Fishing livelihoods threatened by pesticide pollution in Uruguay

The dominant agriculture model in Uruguay is affecting freshwater fishing communities, as a result of the massive use of agrochemicals in large-scale, high input farming, including soya, rice and wheat. This comes as no surprise as the pesticides used on Uruguayan farms are renowned worldwide for their toxicity to aquatic fauna and, in particular, fish. ***Maria Isabel Cárcamo*** *describes findings from PAN Uruguay's new report.*

As a result of Uruguay's 2002 economic crisis, freshwater fishing has become an important alternative source of food and livelihood for many poor rural families. But over the same period small-scale, inland and coastal lagoon fisheries have been badly affected by incidents of water contamination and mass fish kills in different parts of the country. These incidents are linked to use of pesticides hazardous to aquatic life, and most often occur when rainfall shortly after spraying causes pesticide to run-off fields into watercourses. A new report from PAN Uruguay[1] (RAPALUY) is based on information collected from research studies by different national institutions, along with press reports and testimonial information from people affected at local level.

Increases in pesticide use

Uruguay has seen an increase in land use under afforestation and genetically modified soya in recent years [PN75, pp15-17]. This increase has mainly taken place in areas that were formerly used for cattle grazing and has been accompanied by a huge increase in the use of pesticides, many of which are extremely environmentally damaging. Ponds, streams and rivers are one of the natural resources most affected by current levels of pesticide use.

Pesticide impacts on aquatic systems are not only due to acute or direct toxicity. The fact that fish do not always die from pesticide contamination of water does not mean that there is no problem. Research shows that when pesticide-loaded soil or field run-off reaches watercourses, the pesticide may accumulate in the organs and tissues of the fish, which are then eaten by fisher families and other consumers, with consequent risks for health, and for fish-eating wildlife. Pesticide contamination of watercourses not only impacts fish and other aquatic wildlife but also degrades water quality for humans and livestock who rely on surface waters for drinking water.

Large fish kill on Río Yí/Durazno February 2010 *Photo : Carlos Castro*

Unfortunately, reports of water contamination and concerns for fish and aquatic ecosystems are not new. Since the 1990s the River Uruguay Administrative Commission, made up of official bodies on both the Argentine and Uruguayan sides of this river border, has expressed grave concern about water quality and pollution in the river and negative impacts on community fisheries[2].

In Uruguay the majority of freshwater fishing is carried out by small-scale fisherfolk. In total, local fisheries caught between 2,000-4,000 tonnes during 1994 to 2003. On the River Uruguay, the annual fish catch is over 1,300 tonnes. Another important river, the Rio Negro, contributes around 200 tonnes while the Merin Lake coastal lagoons and the River Plate contribute over 500 tonnes together. An estimated 600 fishing boats make up the small-scale fishing fleet on these rivers directly providing a livelihood for around 1,500 fisherfolk.

An interesting case is the fishing conducted by small communities living along the brackish coastal lagoons in the eastern part of Uruguay. Their fishing boats are small and hand-made, using fibreglass or other materials. Over time the materials used have changed. Large, plastic containers formerly used to store chemicals, possibly pesticides, have even been used in their construction. A key concern over the use of such containers for lagoon fishing boats is the presence of chemical residues which become adsorbed to the internal surface and which can then contaminate the water, the fish and those consuming them. Small-scale fishing in fresh and brackish shallow waters shares an ecosystem with an abundance of wildlife and flora. Over 200 fishing families make their living in these areas, including a considerable number of women.

Water contamination data

The River Plate on Uruguay's south coast is affected by activities in industrialised urban zones in its large catchment area on both sides of the border, as well as agricultural land use. High levels of residues of PCBs, organochlorine pesticides, dioxins and furans have been reported in the tissues of

Table 1. Fish kills linked to pesticide contamination

Date	Location/ Department	Incident
Feb 2010	Río Yí/Durazno	Large fish kill. Authorities warn the public to avoid eating local fish until residue results are known.
Sep 2009	Guaviyú/Paysandú (same incident as below)	Fish kills observed in streams. Locals report farm tractors extracting water with the same hoses as used for pesticide spraying.
Aug 2009	Guaviyú/Paysandú	Dead fish reported, mainly sabalo, (*Prochilodus lin eatus*) tararira (*Hoplias malabaricus*) and boga (*Leporinus obtusidens*), close to thermal waters tourist spot.
Apr 2009	Playa Agraciada/ Soriano	Coastal fishermen blame herbicide use in upstream soya plantations for appearance of unhealthy fish, 50% of which are unfit for human consumption.
Apr 2009	Guichón/ Paysandú	Hundreds of fish killed in accidental endosulfan spill from crop spraying plane [see PN85, p15].
Jun 2008	Río Negro/ Tacuarembó	Fish kills along river banks possibily linked to hypothermia.
Sep 2007	Coastal zone/ Colonia	Dead fish and birds found on beaches. Mortality cause unknown although lab analysis rules out microbial causes.
Mar 2007	Puntas de Burucayupí/ Paysandú	Fish kills linked to stream contamination by endosul fan identified following testing.
Jan 2007	Río Negro/Cerro Largo and Rivera	Mass fish kills in tributaries - may be linked to low oxygen levels.
Jan 2006	Río San José/ San José	Thousands of dead fish near the city, mainly cat fish, shad, carp, pejerreyes (*Atherinidae*), of all ages and sizes. Authorities warn the public not to fish or bathe in the river water.
Apr 2004	Guaviyú/Paysandú	Huge fish kills in February 2004 linked to stream contamination by endosulfan and cypermethrin, identified following testing.
Apr 2004	Guaviyú/Paysandú	Farmer responsible for February 2004 fish kill fined for irresponsible use of insecticides. Residue levels in fish tissue exceed permitted levels tenfold.

some bottom feeding fish of high fat content and this therefore poses a serious risk for the health of those consuming this kind of fish. In Uruguay's southern coastal zone, sabalo (*Prochilodus lineatus*, shad) are the most contaminated fish group, along with carp, and these show residues of relatively recent 'fresh' PCB use. In Argentina the Subsecretary for Fisheries in Buenos Aires province prohibited both large and small-scale commercial fishing of sabalo in 2000, including its marketing and processing in any form throughout that province because of the high level of residues of PCBs and organochlorine pesticides reported in fatty tissues of sabalo fish (*Prochilodus lineatus*).

Testing of water and suspended material in Uruguayan rivers, and particularly the River Plate, has shown isomers of hexachlorohexane, heptachlor, aldrin, dieldrin, DDT and its breakdown product DDE. It is possible to find residues of DDT, DDE, chlordane and various chlorophenyls in aquatic organisms. At La Coronilla beach important discharges of particulate matter with unquantified levels of fertiliser and pesticide residues from upstream use in rice cultivation have drastically affected the habitat and the local benthic fauna. Water testing has shown continued problems of contamination by organic matter, zinc, fertilisers and fungicides from neighbouring farmland.

RAPALUY compiled data from national and regional press during 2004-2010, as well as reports from federal and provincial agencies, on water pollution incidents and visible fish kills or other effects on aquatic organisms. Table 1 summarises some of the key information collected.

Effects on fish thermoregulation

Following the January 2006 fish kills in San José, the National Direction for Aquatic Resources (DINARA) and local municipalities undertook studies to see if the mortality was due to pollution or natural causes. One initial hypothesis was that recent drastic increases in temperature recorded in the zone could have affected fish, linked to changes in oxygen content of the water. Another was pollution due to some industrial source close by. Following analysis of water and fish samples, the oxygen level hypothesis gained credence, especially as sudden fish deaths had been reported from other parts of the country at the same time. Almost all fish species were affected, except eels and viejas del agua (*Paraloricaria vetula*). However, RAPALUY has looked at the peer-reviewed literature and discovered recent research from Australia exploring links between exposure to certain environmental pollutants and fish thermoregulation capacity, that is their ability to withstand sudden changes in temperature[3]. This research looked at the effect of contaminants such as chlorpyrifos and endosulfan on freshwater fish. Their findings confirmed earlier suggestions that exposure to non-lethal concentrations of these active ingredients affected the fishes' ability to tolerate large changes in water temperature.

Food chain implications

High levels of pesticide residues in Uruguayan fish pose a serious risk to consumer health and particularly for fishing families. In the 2004 Guaviyú incident, over a tonne of contaminated fish had to be removed from the affected stream and then buried. Two weeks after the fish kills were reported, illegal levels of endosulfan and cypermethrin could still be found in fish, in lake sediment and even in the leaves of sarandies trees some distance from the polluted water. Fish residue levels were ten times above permitted levels. Fish consumption by fisher families is much higher than the average Uruguayan diet, therefore eating contaminated fish makes the fishing community more vulnerable to health risks. Local ranchers were warned to prevent their cattle from drinking river water, to prevent residues entering milk and the food chain. Residues above permitted levels in fish or temporary prohibitions on fishing due to contamination risk can also affect jobs, income and the economy in local, regional and international food trade, as has happened with high organophosphate residues in Uruguayan cheese preventing export in the past.

Pesticide use and policy

Over 1,000 pesticide products are registered in Uruguay, containing 300 different active ingredients; all of these, to some extent, can end up in the country's water resources. Some of the most problematic are organochlorine and organophosphate insecticides and triazine herbicides. The use of hazardous pesticides has grown in Uruguay in parallel with the large increase in areas under genetically-modified soya and wheat, tree plantations, as well as traditional crops. Herbicides are used in the largest volume, followed by fungicides and insecticides. The impacts of these pesticides on fish have been documented and many formal complaints made. Paysandú Department's Director of Municipal Health commented after the 2004

fish kills in Guaviyú that basic controls on pesticide use were absent and with persistent actives like endosulfan, residues could remain in the environment for long periods, as demonstrated by analysis of river bed sediment. The perpetrators had ignored all the health and safety instructions on the pesticide container labels, by dumping containers in contact with water sources and washing spray equipment in the river, even when the label specifically prohibits such practices. He also highlighted how contamination risk had increased in areas with continuous soya cultivation, leading to more regular pesticide applications.

This study demonstrates the difficulties of co-existence between high-input agricultural systems using hazardous pesticides and freshwater fisheries. Small-scale fishing is very important livelihood for many rural livelihoods, particularly for people on low incomes. Freshwater fishing is more vulnerable than sea fishing to the impacts of pesticide water contamination, due to the closer proximity to farmland run-off. Records of fish mortality incidents have increased considerably in recent years but unfortunately without regular residue monitoring not enough information is available to judge which local freshwater fish remain safe for human consumption. Of course, there are many other factors which affect small-scale fishing in Uruguay: prohibited seasons declared by the Ministry of Livestock, Agriculture and Fisheries; physical barriers blocking fish migration caused by hydroelectric generation schemes; the impact of invasive exotic species such as the golden snail; as well as water contamination by a wide range of organic and synthetic contaminants.

The situation is unlikely to change while the country continues to approve the use of pesticides highly toxic to aquatic life. With more than eight different national and provincial agencies directly or indirectly involved in controlling water use, aquatic resources and fisheries and without adequate coherence between their work, it is not surprising that Uruguay has reached this current crisis in water contamination, reflected in the death of thousands of fish on an annual basis and unknown chronic effects. DINARA has never responded to RAPALUY's formal request for Uruguayan studies to explore the possible link between sub-lethal pesticide exposure and fish thermoregulation reported by Australian researchers.

RAPALUY concludes that regulations to prevent water contamination are woefully inadequate, particularly as there is almost no monitoring or implementation of those regulations that do exist. However, even if the legislation was put into practice, it mainly aims to mitigate the effects of pesticide use and not to eliminate their use. RAPALUY believes it is important to disseminate this information on pesticide impacts on freshwater fish and their environmental and human health implications, in order to influence decision-makers to take action.

The children of Puntas de Buricayupí

Students from 'the little fishes' receive their prize at the National Fair in October 2007

In October 2007, during a national science fair, Uruguayans of all ages were rewarded for ingenuity and creativity. Prizes were awarded in a number of categories and in one category, first prize went to 'the little fishes' science club formed by third and fourth year students of School Number 34.

'The little fishes' had carried out an investigation into fish mortality in the river Buricayupí (Paysandú) which runs past their school. On 13 March 2007 numerous dead fish were observed prompting the students to conduct an investigation. They contacted various people and institutions with questions about the incident, including the Minister for Livestock and the Mayor's office, and agronomists that carried out a study of on the incident. The students concluded that the fish deaths were caused by the insecticide endosulfan which is used for aerial spraying of soya plantations in the region.

Authorities informed of the fish kills of Puntas de Buricayupí

After their success the students went one stage further. On 31 October 2007, the children of School Number 34 handed their results to the deputy (Members of Parliament) of the department of Paysandú, Mr David Doti Genta who then passed them to the representative of the lower chamber of the Uruguayan parliament.

On 15 November 2007, students from School 34 of Buricayupí were joined by students from another school in travelleing to Montevideo to present their work to the interim president Rodolfo Nin Novoa. The president was impressed by the investigative rigour and results from both groups.

The impact of 'the little fishes'

The students' work demonstrated their keen observational skills, a key element of learning, understanding and conservation. Importantly, their work also identified endosulfan as the cause of the fish mortality. Endosulfan is recognised worldwide for its toxicity to aquatic life and for other adverse impacts on the environment and human health. The population of Puntas de Buricayupí drinks and uses this water and eats the fish. They have no alternative source of drinking water.

The investigation has drawn attention to the extensive use of agrochemicals by agroindustry in the Uruguayan countryside and to the effect this has on the lives of many rural communities. In this particular region the main crops are wheat and GM soya, the latter belonging to 'El Tejar', the firm directly responsible for the fish kills and the water contamination in Puntas de Buricayupí. 'El Tejar' also plants these crops in neighbouring areas and so it is likely that similar things are happening elsewhere.

The success of 'the little fishes' gave the opportunity to participate in 2008 in the Second Iberoamerican competition on good practices in relation to health in the school environment, set up by the World and Pan-American Health Organisation alongside other organisations including the Central Advisory Directive (CODICEN). The project was supported by the government, NGOs, and surprisingly by 'El Tejar' itself despite its responsibility for the contamination in the River Buricayupí. On 9 December 2009, the students were awarded the Iberoamerican prize in Montevideo in the CODICEN building.

The student investigation has been widely publicised, beginning with the Minister of Education and Culture, Jorge Brovetto, who awarded the first prize; the House of Representatives, informed via the Member of Parliament of the department of Paysandú; the interim president Nin Novoa, who received the project from the school; and when it was publicised during the Iberoamerican Award ceremony. Rodolfo Nin Novoa personally received the children from the science clubs who won awards.

In spite of this the community of Puntas de Buricayupí still has no clean drinking water and agrochemicals are still sprayed in the area.

http://www.rapaluruguay.org/agrotoxicos/Uruguay/hunden_pesca_artesanal.pdf

References

1. Agrotoxics sink community freshwater fisheries [in Spanish]. RAPALUY (PAN Uruguay), Montevideo, 2010. ADD webref [can't find anything on their or main RAPAL news pages, Sw 24 May 2010]

2. II Seminario de calidad de aguas y control de la contaminación del Rio Uruguay, Colón 11-12 noviembre 1993. Comisión Administradora de Río Uruguay (CARU). http://caru.org.uy/publicaciones

3. The effects of three organic chemicals on the upper thermal tolerances of four freshwater fishes. Chapman, Lim and Gehrke. Environmental Toxicology and Chemistry (2007) 26 (7) 1454-1459.

María Isabel Cárcamo is Coordinator of RAPALUY; coord@rapaluruguay.org; http://www.rapaluruguay.org