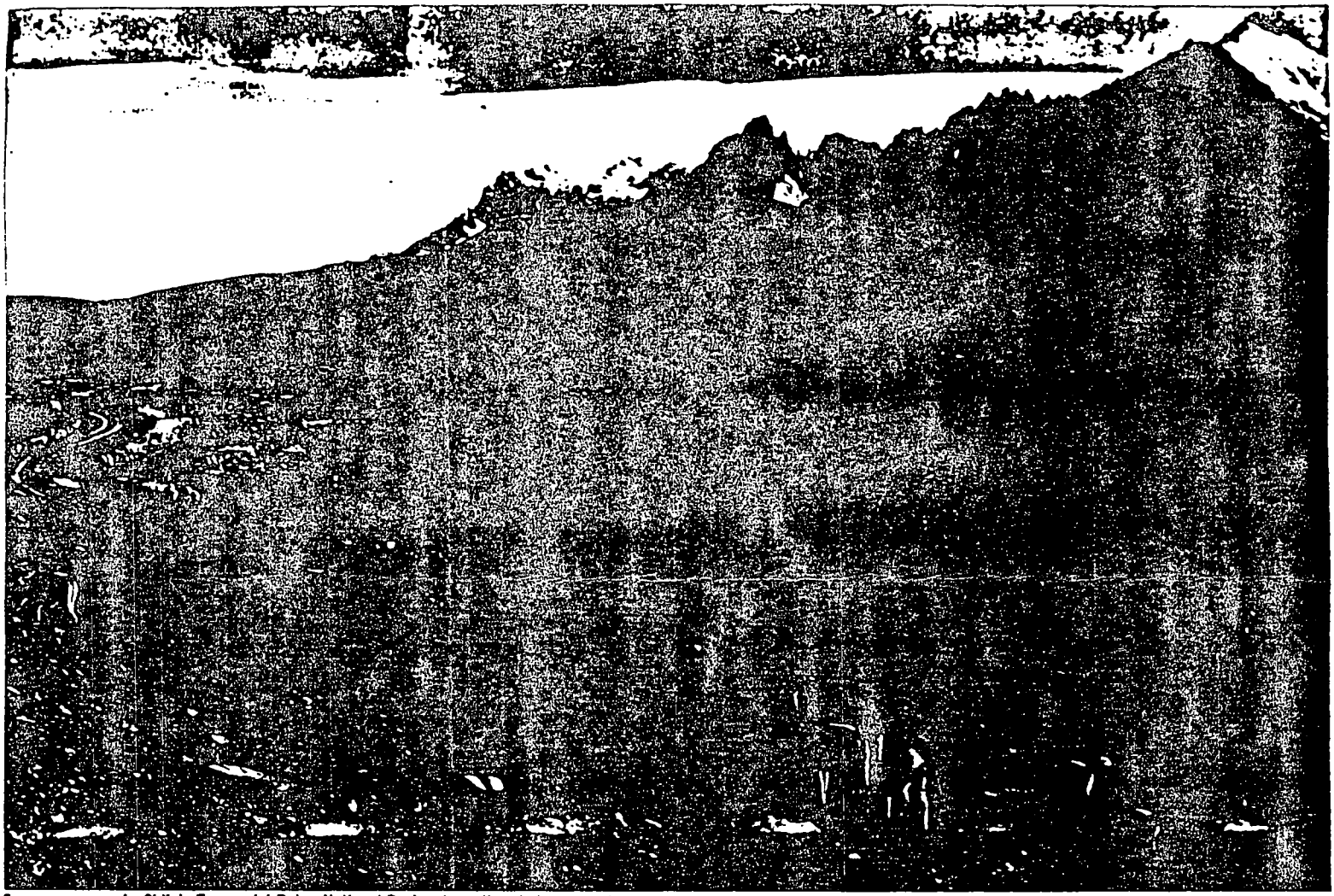
Founded as a lonely military outpost at the tip of the South American mainland,

A NASA orbiting satellite sent images of the ozone hole over Antarctica in 1987.

Punta Arenas prospered during the last century as a coaling station for ships rounding Cape Horn. But in 1914, when sea lanes shifted 5,000 miles north to the newly dredged Panama Canal, there was little further reason for a city here. That same year, however, record numbers of Croatians were headed for America—anywhere in America. Rumors of gold enticed many to Tierra del Fuego, just across the Straits of Magellan. The big island's ample moors looked lush compared to the Croatians' rocky Dalmatian coast homeland. After gold fever cooled, they stayed and became sheep ranchers, and Punta Arenas revived as a wool-exporting port.

At first, the news that the ozone layer, the earth's protective sunscreen, had been perforated due south of town evoked little attention among Punta Arenas' 125,000 residents. In these latitudes, an increase in lethal ultraviolet rays was considered just one more piece of bad weather. Nearly constant winds shriek in here from the Atlantic, from the Pacific, down the Andes or up from Antarctica, often simultaneously. Even in midsummer, when the sun shines nearly 20 hours straight, sweaters knit from the thick fleece of Tierra del Fuego sheep remain firmly in fashion.

NASA



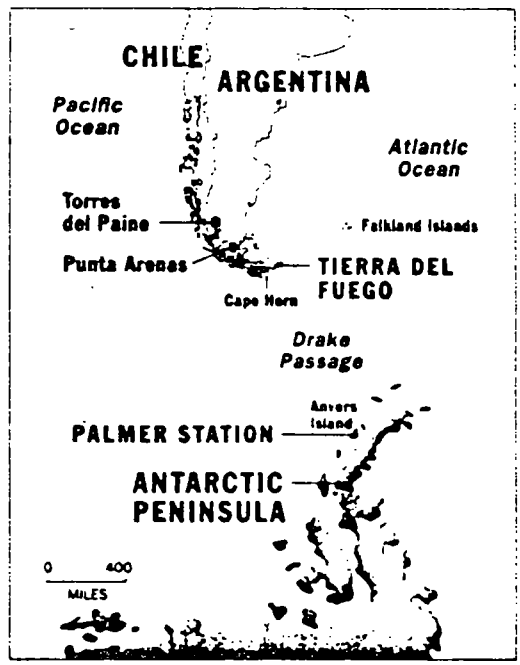
Guanacos graze in Chile's Torres del Paine National Park, where the air is pure—but as the ozone hole spreads north, plant and animal life will be hit with increased ultraviolet rays.

But the sudden arrival of legions of foreign scientists got everyone's attention. In August, 1987, in order finally to determine what was devouring the south polar ozone, the U.S. National Aeronautics and Space Administration flew 150 scientists and technicians, mostly American and British, to Punta Arenas. NASA even repaved the airport to accommodate a U-2 spy plane, capable of soaring 70,000 feet into the stratosphere. Redubbed the ER-2 and equipped with chemical probes, it was prepared to enter the ozone hole itself.

Obviously, something portentous had provoked all this expense. Yet beyond glimpses of the visitors in restaurants, conferring in English over plates of local mutton or king-crab pizza, few Punta Arenans learned many details. The hangar that housed NASA's headquarters was off-limits, and little news emerged. Attention focused more on the dollars the NASA folks were spending around town than the reason they'd come.

One local who slipped through the tight security was a pale, rangy electrical engineer, an assistant professor at the city's Magellan University. Bedrich Magas, who arrived in Chile from Croatia as a boy in 1959, could speak English, and he ingratiated himself with NASA's Airborne Antarctic Ozone Experiment personnel by arranging to have some precision adapters needed for a laser measuring device machined on 24 hours' notice.

"Forget it," he told Dr. Robert Watson, the project director, when asked to submit a bill. Two years earlier, Magas had sailed across the Drake Passage to Antarctica on a university research trip. Seeing the ivory continent, encircled by its ever-changing horizon of floating mountains of ice, had stunned him. Antarctica was simply gorgeous. It was also abounding with humpback whales, south polar skuas the size of eagles, soaring giant petrels, elephant and leopard seals, cormorants and thousands of irresistible penguins.



The capacity for life to flourish in such consummate cold, Magas had learned, is based on an enormous supply of inorganic nutrients, dragged by deep currents from the world's oceans to the Antarctic, where the waters rise and begin again to circulate northward. Reduced to their simplest components after years at great depths, these nutrients—nitrogen, phosphorus—support trillions of phytoplankton: tiny plants suspended in Antarctic waters. These plankton, in turn, are the main course for transparent, shrimp-like crustaceans called krill. Living in a sea of food, krill multiply into swarms that stretch for miles. Whales and penguins gorge on krill; leopard seals gobble penguins; the krill larvae, which graze on microscopic plants growing on the underside of the ice, are in turn consumed by silverfish, the Antarctic herring that ends up in the bellies of skuas. . . .

Unobscured by the complexity of the tropics, the food web of Antarctica stands conspicuously revealed against its stark white background. As Magas tried to explain in talks he began delivering around Punta Arenas, the whole elegant system would collapse without tiny phytoplankton. And, from what the visiting scientists were finding in the ozone layer, the phytoplankton were now at risk.

NASA had set out to test whether a theory, often ridiculed after it was proposed in 1974, was true after all. F. Sherwood Rowland and Mario Molina, chemists at the University of California in Irvine, had suggested that chlorofluorocarbons (CFCs), man-made chlorine compounds that were indestructible on Earth, were being ripped apart by solar ultraviolet rays when they rose to the stratosphere. The UV radiation, Rowland and Molina contended, would free pure chlorine, which would attack the natural layer of ozone that kept those ultraviolet rays away from earth.

"When that happens," Magas would tell whomever would listen—scout groups, women's clubs, crab fisher-

Contributing editor Alan Weisman is currently working on "Vanishing Homelands," a documentary series for National Public Radio.

Photos above, Cecile Weisman; opposite, Alan Weisman; map and graphic, Anders Ramberg

them, sheep farmers' associations— the trouble really starts."

Part of the trouble, however, was trying to keep things simple. "Ozone," he would attempt to explain, projecting a color slide covered with circles and arrows on the wall, "is just a regular oxygen molecule, O_2, with an extra oxygen atom, which makes it O_3. Cl—free chlorine—steals that atom away. That leaves oxygen, O_2 again, and chlorine monoxide, ClO," he'd say, aware of increasingly blank stares. "Two ClOs then pair together," he'd press on; "sunlight breaks them up into more oxygen and free chlorine again, and the whole thing starts over. Each chlorine atom ends up wrecking at least 100,000 ozone molecules before some other airborne chemical intercepts it."

"What about the plankton?" someone would ask.

He was getting to that. First, the latest bad news: If chlorine monoxide showed up over Antarctica, that would prove that the stratospheric chemistry Rowland and Molina had predicted was indeed responsible for the huge new ozone losses—not, as chemical manufacturers were insisting, natural weather processes. The year before, in 1986, a hastily assembled ground experiment by U.S. researchers had first detected ClO above Antarctica. Now, a device slung under the wing of the converted spy plane that flew directly into the ozone hole not only confirmed their observation, but brought back frightening numbers:

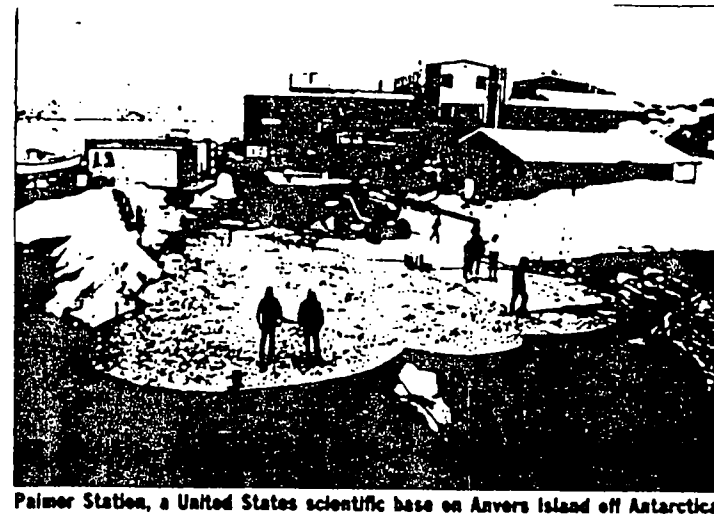
NASA had found 500 times more stratospheric chlorine monoxide than was normal at Earth's mid-latitudes.

As the implications of these figures sank in, Magas had watched apprehension accumulate in the faces of project director Watson and Harvard University's Jim Anderson, who designed the chlorine detector. A decade earlier, a public fuss in the United States over potential ozone damage from supersonic transport planes and underarm sprays had scuttled plans for an SST fleet and led to a ban of CFCs in aerosol cans. Most people assumed that the problem was solved; unfortunately, the ban neither prohibited CFC sprays in other countries nor stopped companies such as Du Pont, their largest manufacturer, from selling the chemicals for other uses: cleaning electric circuit boards, filling car air conditioners, making insulation or blowing foams for running shoes.

During the 1980s, more chlorofluorocarbons were manufactured than ever. Millions more tons drifted toward the stratosphere, where winds distributed them evenly over the Earth. Then British researcher Joe Farman, after doubting his own data for two years, announced in 1985 that 40% of Antarctica's ozone appeared to be missing overhead each spring. No one, not even Rowland and Molina, had predicted anything like this. No one was sure why the effects first appeared over unpopulated Antarctica. Some saw this as a blessing: At least nobody was bathing in ultraviolet radiation—except for all those delicate phytoplankton and everything else that depended on them.

But the same chemicals that caused this, Bedrich Magas informed his little Punta Arenas gatherings, were also above Chile. The ozone hole was getting deeper and bigger every year. "We could be next. In fact, we will be," he told them.

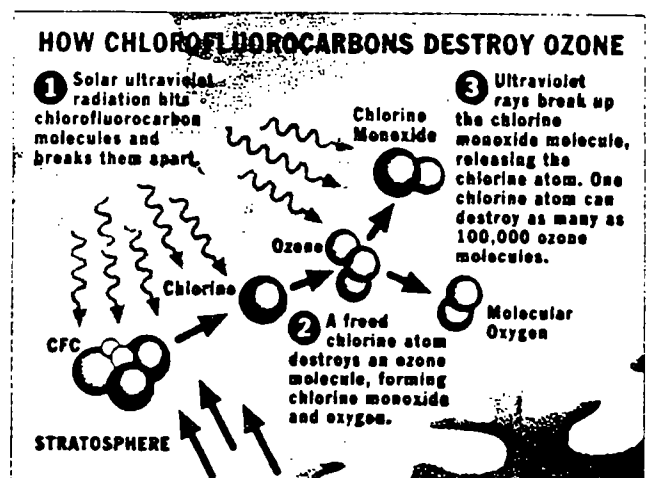
ULTRAVIOLET RAYS DISRUPT DNA, WHICH contains life's genetic codes. Oddly enough, they also helped to fashion life as we know it—and they created the ozone layer itself. Back when the primordial goo of the Earth's surface was being pelted with unimpeded ultraviolet radiation from space, at some pivotal instant—perhaps sparked by a jolt of lightning—the first biological molecules formed. These living cells mutated rapidly under the high energy of UV rays, metabolizing inorganic compounds and turning them into new organic ones. Eventually, one of these reacted to carbon dioxide and sunlight in the primitive atmosphere by giving off a new kind of exhaust: oxygen.



Palmer Station, a United States scientific base on Anvers Island off Antarctica.

Now the ultraviolet rays had a new target. Picking off O_2 oxygen molecules, they split them apart. The two single oxygen atoms immediately latched onto nearby O_2 molecules, forming O_3: ozone. But ultraviolet easily breaks the ozone molecule's extra atom off, re-forming oxygen; just as quickly, that atom sticks to another pair, forming more ozone until it absorbs more ultraviolet and spins off again.

Gradually, beginning about 10 miles above the surface, a state of equilibrium emerged: Ozone was constantly being created, pulled apart and recombined, thus constantly occupying UV rays so they never reached the ground. This was especially true of mid-range ultraviolet, UV-B, the most dangerous to organisms. As the layer of ozone stabilized, so did the life on Earth it was shielding.



Eventually, species evolved that could never have tolerated the former levels of UV-B bombardment. Eventually, one of them was us.

Unfortunately, during the past 60 years, humans managed to undermine the oxygen-ozone balance that has remained relatively constant since soon after life began. Beginning in the 1930s with Freon, the trademark name for the CFCs used in refrigerators, we started dissolving this protective ozone covering by soaking it with chlorine. The same year that NASA proved this, 1987, delegates from 24 nations in Montreal agreed to cut CFC production in half by the end of the century. They also restricted bromine compounds used mainly in fire extinguishers, now known to be even more reactive than chlorine in the stratosphere. It was obvious to most atmospheric scientists, however, that halfway wasn't enough.

"Think of the atmosphere as a big bathtub, filling from the taps with chemicals while the drain runs extremely slowly," argued David Doniger, attorney for the Washington-based Natural Resources Defense Council during the lobbying effort in Montreal. "The only way to get chlorine levels down is to turn off the taps and wait 100 years for the tub to drain."

Until then, he repeated, the only way the hardy CFCs would wear out was by depleting ozone. The more chlorine and bromine that kept escaping into the stratosphere, the longer that would take. And nobody really was sure what would happen to life on Earth in the meantime.

RAY SMITH, AN OPTICAL PHYSICIST AT THE University of California, Santa Barbara, understood the double bind of research. Special interests liked to use research as a delaying tactic. In 1988, it occurred to Smith that 14 years had been lost since Rowland and Molina's warning. During that time, industry had successfully stalled, demanding more proof before subjecting society to the hardship of doing without air conditioning until alternatives to CFCs could be developed.

Back in the 1970s, Smith had built an instrument to measure UV-B penetration under water. The idea was to learn how ultraviolet radiation affects anchovy eggs and larvae, but after the aerosol ban, government money for ultraviolet research suddenly dried up. With no funding, Smith packed away his instrument. Then the ozone hole appeared and kept growing. At the time, he was studying the impact of coastal weather fronts on phytoplankton with his good friend Barbara Prezelin, a UC Santa Barbara biologist.

"Think of the hole as an ozone front," Smith would say to her. "If you knew the ultraviolet fluctuations, could you predict biological effects?"

Two years later, in September, 1990, Prezelin and Smith—along with his renovated underwater UV spectroradiometer, four more tons of equipment and a crew of 19—were headed to Chile. They had received a National Science Foundation grant to sail into Antarctica's Bellingshausen Sea and wait for the ozone hole to open up over them. This occurs every October soon after the beginning of the Antarctic spring, just as the sun rises after six months of darkness. Scientists now realize that frozen particles in polar stratospheric clouds are major culprits, by providing a surface for chlorine atoms to cling to. The energy of the rising springtime sun then releases the chlorine, triggering the deadly reactions. The polar clouds also freeze nitrogen, which in its unfrozen state helps divert chlorine from the ozone. The destruction of the protective ozone shield occurs just as vulnerable young phytoplankton are ready to absorb light to begin the springtime process of photosynthesis.

For 10 days in Punta Arenas they unpacked massive numbers of boxes, recalibrated delicate equipment, fought to get computers through customs and prayed that the navigation gear on their research vessel, the Polar Duke, would get fixed before the spring ozone hole had already closed. In the meantime, Barbara Prezelin kept having to apologize to people for not knowing why their sheep were going blind.

Another project scientist, Deneb Karentz, then of UC San Francisco, had passed through two months earlier and had some long conversations with Bedrich Magas. Magas had learned that Karentz, a marine biologist there to identify phytoplankton and measure radiation dosage, had spent three years studying the genetics of UV damage in human skin cells. Magas was trying to convince Dr.

pale-skinned people of European descent [illegible] were in imminent danger of ozone-induced skin cancer.

He was not having much luck, he confessed. Although Abarca admitted to a recent increase in malignant melanomas, he was not prepared to link anything to ozone depletion. It was far too early to tell—and besides, without knowing how much UV-B radiation was hitting Punta Arenas, it was also impossible. The U.S. National Science Foundation had put UV monitors in Antarctica and on the Argentine side of Tierra del Fuego, but none in Punta Arenas, where most of the people lived. Neither the Argentines nor the Americans had sent them any data—in fact, since NASA left three years ago, they'd received no information at all.

It was obvious that people in Punta Arenas were becoming concerned. Pharmacies were stocking up on sunscreen, and optical shops advertised the latest in sunglasses for children. Greenpeace was funding local environmentalists to collect and send rabbit eyes to a university laboratory for analysis. Newspaper headlines announced that 31 groups had canceled tours to Torres del Paine, fearing the ozone hole. And everyone was complaining about something almost unheard of in this sub-Antarctic climate: sunburn.

UC Santa Barbara scientists Ray Smith and Barbara Prezelin in the Antarctic.

AFTER FIVE DAYS OF CROSSING THE DRAKE Passage, Prezelin and Smith awoke to find the Polar Duke pushing through a sea of loose brash ice. Huge icebergs, recently calved from glaciers, had flipped in the water, so the oldest ice now towered above the pilothouse. Thousands of years of pressure had squeezed out air bubbles until light refracting through the frozen water was as undiffused and blue as the polar sky.

In Antarctic ice-core samples, the birth of the industrial revolution could be detected in minute traces of carbon and lead. Subsequent deposits marked the first nuclear explosions. Now the atmosphere was filling with chlorofluorocarbons, and, in a century, its carbon dioxide had increased by a third. Here, in this revealing environment at the bottom of the world, scientists expected to find the first conclusive repercussions from both.

They docked at Palmer Station, a United States scientific base at the edge of a receding glacier on Anvers Island, just off the Antarctic Peninsula. Palmer, a blue clump of prefabricated steel labs and dormitories, houses 43 researchers. Scientists here wondered if the unprecedented absence of an algae bloom along the melting ice edge was due to an increased cloud cover caused by global warming—or something else. Whatever it was, the krill, starved for carbon nutrients, were hardly reproducing. It was early October; the Antarctic dawn had begun, and ozone levels were dropping. Researchers studying nearby breeding colonies of Adelie penguins wore dark glasses and coated their faces with grade-25 sunscreen, but, despite the sun's low angle on the northern horizon, the blondest among them were already becoming sunburned.

Deneb Karentz and three student assistants had arrived at Palmer two months earlier during the Antarctic night, to prepare cultures of local phytoplankton that the scientists would use as controls during their cruise. Now they were headed south, racing the rising sun to the edge of the pack ice. It was well known that UV-B damaged living cells in laboratories. The discovery of the ozone hole had finally freed up research funds to see what UV-B did in the real world.

For the next six weeks they floated along transect lines hundreds of miles long, suspending water and plankton [illegible] things, they tested to [illegible] if plankton could produce [illegible] ral sun-block pigments—the microfloral equivalent of a suntan—to resist the increased ultraviolet radiation. With Smith's underwater spectroradiometer, they also settled an old scientific controversy, proving that UV-B penetrates the ocean—to at least 70 meters, with detectable effects on microorganisms as deep as 35 meters.

Once every minute, they monitored UV at the ocean's surface. Using a mathematical model Smith devised, corroborated later by a NASA satellite, they calculated the shrinking ozone overhead. The ozone hole, an elongated depression bigger than the United States, was rotating like an invisible propeller every two weeks. Through extraordinary luck, they had three full cycles to measure phytoplankton growth and reproduction with and without the hole. Whenever blizzards didn't blow and light permitted, they took samples, alternating two-hour shifts on the Polar Duke's wet, freezing deck. The harvest of data grew.

Every day at 4 a.m., Prezelin and Smith checked the weather, then roused the early shift to get instruments and specimen trays over the side and securely moored. Finally one morning, after she and a graduate student had rammed numbers through her computer all night long, Prezelin told him, "I think we're seeing it."

Smith already knew: They all did. Every time the ozone hole passed over, there was an unmistakable trend: Phytoplankton growth faltered. Because no measurements existed before the ozone hole was discovered, they could only guess how much loss had already occurred. Being purposely conservative, they announced phytoplankton production decreases of up to 12% each spring. Privately, they suspected the figures to be significantly higher, but it would take years of interpretation to understand what their findings really implied.

Since the damage began during the phytoplankton's spring reproduction, would those numbers tumble through the food chain, resulting in even greater percentage losses of krill, penguins and whales? So far, these observations represented just a small fraction of the world's phytoplankton output. If serious ozone depletion spread beyond Antarctica, would that mean the aquatic equivalent of burning rain forests, depriving the earth not only of food but of even more plant life to convert carbon dioxide back to oxygen?

And the hole was staying open longer and getting deeper. The UV monitor at Palmer Station showed that springtime ultraviolet radiation had doubled since 1970. After six months of darkness, tender organisms were suddenly being awakened by blasts of ultraviolet light beyond what they normally received in midsummer. Karentz and her colleagues had identified eight different sun-blocking compounds in local plants and threshold of tolerance? What would that mean for tender human organisms, such as children in southern Chile?

Across the Drake Passage, Bedrich Magas wormed over the same thing. As warm, high-pressure air pushed down over Antarctica, breaking up the annual ozone hole, chunks of the hole drifted north over New Zealand, Australia and South America. Mothers and kindergarten teachers stopped Magas in the streets of Punta Arenas, complaining of children who went outside to play and returned pink as lobsters. A local artist hauled him to her garden to see desiccated rosebuds and the yellowing grapevines in her solarium.

"Did you water them?" he asked.

Of course, she retorted. The artist had also taken one of the odd, double-headed sprigs of lupine that had suddenly appeared in her yard to the Patagonia Institute, a research wing of Magellan University, to show horticulturist Lothar Blunck. Blunck assured her that it was a normal anomaly, not an ozone-hole mutant.

Blunck was getting tired of newspaper portrayals of sheep stumbling into water holes and drowning. He was aware that sporadic viral blindness among livestock wasn't unknown in the region, albeit maybe not hundreds of cases in a single flock. He didn't want to contribute to panic over the ozone hole. But for five years now, he had been noticing how certain plants in his greenhouses, such as African violets and cucumbers, increasingly turned yellow. Chile's economy now depends on its agricultural exports. If these things actually signaled increased ultraviolet radiation, he wondered what it portended for the country.

WHEN SEN. ALBERT GORE JR. WAS AN UNDERgraduate at Harvard, a professor explained the greenhouse effect to him. Twelve years later, when he was elected to Congress, Gore held the first congressional hearings on global warming. Soon he found himself dealing with another atmospheric crisis. "The scientific community has screened more than 300 species of crops," Alan Teramura, chairman of the University of Maryland botany department, was telling Gore. "Alarmingly, over half seem to be sensitive to UV radiation."

Even more disturbing, the list included major staples such as peas, beans, cassava, soy, rice and the entire squash family—among which the most susceptible to UV were cucumbers.

For the second time in 1991, the Tennessee senator, now chairman of the Senate Committee on Commerce, Science and Transportation, was holding emergency hearings on ozone depletion. Even before any public announcement of plankton decline in the Antarctic ecosystem, the world had already suffered two ozone-related shocks within a single year. The first, in April, was when William K. Reilly, chief of the Environmental Protection Agency, announced that the ozone layer was disappearing over the United States 300% faster than previously believed. This, he conceded, would add at least 200,000 skin-cancer deaths over the next 50 years.

The second, in October, was a United Nations report that the northern hemisphere's ozone losses had mysteriously extended into the spring and summer, when the sun's rays were most direct. The worst possible case for the year 2030 had already come true.

Just one year earlier, nations that had agreed to phase out 50% of offending chemicals by the year 2000 had upped that figure to 100%. Against U.S. resistance, a multimillion-dollar fund was established to help developing countries convert to alternative technologies as they became available. Now, Gore was calling for banning CFCs and destructive bromine compounds by 1996, as European countries had promised.

Even cynics who believed that Albert Gore was simply trying to embarrass President George Bush were having trouble ignoring witnesses such as Alan Teramura. Ma

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strains of rice—the world's most important food crop—appeared to be nearing their threshold of UV tolerance, the botanist explained. EPA-funded rice studies in the Philippines had also revealed an unsettling twist: As the world's population increased, more rice paddies were releasing more methane, a greenhouse gas that accelerates global warming. Methane passes through the stems of rice plants as through a conduit; ultraviolet radiation seemed to force rice to develop extra branches, increasing the number of straws that allow methane easy passage. As climate changes affected rice, Teramura suggested, rice, in turn, could aggravate climate change.

Splicing genes from more UV-resistant crops might help keep the world fed, he said. But the research had yet to begin. To engineer new varieties would take 10 to 20 more years—both to find the genetic mechanism for resistance and to breed out flaws the resistant strains might have, such as vulnerability to pests.

A worse problem, Teramura added, was the natural environment. We couldn't breed entire new forests nor could we protect them with hats, sunglasses and sunscreen. Long-lived plants such as trees may be especially sensitive: Preliminary research on three commercial species of pine suggested they accumulate ultraviolet radiation effects over time, so any damage would appear after UV dosage passed some unknown limit.

From trees to phytoplankton, Teramura concluded, natural diversity will decline, as the balance gradually tips toward species that can endure more ultraviolet. As Dr. Margaret Kripke, head of immunology at the University of Texas' M.D. Anderson Cancer Center, testified, the same holds for humans.

Although ultraviolet-induced skin cancer mostly afflicts Caucasians, darker pigmentation provides no extra protection for immune cells in the skin. The tendency for some people's immune systems to be more easily suppressed by ultraviolet light seems to be inherited regardless of race. Little is understood about the increased risk for infectious diseases, although UV is known to trigger the herpes virus, and a new U.N. report warns that in laboratory mice UV seems to activate the AIDS virus. "There are two major public health problems in the world: inadequate nutrition and infectious diseases," Dr. Kripke said. "Ultraviolet radiation has the potential to affect both."

IN PUNTA ARENAS, BEDRICH MAgas was finally able to show data from Argentina to the reluctant dermatologist, Dr. Jaime Abarca, indicating that the ozone hole sometimes brushed the tip of South America. The situation had not existed long enough for attributable cancers to appear, but each spring, Abarca realized, his patients were exhibiting increasingly severe non-malignant disorders, such as sun allergies and lupus. Why, he wondered, weren't researchers from CFC-producing countries such as the United States down here, studying the biggest human population under the ozone hole?

The answer, Margaret Kripke knew, was that the United States was barely funding UV-effects studies at home. She had written senators protesting the dearth of UV research money for biologists and medical investigators, who perhaps weren't as sophisticated as NASA at lobbying Congress. About 100 times more had been spent on atmospheric studies of ozone depletion than on its biological effects. Lately, she feared that funds would be diverted into finding CFC substitutes, not toward studying human health. "That is shortsighted. The ozone depletion we've already caused will be around a long time," she said. "We need to know what sunscreens to wear. We need to know what we should be looking for."

NASA, meanwhile, was doing its own looking. For 13 years, Total Ozone Mapping Spectrometer (TOMS) had been orbiting north-south 600 miles above the Earth, its volume of information so overwhelming that data processors failed to notice the ozone hole until British researcher Joe Farman reported it from the ground. In 1991, two more ozone-tracking satellites joined TOMS. Then, last December, a group of scientists, including Sherwood Rowland, who discovered the chlorofluorocarbon-ozone connection, and Harvard's Jim Anderson, gathered in Bangor, Me., to watch the ER-2, NASA's converted spy plane, carry Anderson's chlorine detector and other instruments over the North Pole.

A series of flights had been planned through March. Halfway into the mission, the results were so grim the scientists felt obliged to go public. This time, there was even more chlorine monoxide over northern New England and eastern Canada than they'd found in the Antarctic in 1987. They sent the ER-2 south to the limit of its range, near Jamaica. More chlorine than ever was also over the tropics, where the sun is highest and ultraviolet radiation shines most intensely.

Even more sobering were signs that naturally occurring droplets of sulfuric acid in the mid-latitude atmosphere over the United States and Europe were behaving like the ice crystals of polar stratospheric clouds. The droplets were providing tiny surfaces for chlorine reactions to take place and suppressing the stratosphere's immune system by tying up nitrogen compounds that retard chlorine's assault on ozone. As if that weren't enough, the massive eruption of Mt. Pinatubo in the Philippines had injected 10 times the normal amount of sulfur particles directly into the stratosphere, where they will remain suspended for nearly four years.

During that time, atmospheric chlorine will be nearing its all-time peak, reaching it just after the turn of the century. Efforts to phase out CFCs cannot coax it back to pre-ozone-hole levels un-

til about the year 2075. What will happen, especially during the next decade, is unknown. The dynamics the scientists were studying in the northern hemisphere, Jim Anderson realized, were more subtle and complex than the sledgehammer effect of the concentrated vortex over frigid Antarctica. The northern vortex, buffeted by atmospheric waves along mountain ranges, oozed like an amoeba, sending one lobe over Quebec and Maine, another over Russia. If the vortex remained intact into the spring, enough ozone would be lost to call it a bona fide hole—if not this year, then soon.

The real question, though, involved not the North Pole but the sky above the United States, Europe, Japan and China, where so many people live. Many different reactions at different altitudes—chemistry involving not only chlorine and bromine—were combining to erode ozone. Every molecule in every catalytic reaction held a surprise, and they had yet to study even half of them.

"In some sense," Anderson observed, "justice is prevailing. The northern hemisphere produced an overwhelming amount of CFCs. The ozone hole opened in a distant place. Now the problem has come home to roost." By the century's end, he added, living near Antarctica's concentrated hole with its occasional passes overhead may be preferable to life under the northern swath of thin, ruptured ozone. The prospect of people hiding from the sunlight was unspeakable to him. But now he and his colleagues were wondering if anyone would be lying on beaches over the next several decades.

In response to the NASA announcements of new ozone loss over the United States, last month President Bush reversed his former stance and announced that "with limited exceptions for servicing certain existing equipment, all production of these substances in the United States will be eliminated by Dec. 31, 1995."

"We've wasted more than a decade," says Sherwood Rowland. "A lot more industrial CFCs appeared after we'd already banned aerosol sprays." With no law to compel them otherwise, industry has dawdled in developing clean substitutes. Currently available alternatives, mostly related compounds called HCFCs, while an improvement, still harm ozone and are expensive. Even Rowland's own university, UC Irvine, recently chose a new central cooling plant that uses CFCs instead of a more benign substitute—which one day will also have to be phased out.

BEDRICH MAGAS, HIS long legs dangling over a cliff at the end of the American continent, gazes at snowcapped islands where the Andes bend eastward and become the Darwin Mountains, named for the explorer who came to Chile to discover the origins of life. The pink, gray and golden dusk is so beautiful that Magas finds it hard to remember that the sky is sick. The hardships the United States will now endure by retrofitting millions of car air conditioners will be nothing, he knows, compared to effecting changes in the developing world. Despite international agreements, salesmen dumping CFC-based compressors and freezers are already in town, making the rounds. But that is not Magas' real worry.

Humanity's unintended, unfortunate experiment with the ozone layer is coming to a close, although it will be many years before human beings know if the damage was halted in time. But there are other crises pending, and thus far, no one has heeded the ozone hole's costly lesson about delaying too long. Across the water on Tierra del Fuego, and throughout the world, oil is being pumped to the last drop, despite years of warnings by Rowland and others that to continue burning fossil fuel risks planetary suicide because of global warming. No government yet dares to dream of phasing out gasoline. This time, Magas wonders, will we really wait until it's too late?

Recently, for allegedly scaring off developers with his ultraviolet alarms, Magas was publicly branded an "eco-terrorist" by the provincial governor. Now, he supposes, if he takes on global warming, he'll be scorned as the Prophet of the Apocalypse.

A flock of upland geese flies past, silhouetted by the lingering glow over Cape Horn and Antarctica. "I wish the governor were right," he says. "I'd rather be wrong about all this. I wish it were all a dream—that all we had to do is awaken, and the world will be right again." ■

Life Under the Ozone Hole

In Chile, the mystery of the bug-eyed bunnies

Walter Ulloa had no idea he lived in the Twilight Zone. He was too busy herding cattle on the southernmost spit of land in South America to have heard about the blind salmon caught in Tierra del Fuego. Or the pack of rabbits so myopic that hunters plucked them up by their ears. Or the thousands of sheep blinded by temporary cataracts. None of that much mattered—until unusual things started happening to Ulloa himself. After long days on an upper pasture, the 28-year-old ranch hand found that his arms burned "like boiling water," he said. His eyes, swollen and irritated, clouded over; his left one is now completely blind. Another ranch hand was also affected: focusing on objects now makes him weep uncontrollably.

Examining the symptoms, Chilean doctors said the two men were probably hit by excessive ultraviolet-B radiation. They suggested UV-resistant sunglasses. "I can't afford glasses," says Ulloa, gazing over the grassy tundra. "Besides, they would look strange out here."

BROOK LARMER

Taking no chances: *Ulloa at work—and wearing a baseball cap for protection*

Strange, indeed. But strange things are becoming commonplace around the Chilean port of Punta Arenas, the largest town (population: 115,000) to be located on the cusp of an ozone hole. Every year from late August to early December, the hole over Antarctica expands northward. Its outer reaches now cover the tip of South America, exposing flora, fauna and people like Ulloa to increased doses of ultraviolet radiation. The U.S. National Aeronautics and Space Administration recently found that the ozone hole has grown much faster than had been anticipated; it is now four times larger than the United States. Several Chilean scientists estimate that levels of the carcinogenic ultraviolet-B radiation jumped more than 1,000 percent in Punta Arenas on peak days last year. "This has never happened to a human population at any time in history," says Jaime Abarca, the region's lone dermatologist. "It's as if Martians had landed."

Residents lose no time in telling visitors about the otherworldly phenomena—from wilder-than-normal climatic gyrations to shifting reproductive patterns in birds, wild llamas and even cabbage. Nursery owner Ana María Schultz shows off two Veronica plants, one lush and green after a year in a greenhouse, the other yellow and sickly after being burned, she says, by radiation. Skipper Robert Mahler says his yacht's dacron sails now become brittle and deteriorate nine years before their 10-year guarantee is up. Veterinarian Vladimir Mazlov claims that a small but increasing number of the region's 2.4 million sheep are being struck by temporary blindness. But nothing is more troubling than the possible effects of UV-B radiation on human beings: skin cancer, cataracts, even a weakened immune system. "It's like AIDS from the sky," says Bedrich Magas, an electrical engineer who has waged an aggressive campaign to attract public interest—and research funds. "We get one dose every spring."

Skeptics say Magas is acting less like Galileo than Chicken Little. To date, very little direct evidence exists of a link between the freak occurrences in southern Chile and excess UV radiation. There are only sparse data—and spirited debate—about the intensity of UV rays in Punta Arenas. Some scientists claim that sun worshipers in Miami and Acapulco are bombarded by more ultraviolet rays than residents of southern Chile, partly because the subarctic climate and oblique sunlight give residents little incentive to put on string bikinis. The blinded sheep, according to some farmers and veterinarians, may simply have contracted a virus unrelated to UV radiation. And the bug-eyed bunnies? They may have been the victims of a virus first spread 20 years ago to thin out an overpopulation of rabbits that threatened ranching. "Blindness," Magas concedes, "is one of the dark spots of radiation research."

Skin cancer: But not the only one. So far, most studies have looked at the effects of radiation on plankton and other spineless creatures that form the basis of the marine food chain, not on human beings. In Punta Arenas, a living laboratory for human reactions to radiation, there is a startling lack of research on the problem.

Abarca, the dermatologist, has noticed a high incidence of melanomic skin cancer (four times its average rate) and an increase in cases of skin burns and blotches. But he is cautious about blaming ultraviolet radiation. "We need more instruments and information," Abarca says. Neither is forthcoming. A three-year University of Chile project to study the effects of the ozone hole has foundered. The team of scientists has been unable to raise the last $11,000 needed to buy a spectral radiometer, which measures radiation levels. "We are paying the bill for industrialized countries that are depleting the ozone," says Rodolfo Mansilla, who lost 80 sheep to blindness last year. "They have to take an interest."

The Chilean government was dragged into the fray last month. Manuel Baquedano, head of the Institute of Political Ecology, demanded that the government remove 17 children living on a Chilean air base in Antarctica, directly under the ozone hole. Air Force chief Ramon Vega Hidalgo said there was no immediate danger but conceded that the problem should be studied more vigorously and with better instrumentation. Meanwhile, back in Punta Arenas, sunglasses are selling briskly and sunscreen is being stocked in pharmacies for the first time. It is a cold and cloudy afternoon, but Lionel Morales is wearing sunglasses, a wide-brim hat and sun block (factor 15). "I may look silly," he said, "but at least I'm safe." In the Twilight Zone, looking silly may be the only sensible thing to do.

BROOK LARMER *in Punta A*

HEADLINE: Business and the Environment;
Rabbits blinded by ozone hole

BYLINE: LESLIE CRAWFORD

HIGHLIGHT:
Leslie Crawford witnesses strange occurrences in southern Chile

BODY:
Last month satellites from Nasa measured the biggest ozone hole ever recorded over the Antarctic. It now extends more than 21m square kilometres, which is more than four times the size of the US, and is affecting parts of southern Australia, New Zealand, Argentina and almost half of Chile.

Antarctica loses about 70 per cent of its ozone cover as a result of a photochemical reaction - involving chlorofluorocarbons - which is triggered by

the first rays of the spring sun. The ozone hole allows increasing levels of cancer-causing ultraviolet rays to reach the earth.

Although Antarctica's ozone levels recover in summer, scientists note that the springtime hole is getting bigger, appearing earlier and lasting longer.

Moreover, strange things have begun to happen in southern Chile. Fishermen are catching salmon that are blind. Peasants report that wild rabbits have developed bulging eyes and must be suffering from impaired vision because they are so easily caught. Rodolfo Mancilla, a sheep farmer in Tierra del Fuego, says his animals are also going blind.

Some tree buds this austral spring are showing deformed growth, while certain types of marine algae are secreting a red pigment never seen before.

In Punta Arenas, there is fear and concern over the invisible bombardment of ultraviolet-B radiation. Nobody leaves home without protective hats or sunglasses. Doctors are being besieged by patients with allergies, eye irritations and skin complaints.

'These bizarre occurrences have no clear explanation,' says Bedrich Magas, a researcher at the University of Magallanes in Punta Arenas, 'but they coincide

with the thinning of the ozone layer which allows 20 times more ultraviolet radiation to reach the earth.'

With a manual radiometer, Magas has recorded the same intensity of radiation that is found in the Caribbean in summer. 'Southern Chile does not have a tropical habitat, it cannot take this kind of punishment,' he says.

Magas believes there is an urgent need for a serious scientific study on the impact of UV-B radiation in southern Chile. 'This region would be an excellent laboratory to study the effects of ozone depletion,' he explains.

In Santiago, Sergio Cabrera, associate professor of molecular biology at the University of Chile, is trying to raise funds for a three-year study on the effects of UV-B radiation on humans and its consequences for fishing, forestry and agriculture. He is still Dollars 11,000 (Pounds 6,000) short of being able to afford a US-made spectroradiometer that measures ultraviolet radiation

these data are crucial for a country that works on a model of economic development heavily dependent on the export of fruit, fishmeal and cellulose.

Research conducted in Australia and the US has shown that UV-B radiation stunts growth in plants. It is lethal in the early stages of life because it can destroy the genetic information contained in reproductive cells.

It is a cruel irony that southern Chile receives the highest levels of UV-B radiation during spring, when plant and animal life are at their most vulnerable.

Ultraviolet rays can also penetrate depths of 20-40 metres into the ocean. Again, scientists in the Antarctic have observed that UV-B rays affect the growth and reproduction of phytoplanktons, the basis of the marine food chain. The red pigment noted in some marine algae is believed to act as a protective screen against excessive radiation.

Humans have no such natural defences, and exposure to UV-B radration can cause skin cancer, cataracts and immune deficiencies. The blindness of sheep and rabbits in southern Chile may be caused by the high levels of radiation.

Cabrera believes that Chilean agriculture will soon have to start selecting UV-resistant seeds for its crops, as not all plants appear to have the ability to create pigment shields against harmful radiation.

This kind of genetic engineering is expensive, and it raises the ethical question of why Chile, a developing country with limited resources, should pay for the consequences of ozone destruction caused by the industrialised world.

The potential damage is enormous, as the effects of UV-B radiation are cumulative and the ozone hole will continue to grow for decades after all CFC production stops.