

El Niño and La Niña

Blowing hot and cold

The terrible climatic twins—El Niño and La Niña—have periodically wreaked havoc on the Peruvian fishery

There is perhaps no other global phenomenon that has such a devastating local impact as El Niño, or ENSO (El Niño Southern Oscillation), as it is now increasingly known. The Southern Oscillation refers to the swings in atmospheric temperature and pressure between the Indian Ocean and the Eastern Pacific. After an El Niño, the system reverts back to 'normal', but, in the process, may overshoot. This brings abnormally cold waters off the coast of South America, and abnormally warm waters off Australia, Indonesia and the Philippines.

Such extreme changes have a pronounced impact on evaporation, which, in turn, changes where tropical storms occur, and this, in turn affects wind patterns more widely. El Niño suppresses tropical revolving storms (hurricanes and cyclones), while La Niña enhances them.

The 1997-98 ENSO has probably been the strongest of the century, and its impact over the last 18 months has been particularly severe. It has been blamed for drought and famine in Papua New Guinea and China; floods and land slides in Peru and Ecuador; parching in Indonesia and Australia; torrential rains in East Africa; and in flaming forest fires in Mexico and Florida.

Its impact in Indonesia became a factor in the overthrow of President Suharto, who was unable to deal with the combined impacts of economic, political and climatic crises. It has disrupted weather patterns and ocean currents worldwide, bringing death and destruction to hundreds of communities around the globe. Following in its footsteps, its chilling twin sister, La Niña, is currently being blamed for a debilitating drought

in Chile, floods in China and Bangladesh, and exceptionally strong hurricanes in the Atlantic.

According to popular folklore, it was Peruvian and Chilean fishermen in the 16th century who first coined the name 'El Niño'. They noticed that in some years, around Christmas time, the coastal waters became warmer, heralding the arrival of the Christ Child or El Niño in Spanish.

It is now known that the warming effects of El Niño extend far beyond the coastal waters off South America. This year's El Niño warmed waters stretching a quarter of the way round the world, from the coasts of Ecuador, Peru and Chile to a point North of Fiji.

While El Niño refers to a warming of the waters south of the equator off South America, La Niña refers to a cooling of these waters. La Niña is the 'saw' of El Niño's 'see': the flip side of the coin, or the volte-face of the Southern Oscillation.

As a rule, the trade winds in the tropical Pacific blow from east to west: from the west coast of South America to the eastern seaboard of Indonesia and adjacent areas. They set up a current which pushes warm surface waters away from South America towards South-east Asia.

Counter-current

An area of warm water is thus built up on the western edge of the Pacific (off Indonesia, Philippines and Australia), while a weak equatorial counter-current flowing from west to east helps to keep this in balance. The warm waters that accumulate in the south-west Pacific pump heat and moisture into the atmosphere, producing the monsoon rains which fall so prolifically in the South-east Asian region.

In El Niño years, the trade winds weaken, and the equatorial counter-current strengthens. Unrestrained by the trade winds, the warm waters built up on the western edge of the Pacific flow back towards South America, warming the coastal waters there.

This causes a dramatic change in local weather conditions, producing monsoon-like storms and heavy rains. In the Southeast Asian region, weather patterns are also disrupted. The cooling of the sea waters results in less moisture being pumped into the atmosphere. This causes a failure of the monsoon rains, bringing drought and famine to many areas.

In coastal Peru, floods may wash away roads, bridges and even entire villages, causing significant loss of life, limb and property. The Peru (or Humboldt) current is disrupted, and upwelling patterns off the coast of South America change.

As a result, fish stocks migrate south and into deeper waters, fish catches plummet and fish-eating birds die in thousands. Many believe that in 1972-73 the combined effects of overfishing and El Niño led to the collapse of the anchovy fishery. It subsequently took about 20 years for fish catches to reach pre-1970 levels. In theory, a strong counter-oscillation, or a Niña, should *enhance upwelling* and stimulate the fishery

production cycle. So the years after 1998-99—and failing another strong El Niño—could provide bumper harvests for the Latin American fishmeal industry.

Peru, the country which gave El Niño its name, is perhaps the most affected by this traumatic oscillation. According to the Peruvian National Weather and Hydrographic Service (SENAMHI) records, Peru has experienced El Niño phenomena in the following years: 1918, 1925-26, 1929, 1932, 1939, 1940, 1943, 1951, 1953, 1956-57, 1965, 1972-73, 1982-83, 1987, 1991-93 and 1997-98. Intensities are defined as 'weak', 'moderate', 'strong', and 'exceptional'.

Its arrival in Peru is heralded by an increase in sea and air temperatures in the coastal belt, torrential rain storms and flooding on the north coast, a lack of rain in the southern hills, a greater frequency of landslides on the western slopes of the Andes between 1000 m and 2800 m, and an increase in the flow rates of rivers entering the Pacific.

According to SENAMHI, the 1997-98 El Niño first appeared 40 miles off the southern coast of Peru, between Atico and Tacna in January 1997, through an inward movement of subtropical oceanic waters.

Temperature rise

These waters, moving in a northerly direction, increased the sea surface temperatures 20°C above average. From

El Niño: Opportunities and Threats

The perico or dorado (*Coryphaena* spp) is one species that has become particularly important during recent El Niños. A voracious predator with excellent white flesh and growing up to 1.5 m long, it prefers tropical waters with a minimum temperature of 24°C. It is widely dispersed throughout the surface equatorial waters of the tropical Pacific ocean, stretching some 6,000 miles (or 10,000 km) from the Gulf of Guayaquil (between Colombia and Ecuador) to the Tahitian islands.

Ever since its creation in 1970, the Ministry of Fisheries has kept records of the fresh-fish landings in each port. Its statistics for perico over the last 28 years show that it is usually caught only in the summer months, with catches of a relatively small size, averaging 35 tonnes per year. However, during times of El Niño, there is a marked difference. Thus during the exceptional El Niño which began in 1982 and ended in 1984, in just four months in 1983, recorded landings of perico reached 3,271 tonnes. In 1987, 3,718 tonnes were recorded. In 1992, 3,992 tonnes and in 1995, 6,598 tonnes. In January 1998, the Ministry of Fisheries recorded more than 2,340 tonnes passing through the wholesale fish markets in Lima. Estimated sales in February were around

4,300 tonnes, bringing the total for these two months to almost 7,000 tonnes. Taking into account the operational practices of the artisanal fishing sector, it is likely that, overall, more than 12,000 tonnes of perico were landed in the first two months of 1998.

The perico, like shark, sail fish, marlin and other tuna-like species, is generally found more than 25 nautical miles off the coast, in the zone between Pacasmayo in the north and Mollendo in the south. Vessels which fish these species belong to the artisanal deep-sea longline fishery. Fishing trips last at least eight days, and vessels must have an insulated fish-hold capable of carrying ice up to a third of their total carrying capacity.

In recent years, only a few specialized vessels have been able to profit from this fishery. In fact, the last census, undertaken in 1995, records that only 200 of a total of 6,258 artisanal vessels belonged to the high-seas longline fishery. Since May 1997 the perico fishery has grown steadily. Due to the continued presence of tropical and subtropical waters, perico has occurred along the length of the coast, and because it has been found within 10 miles of the coast, it has not required

March to July, tropical oceanic waters continued to flow in; causing sea temperature rises of 60°C in the north, 50°C in the central coastal area, and between 30°C and 40°C in the south. From August to September, the warm waters remained at the surface, maintaining a high temperature along the north and central coasts, which declined towards the south.

These climatic changes put the scientific institutions on full alert. They began to devote all their attention to recording them, and predicting whether they really heralded an El Niño, and, if so, what its intensity would be.

Subsequently, many predictions were made, but it is now widely agreed that the 1997-98 El Niño was one of the most severe this century. It was possibly even more severe than the exceptional 1982-83 El Niño, which is reported to have killed 300 people and left 1.15 million destitute in Peru alone.

The most devastating impacts of the current El Niño were recorded between December 1997 and March 1998. Some provisional figures put the death toll at around 300, with more than 16,000 injured, and with some 400 people missing. About 390,000 people have been left destitute, more than 13,100 homes wrecked, and 67,000 damaged. About 63,400 hectares of crops have been destroyed, and some 255,000 km of roads washed away. These figures do not include such indirect impacts as economic and production losses (from industry, agriculture, fishing, etc), and the impact on services (water, sewage, health, education, markets and transport). Peruvian President Alberto Fujimori has estimated that US\$800 million worth of damage has been done to his country. Others put the figure closer to US\$1.8 billion.

Hard hit

The Peruvian fisheries sector, more than any other sector, has been hit hard by El

fishing trips longer than one week. With prices paid rarely dropping below us\$1 per kg, there have been some powerful incentives for the artisanal fleet to convert to high-seas longline fishing. A boat of three tonnes, fishing no longer than three days at a time, can catch 2,000 kg of perico, providing gross earnings of 5,000 new soles (about us\$1,700-2000). This fetches an income of about 1,500 new soles (us\$500-700) for each owner-operator. Around 1,000 boats, some 20 percent of the fleet, have each invested at least us\$300 in equipping themselves with longlines and installing fish-holds, and headed out to sea.

However, on 15 January 1998, the Peruvian government enacted Ministerial Resolution 020-98-PE. This law allows the fleet of around 615 industrial purse-seines, which usually fish for sardine and anchovy during El Niño, to catch perico, bonito, marlin, sailfish and other species associated with this opportunistic fishery. Allowing the industrial fleet access to these resources completely undermines the management plans which have been developed for the fishery in recent months. It also conflicts with the main purpose of the new regulations which have been developed for the industrial fleet (Supreme Decree 008-97-PE, introduced in October 1997). After operating for more than two decades without effective

regulations, specific restrictions are now applied to the fleet. These place limits on hold and catch size, and restrict fishing licences to designated fish species.

Under the new law, and with a relatively small investment in a set of longlines and plastic iceboxes, large numbers of industrial vessels will now compete with small vessels with an average hold size of two tonnes.

The main objection to granting the industrial fleet access to this fishery is that, in the longer term, it can not support vessels which consume as much as 40 gallons of diesel per hour. Given the opportunistic nature of the fishery, and given the small shoals that these fish swim in, it will not be worthwhile for these boats to use longlines. They will, therefore, resort to using their purse-seines, and it will take only a few boats to greatly increase landings, causing prices to crash. The market, which, in February, had daily landings of 165 tonnes, will then be flooded. This will jeopardize the future of the newly converted artisanal fleet.

The introduction of this new law is a grave mistake. It will undermine the ability of artisanal fishermen to repay their loans and to meet their contractual obligations with FONDEPES, and the private banks. It must be withdrawn promptly.

Niño. Storms at sea disrupt fishing, while, on land, marketing and other services collapse, and access roads are destroyed.

Another striking effect of the El Niño phenomenon is the dramatic change in the fish species that become available. As a rule, all the usual species disappear, and are replaced by others more usually associated with tropical and subtropical waters.

The impact of these changes on the fisheries sector are clearly shown in the table overleaf, which compares the catches made in January 1997 with those made in January 1998.

In recent years, fisheries have been making an increasingly important contribution to the economy of Peru, representing about 3 per cent of GNP.

In 1995, Peru's fish catch was the second largest in the world next to China. However, catches of most of the

commercially important species have been severely reduced in recent months. According to one report, Peru's fish catch in the first half of the year totalled 1.23 million tonnes, more than 75 per cent down over the same period in 1997.

The fishmeal industry has been particularly hard hit. The resultant slump in production has contributed to a global scarcity which has sent prices of both raw material and processed fish rocketing. Worldwide, in 1998, catches of anchovies and jack mackerel destined for fishmeal production are expected to fall by 10 million tonnes—about 10 per cent of the global fish catch—due to the effects of El Niño. As a result of this, world fishmeal production for 1998 is projected to be two million tonnes less than in 1996—4.5 million tonnes, against 6.5 million tonnes.

Dramatic decline

As can be seen from the table, there has been a dramatic decline in catches of fish destined for indirect human consumption

Fish Catches in Peru
('000 tonnes)

	January 1997	January 1998	Decline (%)
1. Direct human consumption	84.6	44.7	-47.2
Canned fish	27.5	9.3	-66.2
Frozen fish	26.8	12.2	-54.5
Cured fish	4.2	2.4	-42.9
Fresh Fish	26.1	20.8	-20.3
2. Indirect human consumption (fishmeal)	913.4	30.4	-96.7
Anchovy	784.1	0.3	-100.0
Other species	129.3	30.1	-76.7
3. Total (1+2)	998.0	75.1	-92.5

(Source: Ministry of Fisheries)

(fishmeal), with January anchovy landings reduced substantially. Due to warmer sea temperatures and changes in upwelling, this species, together with the sardine, migrated in search of colder and upwelling waters, moving from north to south and into deep water.

According to Ministry of Fisheries (MoF) reports, landings during the first quarter of this year totalled 281,000 tonnes. Compared to the same period in 1997, this represents a fall of 82.7 per cent. This is mainly due to a reduction in anchovy and sardine catches.

The MoF set precautionary quotas on anchovy of two million tonnes for the period November 1997 to February 1998, although the fleet reportedly landed only 600,000 tonnes. The MoF predicts that in 1998 fishmeal exports should be around 1.4 million tonnes, a reduction of 30 per cent over 1997.

As far as landings of fish for direct human consumption are concerned, in the first quarter of this year, MoF recorded 130,200 tonnes, 50.6 per cent less than catches in the same period last year. Overall, the value of fish exports over the period January-March 1998 dropped by 75 per cent, from US\$429.5 million in 1997 to US\$107 million in 1998: In January this year, processing plants in the canning industry were paralysed when

production was cut by 66.2 per cent, due to the scarcity of sardine, horse mackerel and mackerel. Similarly, at the beginning of the year, production in the frozen fish industry was cut by 54.5 per cent. This was due to a major reduction in the landings of its main species, hake, due to the dispersion of fish shoals.

The artisanal fishery is a strategically important sector in Peru. It catches a large part of the fish destined for human consumption, and provides 80 per cent of the fish eaten nationally. It also makes a significant contribution to export earnings.

It consists of a fleet of 6,258 vessels, which provide 50,000 jobs. It supports 450,000 people, most of whom live in conditions of considerable poverty. The sector and the communities it supports have been particularly hard hit by the impact of El Niño.

Northern region

The northern region is traditionally where most of the artisanal catch is taken, and it is also here that 51 per cent of Peru's artisanal fishermen are based. Rough seas, torrential rains and the dispersion of the shoals of hake have not only made fishing operations difficult, but even when there was fish to sell, market access was impossible due to the destruction of roads and bridges.

Although some new species appeared, few people were able to take advantage of this because they did not have the right fishing gears. Also, artisanal fish landing centres were damaged by the force of the sea. In addition, due to torrential rains and electrical storms, and the severe flooding they caused, many homes were wrecked.

Although many of the traditional species like *pejerrey*, *cojinova*, etc. almost completely disappeared, some other species have appeared. One of these species is the *perico* or *dorado* (*Coryphena* sp.), and for some fishermen who modified their boats and adopted different fishing methods, this has proved a boon.

Perico catches have increased by over 200 per cent since last year, and this has partially helped to make up for the loss of income from other species. The best landings were recorded in January and March 1998, but because most boats were not prepared for high-seas fishing, there were few who could take advantage of this.

Catches of several other species have also greatly increased, compared to 1997. For example, catches of mackerel and octopus increased by 498.5 per cent and 234 per cent respectively.

Also, the warm waters of El Niño have favoured several high-value fish species (destined mainly for export markets), including prawn, lobster and other varieties of shellfish, notably scallops. In the central area, the in-migration of prawns has been of particular significance.

Overall, a social crisis has arisen in the sector due to lower earnings from reduced catches of traditional species, and due to the loss of possessions, such as houses.

Many artisanal fishermen have fallen behind in repaying the loans they took to improve their boats and fishing gears, and to purchase refrigerated trucks to market their catches directly.

Debts are mounting due to interest rates and other charges, and are becoming difficult to repay. Agents threatening to

seize their equipment are now appearing in many of the fishing communities.

Despite this, no state of emergency has been declared for the fisheries sector. Government support to the affected artisanal fishing communities has been limited mainly to the provision of food parcels.

But what most artisanal fishermen urgently need is that their loans be refinanced. In this way, they will be able both to meet their obligations to the loan companies, and to purchase new fishing gear to take advantage of high-value species like prawns, which are now found in abundance.

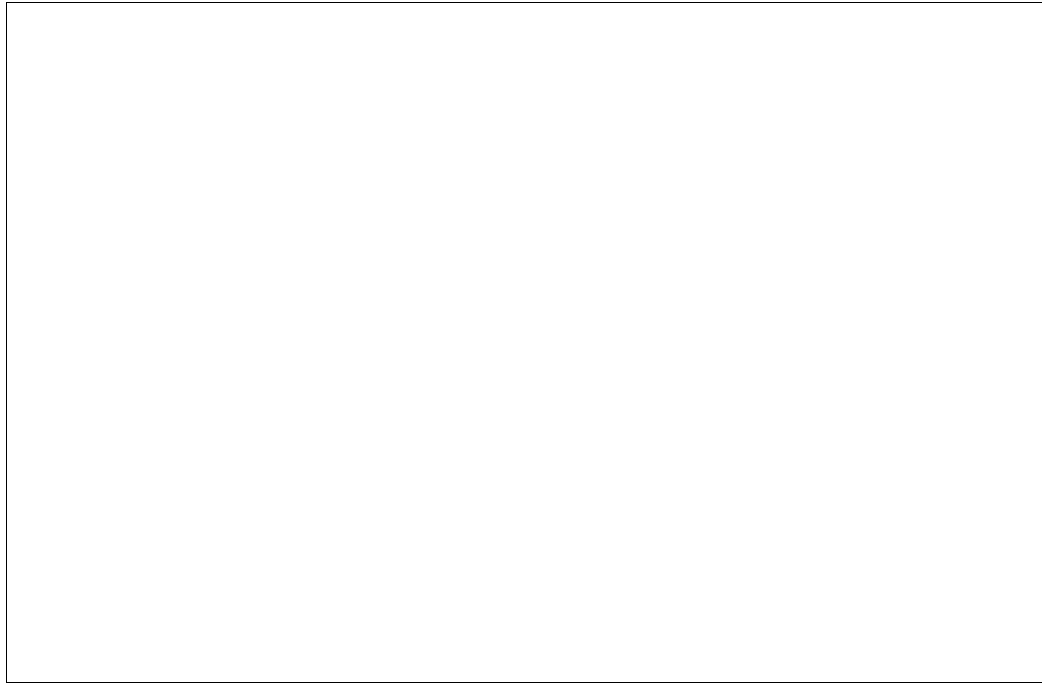
These problems, and many others, were the main focus of the IVth National Congress of Peruvian Artisanal Fishermen, organized in Callao between 28 April and 2 May 1998. As a result of this meeting, the Federation for Integrating and Uniting Peruvian Artisanal Fishermen (FIUPAP) initiated discussions with the authorities, requesting them to provide adequate and appropriate measures, such as the reconstruction and strengthening of the harbour infrastructure and rebuilding the main access roads.

There are several important lessons to be learnt from the 1997-98 El Niño. First of all, there is a need to greatly improve the accuracy of scientific forecasting techniques, and to establish effective early warning systems.

Secondly, there is a need for institutes of science and technology, universities, businesses, and local and national organizations to work together with the government in a more co-ordinated way, and to establish jointly an effective civil defence system. Thirdly, the reconstruction of damaged infrastructure networks needs to take into account that El Niño is a regular occurrence, forming part of the natural scheme of things.

Fresh evaluation

Now that climatic conditions are beginning to normalize, it is necessary to evaluate what has happened generally at a national level, and specifically in the fisheries sector. Of particular relevance to



the artisanal fisheries sector would be the design and provision of in-depth training and technical support services to enable the fishermen to adapt to changes and to learn how to live with nature. ❧

This article was compiled by Brian O'Riordan from a number of sources. These include material prepared by Luz Pisua in Peru: articles in FIUPAP's El Mundo de la Pesca Artesanal, No. 4, which focuses on the impact of El Niño, ITT Peru; Fishing News International and The Sacramento Bee, November 1997