Tasmanian Seafood Industry Council

07.04 Scammell Report

Environmental Problems
Georges Bay, Tasmania

Collated by Dr Marcus Scammell from information gathered, in particular, between February 2004 to June 2004.

Information gathered by:

St Helen's Marine Farmers;
Dr Alison Bleaney (Area Medical Officer);
Dr Marcus Scammell (Marine Ecologist)

Synopsis

Specific Findings
The aerial spraying (using helicopters) of plantation timbers appears to be responsible for large-scale losses of commercial oyster following heavy rainfall events. The normal environmental protection methods do not appear to be in place and no policing of the State's own Forestry Code of Practice appears to be occurring. More disturbingly, the problems associated with oysters also correlate with tumours and mortality in Tasmanian Devils. Further there appears to be a risk to human health as contamination of local drinking water supplies is also possible.

Thus, there is an ongoing economic impact on the St Helen's Marine Farmers, that they cannot sustain. There is an ongoing environmental impact on both marine and terrestrial organisms, and there is a possible impact on the local human community.

The practice of aerial spraying was identified as hazardous by a Federal House of Representatives Committee in 1982. It was further identified as hazardous, particularly when using helicopters, by a Federal Senate Committee in 1990. The Senate Committee noted that no notice appeared to have been taken of the previous findings. The 1990 Senate Committee recommended that if their recommendations were not adopted in full then the practice should be phased out or banned.

It appears that no notice was taken of their recommendations either. It is therefore suggested that the Senate Committee's alternative recommendation should be adopted in accordance with the precautionary principle. That is, that aerial spraying of Tasmanian plantations cease immediately until a thorough investigation can be conducted.

General Findings
The Tasmanian issue appears to be a symptom of a general breakdown in environmental protection and human health protection processes at every level of government. The practices that appear to be causing the problems should have been addressed at a Federal level in 1982 and were again identified in 1990. The failure to implement the Senate Committee's findings and the subsequent failure to implement the State Governments own code of practice has allowed the continuation of a practice that was clearly identified as hazardous in 1982.

Glossary

µg/l	A microgram per litre is one part per billion or a ratio of 1 part contaminant to 1,000,000,000 parts water
Intertidal	This is the area where the tide rises and falls within an estuary
ng/l	A nanogram per litre is a thousand times smaller than a microgram and is 1 part per trillion. This is a ratio of 1 part contaminant to 1,000,000,000,000 parts water
Impact	An impact is a statistically significant change in a biological community when compared with reference (unaffected) locations
Percival report	The Percival report examines possible explanations of why oysters died during the 2004 flood in Georges Bay, Tasmania. It has not been publicly released, but has been mentioned in Tasmanian Parliament and the media.
MSD (Sheet)	Material Safety Data Sheet. These documents list precautions and hazards for end users.
Tri-Butyl Tin (TBT)	A chemical which was used in antifouling paints to keep boat hulls free of fouling organisms (including oysters). It was banned in 1987 in Tasmania and banned in 1989 in mainland Australia.
DBT	Di-Butyl Tin, a metabolic breakdown product of TBT
MBT	Mono-Butyl Tin, a metabolic breakdown product of TBT and DBT
lipid	Organic materials that belong to groups like fats, oils and ester compounds. They are particularly important compounds used to create things like cell walls.
depuration	The process via which an animal removes contaminants from its body. In oysters the process involves feeding.

Contents

Georges Bay History

1980 – Commercial oyster farming commenced in Georges Bay (North Eastern Tasmania).

1997 – St Helen's Marine Farmers (*Farmers*) started reporting problems associated with oyster growth and mortality to the Department of Primary Industry, Water and the Environment (*DPIWE*).

1999 – Dr Scammell was contacted by DPIWE and the St Helen's Marine Farmers to advise them regarding the possible causes of shell deformity and mortality.

2000 – It was established that oysters displayed shell chambering and mortality followed after rainfall. Impacts were limited to the intertidal zone with no impacts reported in the subtidal zone. The impacts followed wind drift patterns. Thus, the causal agent floats. Shell chambering had only ever formerly been associated with a banned chemical called Tri-Butyl Tin (*TBT*).

2001 – Low levels of TBT were found up and down the East Coast of Tasmania, in some places high enough to cause mortality. This was because TBT had been banned from application to boat hulls but not from sale.

2002 – Legislation prohibiting the use of TBT was corrected to also prohibit the sale of TBT. The problem was advertised and TBT was removed from the market place.

Dr Scammell was commissioned by DPIWE to identify TBT issues in Tasmania. The subsequent report concludes that there was at least one other unidentified issue to be dealt with in the Georges Bay (*Bay*) area. This conclusion was supported by the peer reviews of Dr Scammell's report (Prof. B. Noller, Dr. M. Mortimer).

2003 – Additional oyster mortality following rainfall. Oyster tissue was sampled for TBT and its breakdown products (DBT and MBT). None were found.

Farmers were challenged by Dr Scammell to determine what changes in land use in the catchment draining to the Bay had occurred since the mid-1990s. The initial observation of the Farmers was that there had been an increase in potato farming. An initial examination of potato farming practices indicated that large amounts of Urea-based fertilisers were used. This led to the hypothesis that ammonia spikes may occur during rainfall.

Water was sampled on the next rain event but ammonia and other nitrogen levels were found to be normal.

Jan 2004 – Mass (ie. >90%) mortality of oysters was observed and recorded following a flood event in the Bay. Many intertidal species were affected first (oysters, mussels and barnacles) followed by the observation of mass mortality of other organisms from both from the catchment and the Bay (eg. frogs, insects, fish). In other words, unlike other occasions, the impact was not limited to those animals found only in the intertidal zone. The impact was at its worst in the intertidal zone, again suggesting that the causal agent floats. Due to the variety of species impacted and the area covered, Dr Scammell hypothesised that the chemical is likely to be a broad-spectrum lipid soluble pesticide that is toxic at very low concentrations, probably toxic at concentrations of nanograms per litre.

The commercial value of cultivated oysters that died following the 2004 flood event has been estimated by the Farmers to be worth $1.6 million. Obviously losses of this size are not financially sustainable on a regular basis. The commercial value of other animals killed during the event is unknown.

Again the Farmers were challenged to consider what other changes in land use patterns have occurred in the catchment since the mid-1990s. The Farmers indicated that there had been extensive helicopter activity in the month prior to the flood and that one of these helicopters had crashed in the upper catchment. The helicopters are used for aerial spraying over an extensive area of new timber plantations.

The hypothesis that the chemicals used by the forestry industry were responsible for mortality commenced.

Thus in February 2004 this investigation focussed on forestry practices.

Biocide Spill

On the 15th of December, 2003 a helicopter involved in aerial spraying over tree plantations of the upper catchment crashed (specifically, Pyengana area). This was reported to Tasmanian Fire Service and the Tasmanian Police by the helicopter operator in accordance with procedure and protocols in place for such incidents. The crash was not immediately investigated by any agencies other than the fire brigade. The chemical spill which occurred at the time of the crash was determined by Spray Information and Referral Unit to not be hazardous. This determination was made sixteen weeks after the crash.

After a number of inquiries to the local council (Break O'Day) Dr Bleaney received written confirmation that the helicopter was carrying alpha-cypermethrin.

Alpha-cypermethrin is highly lipid soluble. In other words it floats and it is not readily dispersed in water. It is toxic at extremely low concentrations to some organisms and it has broad spectrum toxicity, ie affects many species. This chemical was consistent with past observations as having similar environmental behavioural characteristics to TBT.

The investigation of the crash site identified other chemicals were also present. These other chemicals were Atrazine, Simazine, Chlorothalonil and Terbacil.

The importance of this information is not that it tells us what is at a small contaminated site, rather it tells us what is being sprayed over the vast area that these plantations cover.

2004 Flood Event

The flood event occurred at the end of January 2004 and mortality was observed early February 2004. Oyster samples were taken on the 9th of February.

The Farmers have gathered maps, videos and descriptions of the mortality which are not included in detail in this report. However, a brief overview of what was observed following the flood follows.

Mass mortality of oysters growing in the intertidal farming areas was observed first by the Farmers . Subsequent observations by the Farmers, their staff and others observed extensive mortality of filter feeders (clams, mussels, barnacles, etc.) in shoreline intertidal zone as well as prawns, crabs, sea urchins, starfish and ascidians. The impact covered the entire Bay with effects observed to the mouth of the estuary. Following these observations it was noted that there were a variety of dead fish (3 barred porcupine fish, sea grass whiting, leather jacket, eels and flounder). This was followed with the observation of "rafts of dead frogs and other insects" during the sampling period (8/2/04 – 11/2/04) by the Farmers.

There are a number of salient points to be taken from this brief summary of events.

The impact was most pronounced in the intertidal zone and most pronounced amongst filter-feeders; the causal agent floats.

The impact spread to vertebrates, fish; the causal agent has broad spectrum toxicity.

The impact covered a vast area; the causal agent is toxic at very low concentrations.

Dead terrestrial insects were observed in large numbers; the origin of the causal agent is in the catchment.

Aquatic vertebrates, frogs, are in constant contact with the surface layer of the water, suggesting that the causal agent was concentrated in the surface layer of the flood waters.

The large number of dead locusts suggests that the causal agent was a pesticide.

All of these observations are consistent with alpha-cypermethrin, which we know was in use in the catchment five weeks before the flood.

Possible Explanations of Mass Mortality of Oysters

Two explanations of mass mortality of oysters have been recently mooted in discussions with other parties. These are that the freshwater killed the oysters or that the oysters are genetically inferior. Other hypotheses that have been tested and disproved are that the oysters are being killed by TBT, ammonia, toxic algae, acid sulphate run-off, heavy metals, sewage, bad farming practices and even sabotage.

Fresh water: Oysters were killed by the large amounts of fresh water brought to the Bay during the flood. This was the largest flood event recorded in the area since oyster farming began and hence this was suggested as being a natural occurrence requiring no further investigation.

This explanation is refutable. For example, it does not take historic events into account. Mortality has been occurring since 1997, this flood was just one of a number of times that animals had died or were showing ill effects. Fresh water flushes occur naturally and do not devastate oyster populations. In some cases, they even thrive.

Genetic Weakness: Pacific oysters farmed in the Bay are genetically inferior to other oyster, growing in other areas, and therefore intolerant of extreme events. This explanation fails to make a case for all the other species that were impacted into account.

Chemical contamination: According to what was reported in the Tasmanian Parliament by the press, the Percival report also suggests that there may be a link between chemical application and mortality.

It is also our contention that this is the case.

Technical Difficulties of Environmental Detection

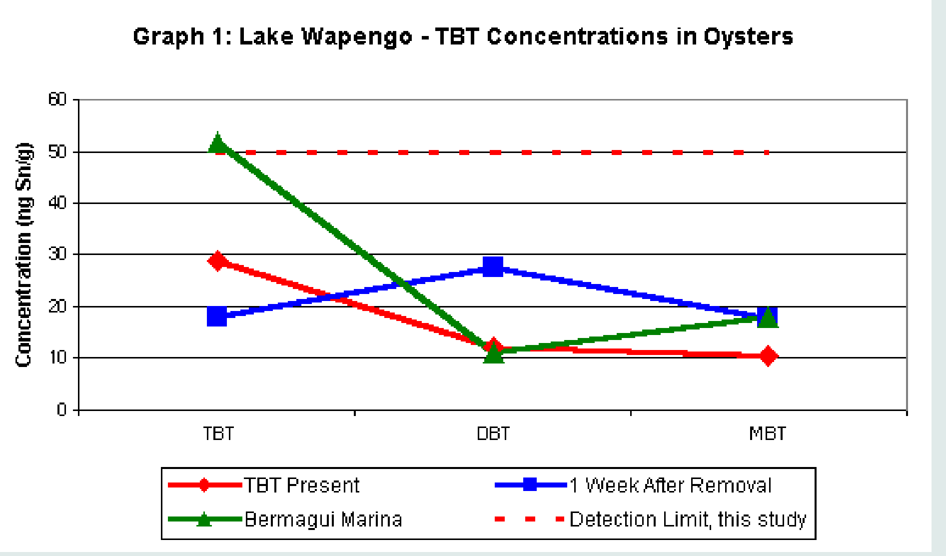
The Animal Health Unit of DPIWE ran a chemical screen following the flood and they could not identify a cause of death. Their detection limit for alpha-cypermethrin was 0.1 mg/kg (100 parts per billion) in oyster tissue. We also submitted oysters for analysis and the detection limit of our lab was 0.05 mg/kg (50 parts per billion) in oyster tissue. We also found no evidence of contamination by alpha-cypermethrin.

According to its own Material Safety Data sheet (*MSD sheet*), this chemical is potentially toxic at considerably lower concentrations than we can measure and this appears to be attested to by the failures noted above. It appears to be counter intuitive to know that something is toxic at concentrations below that at which we can measure.

The methodology typically used to determine toxicity is done using a dilution series. This means that the chemical is progressively diluted and then animals are exposed to the progressively diluted mixture.

For example, mixing 1 ml of chemical with 1 litre of water produces a mixture of 1 part per thousand. If you then take 1 ml of the 1 part per thousand mixture and add that to 1 litre of water you then have a 1 part per million concentration. Repeating this process gives 1 part per billion, then 1 part per trillion dilution. Alpha-cypermethrin is toxic to some organisms at 4 parts per trillion. The lowest concentration we can measure is 50 parts per trillion in water and 50 parts per billion in oyster tissue.

Consider TBT results in graph 1 for Lake Wapengo in 1989. In this study we had a known source of TBT, we had clear impacts of TBT and we found TBT in oyster tissue at 30 parts per billion. TBT was removed and a week later the concentrations in oyster tissue were approximately half that of the week before. The ability to detect such low levels of TBT in 1989 and the inability to detect alpha-cypermethrin in 2004 is not due to the chemical differences between them. It is simply because there was a specific facility available at CSIRO in 1989 which is no longer available for commercial work .



To make matters more difficult TBT had a constant source, boat hulls. Alpha-cypermethrin will be most concentrated during high rainfall events and then is probably most concentrated during the first flush at the beginning of the rainfall period.

Thus, our filterfeeders were probably exposed to the chemical on the 30th and 31st of January during the onset of the flood. Samples were taken on the 9th of February after the onset of mortality. This was 10 to 11 days after probable exposure.

In a depuration study using cows the animals were exposed to alpha-cypermethrin via skin contact. Their milk was subsequently sampled and the chemical was detected for the next seven days after which it was no longer detectable.

Consequently, it will kill some animals at concentrations that we do not currently have the facilities available to detect; it is rapidly metabolised and depurated once exposure has occurred.

In other words, by the time we know we have got a problem it is too late to measure it and even if we capture it in time we probably will not find it anyway.

Alpha-cypermethrin and TBT are both lipid soluble, both rapidly degrade in the environment and both have impacts below 50 parts per trillion in water.

Plantation Practices and Biocide Usage
The following information has been derived from a number of sources. These include a West Australian Forestry web site (http://agsrprrv34.agric.wa.gov.au/environment/trees/publications, TreeNote No.21); information disclosed by Break O'Day Council, information in the public domain and chemical testing undertaken by the DPIWE.

Soft wood and hard wood plantations (like many other plants) are naturally vulnerable to competition for natural resources from other plants, predation by vertebrate and invertebrate herbivores as well as fungal disease.

To protect the plantations a wide range of chemical methods are employed. This protection is particularly important when the trees are young, however, application of chemicals, particularly insecticides may be required throughout the life span of the trees.

During the early stages of tree growth vertebrate herbivores (ie. wallabies, etc) can be a particular problem. To control vertebrate herbivores 1080 baits are used. This pesticide inhibits cellular respiration causing mortality within a relatively short space of time (one and a half hours) after ingestion.

The young trees are also relatively slow growing compared to shrubs and grasses. These other plants will compete with the trees for nutrients and light. To control these other plants a range of herbicides are used. These include Sulfometuron Methyl, Clopyralid acid, Glyphosate, Atrazine and Simazine, as well as a growth regulator called Terbacil.

As well as vertebrate herbivores there are a large number of invertebrate herbivores that can cause substantial crop damage. These include animals like wingless grasshoppers, beetles, moth larvae and so on.

To control crop damage from invertebrates a number of insecticides are used. These include Alpha-cypermethrin, Carbaryl, Maldison, Chlorpyrifos and Dimethoate.

Additionally, the trees are susceptible to fungal damage and thus at least one fungicide (Chlorothalonil) is applied to the crop.

The primary method of applying these chemicals is aerial spraying. This allows quick treatment of large areas. The chemicals are usually applied as a cocktail to enhance their effectiveness and presumably decrease costs.

Summary of Biocides Reportedly Used to Protect Plantations

Table 1

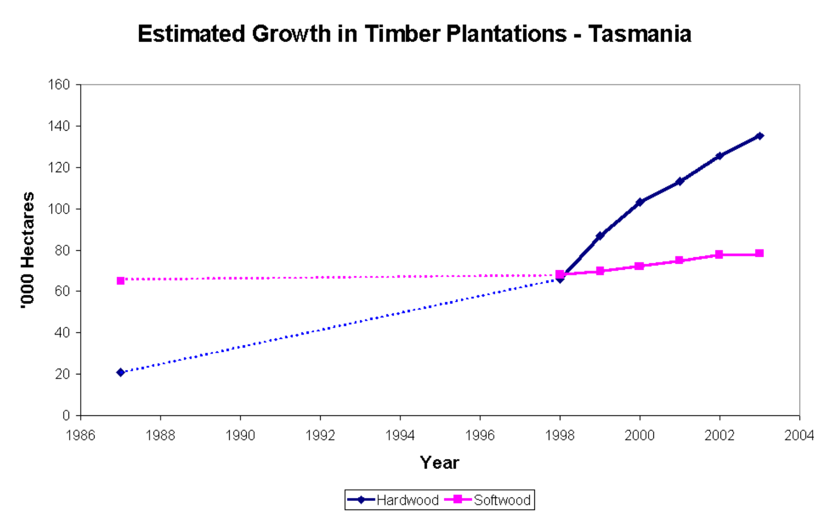
Chemical	**Function**	**Solubility**	**Aquatic Toxicity from MSDS**
Glyphosate	Herbicide	Soluble	11.1 mg/l to 21.6 mg/l
Sulfometuron Methyl	Herbicide	Soluble	> 150 mg/l
Clopyralid triisopropanolamine	Herbicide	Soluble	low toxicity
Alphacypermethrin	Insecticide	Insoluble	0.004microg./l to 3.6 microg./l
Atrazine	Herbicide	Low Solubility	low toxicity
Simazine	Herbicide	Low Solubility	16 mg/l to 71 mg/l (fish)
Terbacil (Paclobutrazol)	Growth Regulator	Unknown	Unknown
Chlorothalonil	Fungicide	Soluble	44 microg./l to 62 microg./l (Fish and Invert.)
1080	Vertebrate Pesticide	Unknown	Unknown
Carbaryl	Insecticide	Soluble	6 microg./l to 10,000 microg./l
Maldison	Insecticide	Partially	1 microg./l to 300 microg./l
Chlorpyrifos	Insecticide	Insoluble	3 microg./l (vertebrates and invertebrates)
Dimethoate	Insecticide	Low Solubility	4.7 mg/l to 60 mg/l
Dispersant/Detergents	Wetting Agents	.	.
Colour Key: Source of Information	.	.	.
Known to Council	.	.	.
Found at Crash Site	.	.	.
Known by Public	.	.	.
Obtained from West Australian	.	.	.
Forestry Web Site	.	.	.

Growth of Plantations as Land Use

Plantations have gained increasing support as an alternative to other forestry practices. However, as is the case with Tasmanian Forestry in general, specific information on the growth of plantation activity was not readily available.

The following has been gleaned from a variety of sources and may not be indicative of the full extent of the crop. The growth in plantation activity (see Graph 2) is as below.

Graph 2



In 1987 tree plantations on State land were mainly soft wood covering 38,000 ha with a further 3,868 ha of hard wood plantation. By comparison, private plantations comprised 27,000 ha of soft wood and 17,000 ha of hard wood. Between 1987 and 1998 plantations on State land grew from 42,000 ha to 64,000 ha with the growth predominantly in hard wood. At the same time private plantations grew from 44,000 ha to over 70,000 ha with the growth predominantly hard wood. By the year 2000 plantations on State land covered 73,000 ha with plantations on private lands covering 89,000 ha.

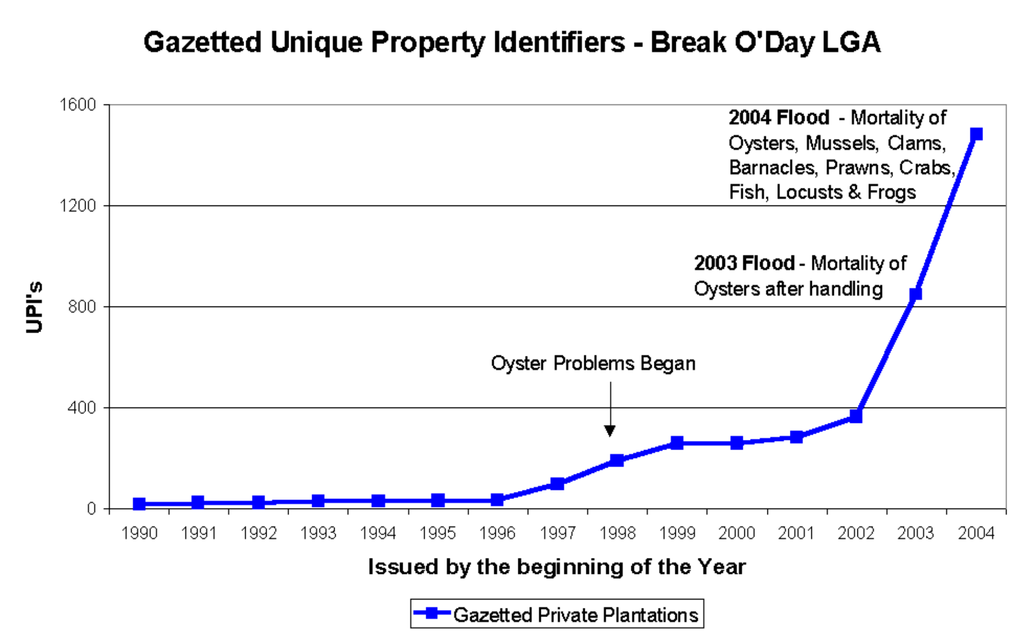
Thus there was a clear increase in the area covered by plantations from 1989 to 2000 from 86,000 ha to 162,000 ha, respectively. This would also have led to a dramatic increase in the levels of chemical application.

According to Private Forests Tasmania, Tasmanian forests cover about 48% of the total area of the State, with private forests making up about 29% of the forest area. Private Forests Tasmania actively promote the replacement of existing forests with plantations. This suggests that plantations are one of the most significant forms of agriculture in Tasmania.

However, getting a clear picture of local area growth of plantation activities is a much more difficult task. Private plantations are required to be gazetted by local council. While no information is supplied as to the area of land under private plantation, the number of private plantations can be determined. Accordingly some indication in the growth of this land use can be implied.

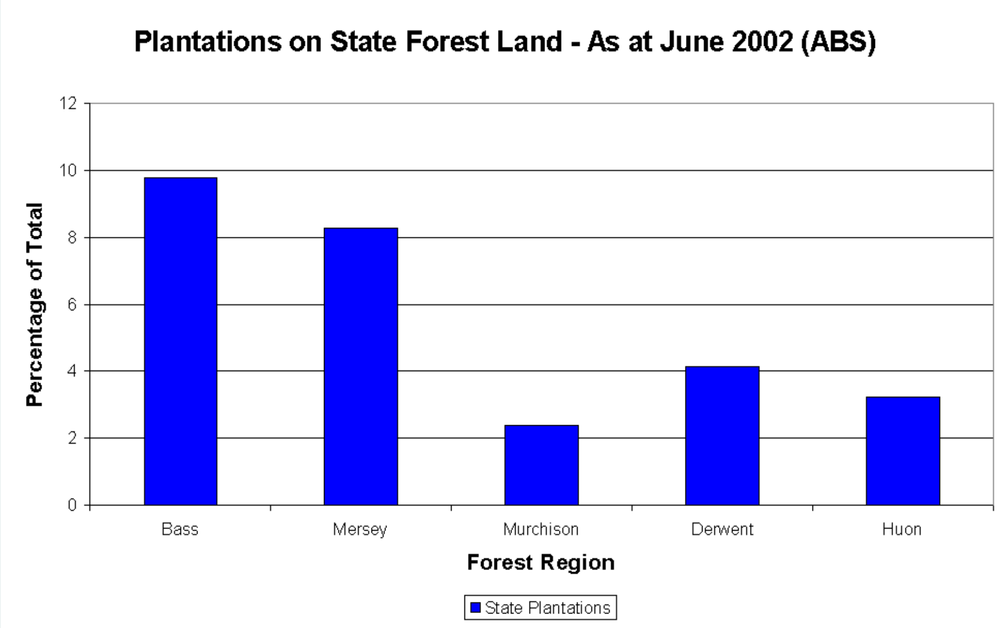
Following is a graph (Graph 3) of the growth in gazettals of Private Forests in the Break O'Day Local Council Areas (*LGA*). A correlation can be seen between the increase in numbers of Private Forests and problems experienced by the marine life.

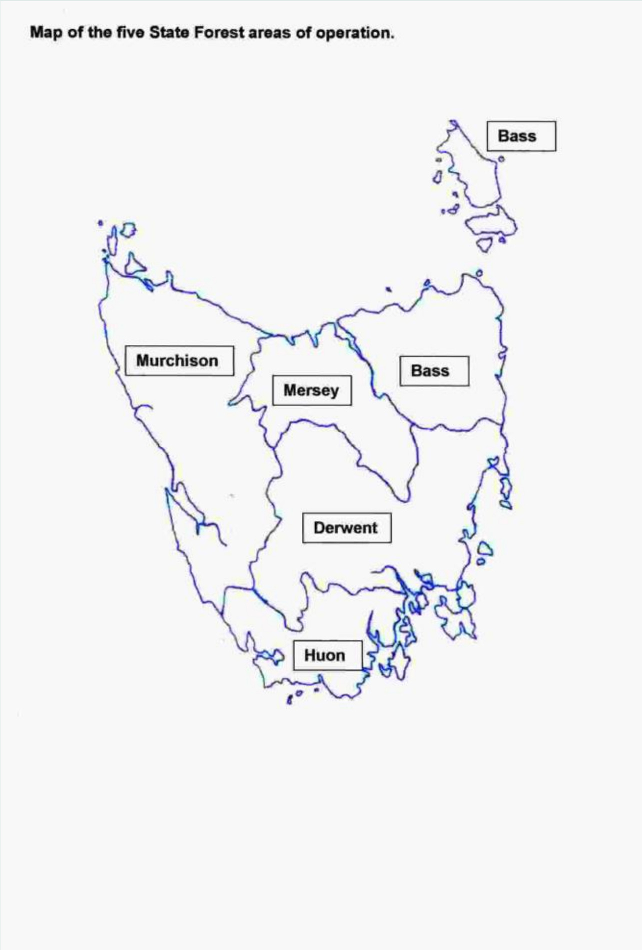
Graph 3



The general growth in State owned plantation can also be obtained from the Australian Bureau of Statistics (Graph 4 and Map)

Graph 4



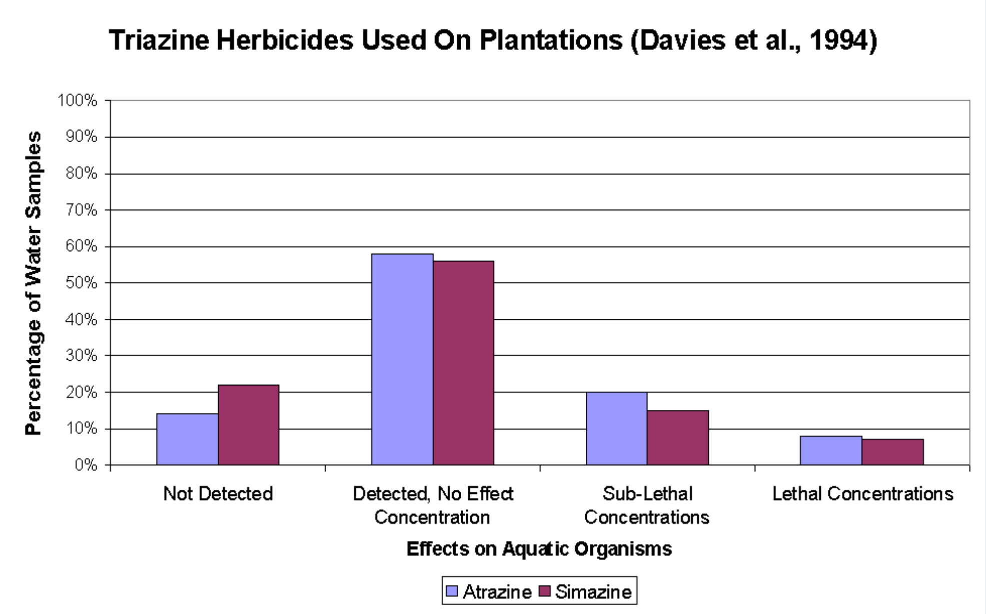


Water Contamination Assessment

Davies, Cook and Barton (1994) undertook an extensive survey of Tasmanian streams downstream of plantations and downstream of food crops, between 1989 and 1992. They took a total of 174 water samples to assess contamination downstream of plantations and 118 samples to assess contamination downstream of food crops (predominantly peas). Their figures suggest that about 1 tonne of triazine herbicides treats approximately 600 ha of plantation, with an equivalent amount treating every 300 ha of food crops. The application method for plantations is via aerial spraying compared with ground-based (eg tractor) methods for food crops.

They found that contamination of streams correlated with rainfall and with the day of application for plantations only.

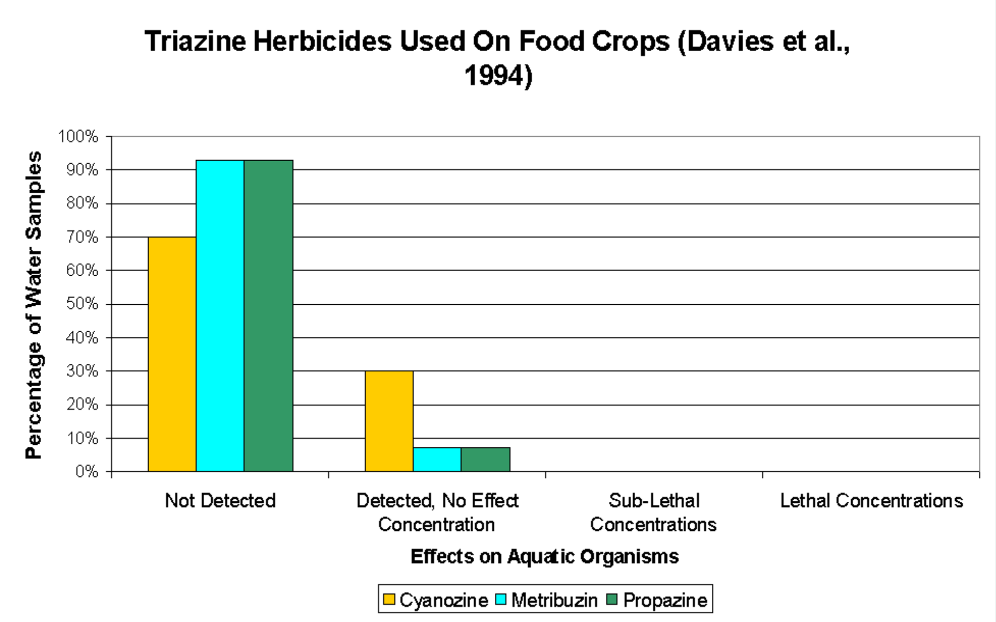
Graph 6



Plantations: With respect to Atrazine and Simazine 20% of water samples were contaminated at concentrations reported to cause sub-lethal impacts on biota (20 – 100 µg/l) and 28% of samples had concentrations within the range reported to cause mortality (20 - 500 µg/l) (Davies et al. 1994). For the purpose of graphing only samples with > 100 µg/l (ie 8%) were presented as lethal.

Food crops: Despite the fact that twice the tonnage of herbicides are applied per hectare of food crop none of the 118 stream samples were at concentrations reported to have adverse impacts on biota.

Graph 7



At the time this study was undertaken approximately 27 000 ha was under hardwood plantation in Tasmania using 40 tonnes of Atrazine and 5.5 tonnes of Simazine. According to Australian Bureau of Statistics 208 000 ha were under plantation in 2003 of which 129 000 ha were hardwood.

Forestry Buffer Zones

Buffer zones are used to protect streams and adjacent property from the movement of sediment from clear felling activity. A buffer zone, in the traditional sense, is a strip of natural forest, say 50m wide, that is left beside water courses, roads, adjacent properties etc. to protect water from sediments in run off and to provide visual amenity.

Barton and Davies (1993) reported a relationship between concentrations of Atrazine in stream water following aerial application and site characteristics. Atrazine concentrations on the day of spraying were strongly negatively correlated with buffer width. In other words, the larger the buffer zone, the smaller the concentration of biocide in adjacent waterways.

Barton and Davies are suggesting that buffer zones are useful in protecting areas not intended to be sprayed from aerial drift of the biocide. It is also probable that they would be useful in protecting the natural environment from the movement of contaminated water, sediments and leaf litter to it.

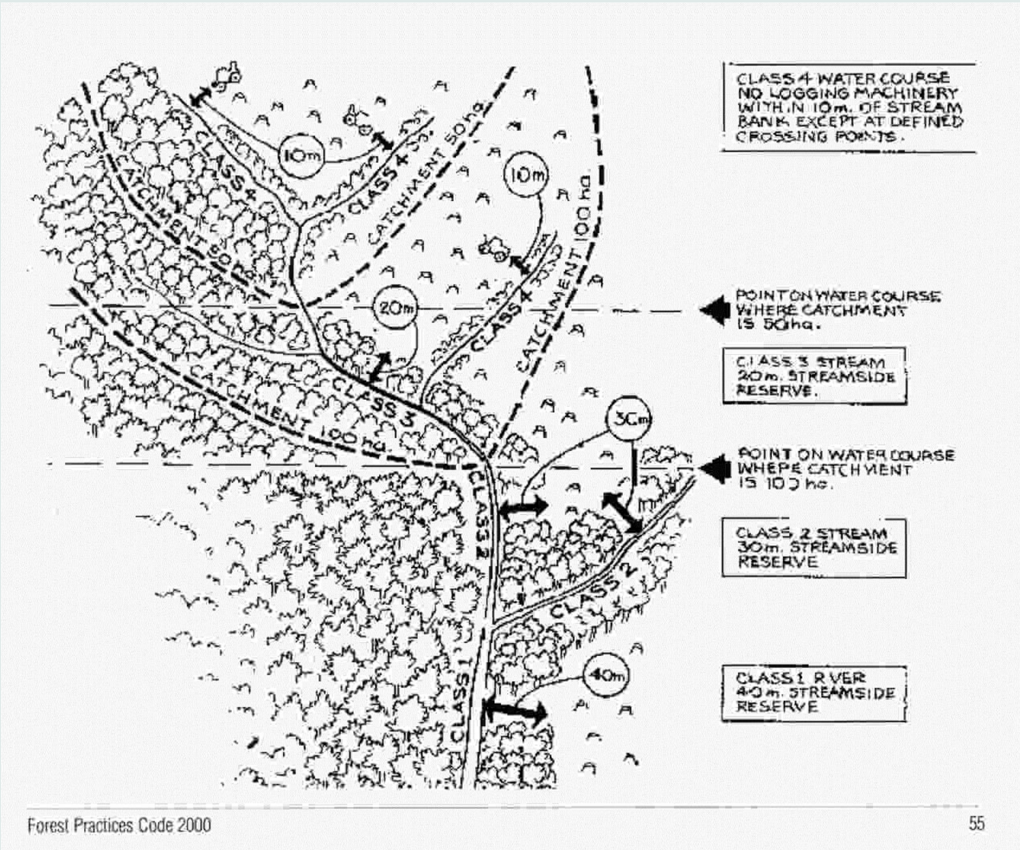
During site inspection around the South George River no buffer zones were evident. Healthy, young plantation trees were growing adjacent to the banks of the river. There was no apparent protection to the streams from the movement of contaminated water, sediment or contaminated organic matter.

During this site inspection large amounts of foam was accumulating in the South George River. The entire visible area upstream was blue gum plantations. This foam was initially believed to be a dispersant/detergent, used to make water insoluble chemicals disperse in the helicopter tanks, so they can be sprayed. A sample of this foam was taken.

Surprisingly the foam was something completely different. The following was reported by the laboratory. "High levels of C16 and C18 fatty acids and cholesterol were detected, these compounds have come from contamination by animal tissue"

The potential implications of having contamination of the river from dead animal tissue needs to be considered.

The Forestry Practices Code 2000 provides details regarding the expected size of buffer zones adjacent to areas of clear felling and plantation operations. Watercourse protection is outlined in section D2.1 on page 55. It states, "Native vegetation will be retained intact in Class 1, 2 and 3 streamside reserves as defined in Table 8 below, subject to other provisions in this Code permitting watercourse crossings and selective harvesting under certain conditions." Following is the illustration of Buffer zones from page 55 of the Code.



Following is a photo showing an example of existing practice adjacent to the Guide Reservoir, believed to part of the water supply for the township of Burnie.

Photo: Guide Reservoir showing recently cleared area and some established plantations. Note that buffer zones of natural vegetation are absent.

By comparison consider the water supply for Sydney. The two photos below, of Warragamba Dam clearly shows natural vegetation adjacent to the reservoir. These photos were in The Sydney Morning Herald (June 19-20, 2004, Pages 1 and 32). The catchment for Sydney's primary water supply is approximately 9,000 square kilometres, the vast majority of which is untouched bush, reserved solely for the purpose of keeping Sydney's water supply clean.

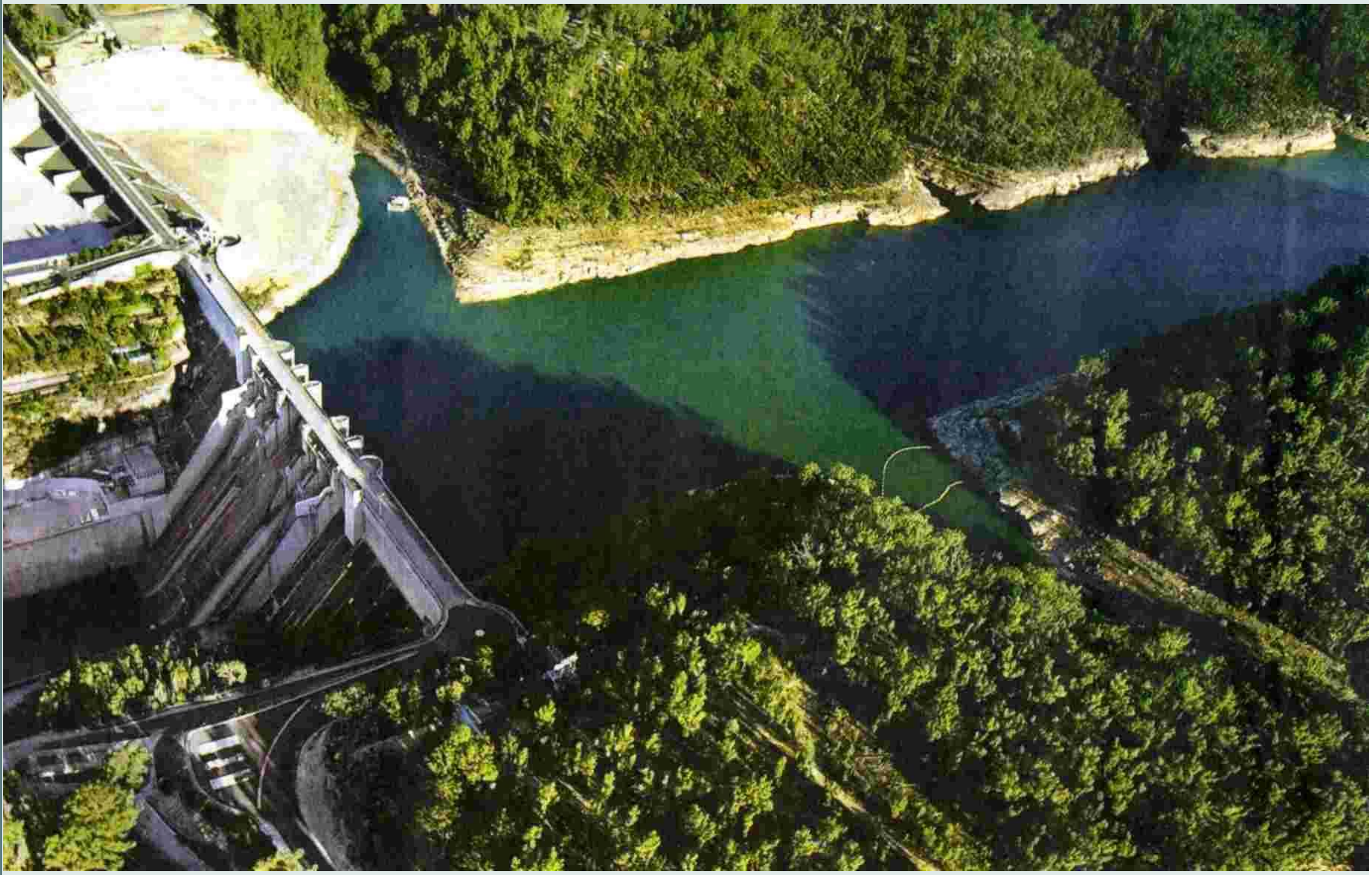


Photo from page 32, Sydney Morning Herald June 19-20, 2004


The well runs dry

Photo from page 1, Sydney Morning Herald June 19-20, 2004

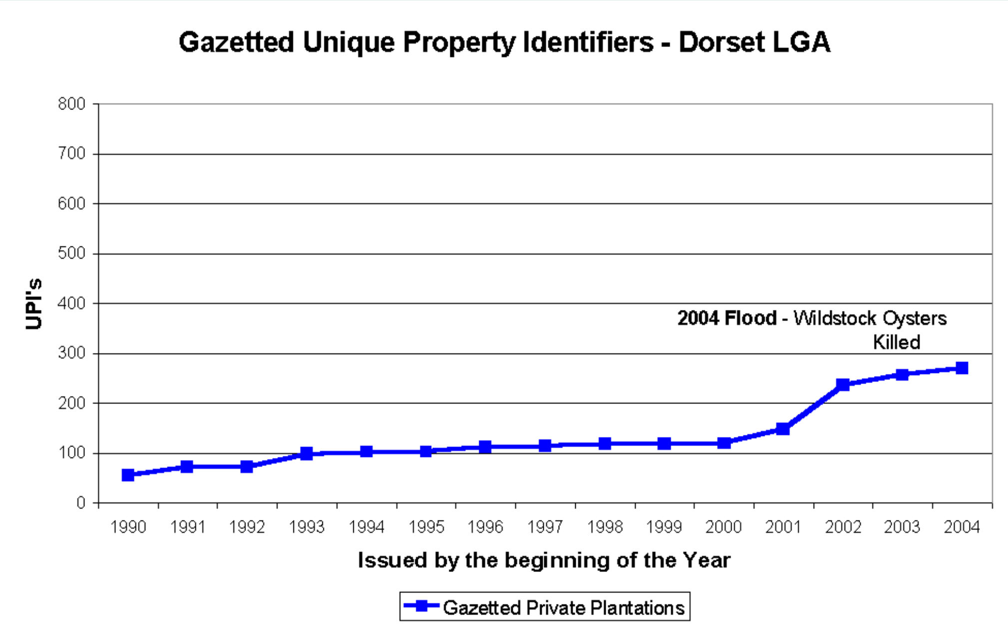
Correlation Between Private Plantation Increases and Issues in Other Areas

If a growth in the number of Plantations correlates with oyster issues in the Break O'Day area then the same correlation should occur in other areas. Similarly areas that have not had rapid changes in this agricultural practice should be similarly free of recent oyster mortality.

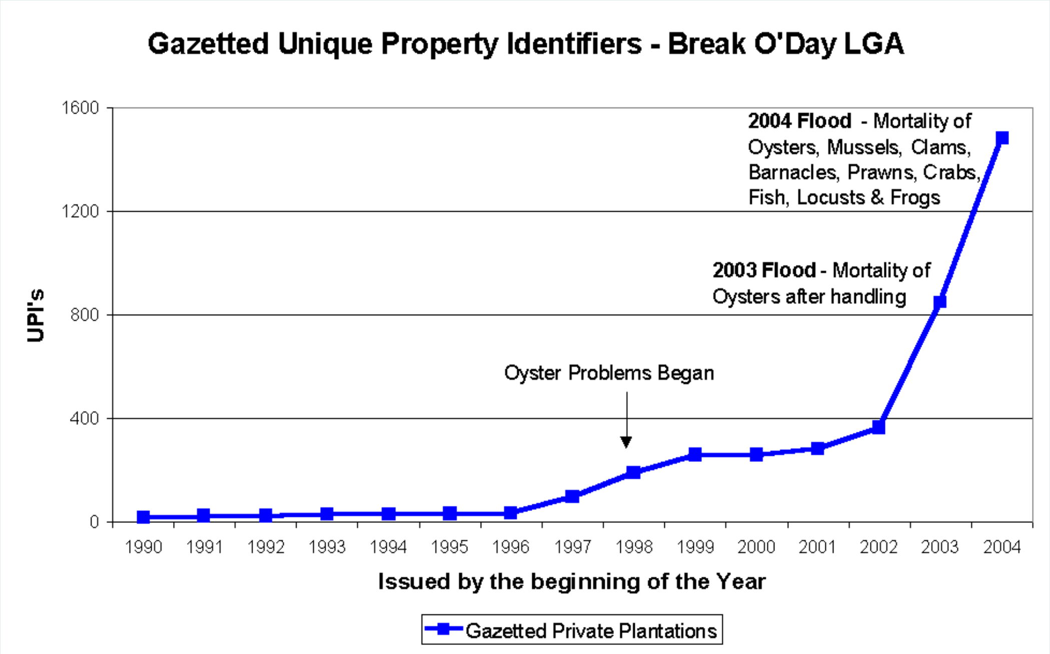
Following the flood event oyster mortality occurred both north and south of Georges Bay. Importantly no mortality was reported from the Sorrel LGA.

Following are graphs of the four LGA's for which oyster data is available.

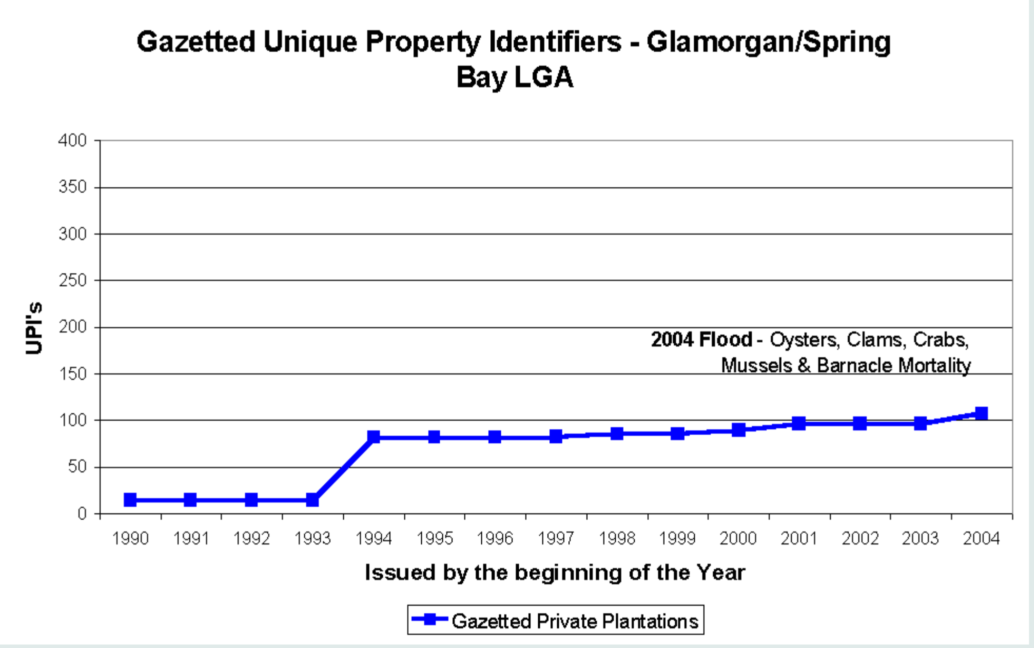
Graph 8



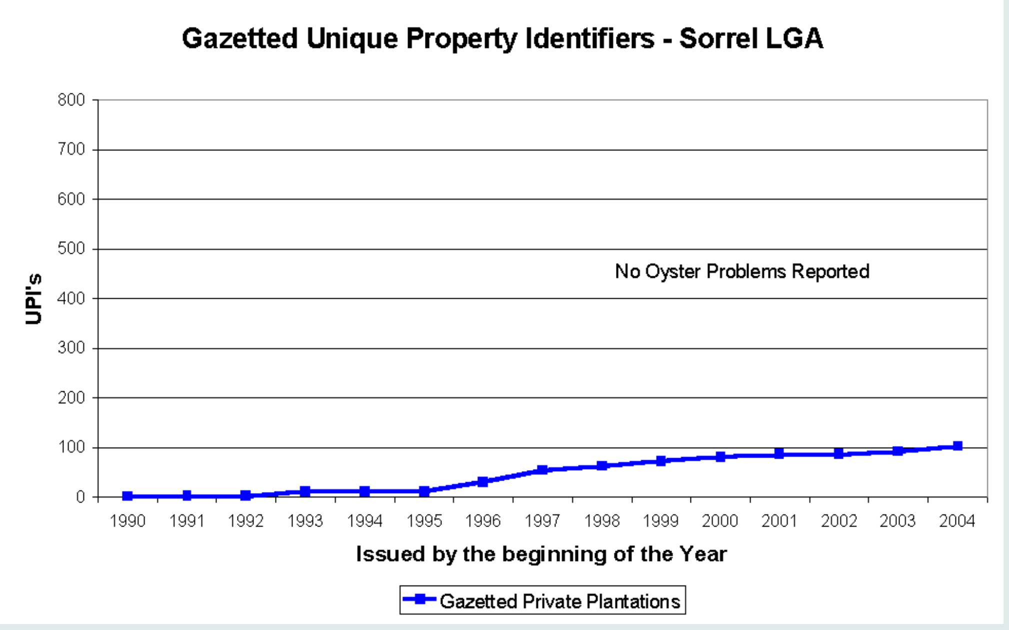
Graph 9



Graph 10



Graph 11



In three of the four local Government areas there has been a period of rapid growth in Private Plantation gazettals while in the unaffected catchment growth has been much more gradual.

No data is available for government plantations at a local government area level.

Correlation Between Oyster Issues and Other Issues
If a widespread agricultural practice like plantations is having impacts on filter-feeders and marine life at the bottom end of the catchment it must be having impacts on terrestrial organisms living in between.

We know it is deliberately targeting herbivores, both vertebrate and invertebrate, but what of other organisms?

There are reports that there are problems with other animals in Tasmania. The local platypus has been reported to be diseased as have the Tasmanian Devils. There are also concerns about the giant crayfish which is only found in Tasmania.

With respect to the Crayfish, there is insufficient information to determine what the problem(s) may be. With respect to the Platypus, the disease was isolated in 1982, well before our activity of concern was well established.

With respect to the Tasmania Devil however, the spread of facial tumours and mortality, correlates through space and time with the issues affecting marine organisms.

Healthy Tasmanian Devil

Animal with Facial Tumours

Photos from www.parks.tas.gov.au and www.tct.org.au.

The disease affecting the Tasmanian Devil was originally observed with one affected animal found in Mt William National Park in 1996. In 1997 Oysters were reported with problems from Georges Bay. In 1999 a Tasmanian Devil with facial tumours was captured at Little Swanport. In 2000 the disease was declared a plague and believed to be caused by a virus. By 2001 the plague status was declared as far south as Freycinet peninsula. By 2004 Filter-feeder mortality had extended as far south as Little Swanport as well.

Interestingly at Sorell there were no problems with oysters, there were similarly no problems with Tasmanian Devils and there was no rapid growth in Private Plantations.

Further, a recent survey of fifty Tasmanian Devils in Narawantapu National Park, in the centre of the area declared under plague, has been declared free of the virulent facial tumour. There has also been no incidence of tumours in the States wildlife parks. This is consistent with the hypothesis that chemicals are causing the tumours. Only animals that come in contact with the chemicals will get the tumours.

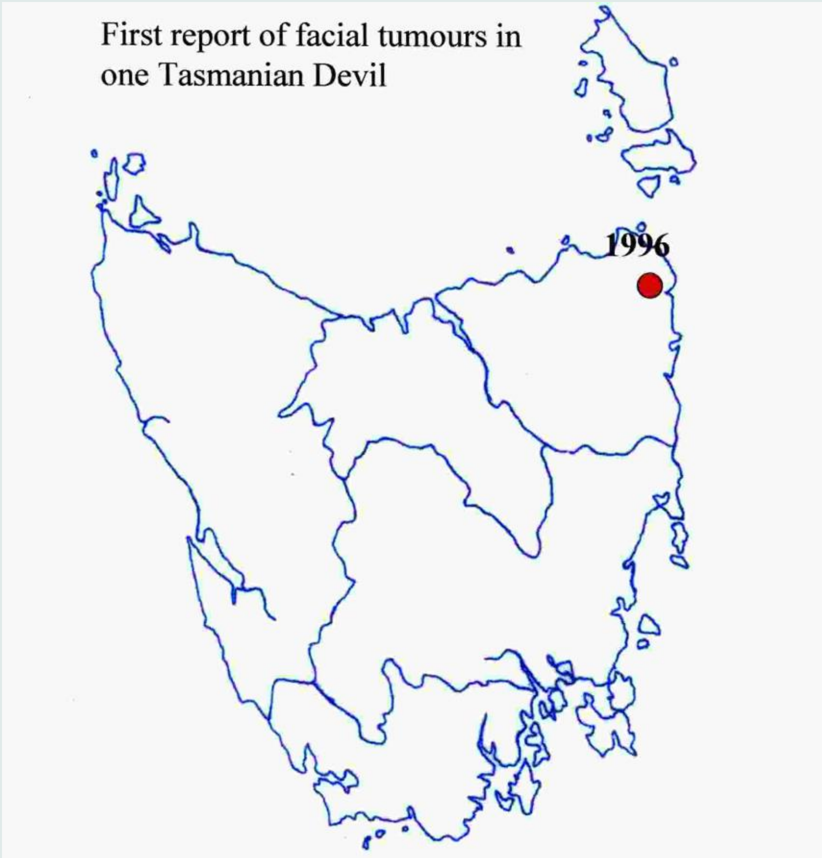
At least three of the chemicals used to protect plantations have been associated with tumour development in life time exposure studies in rodents (information from Material Safety Data Sheets).

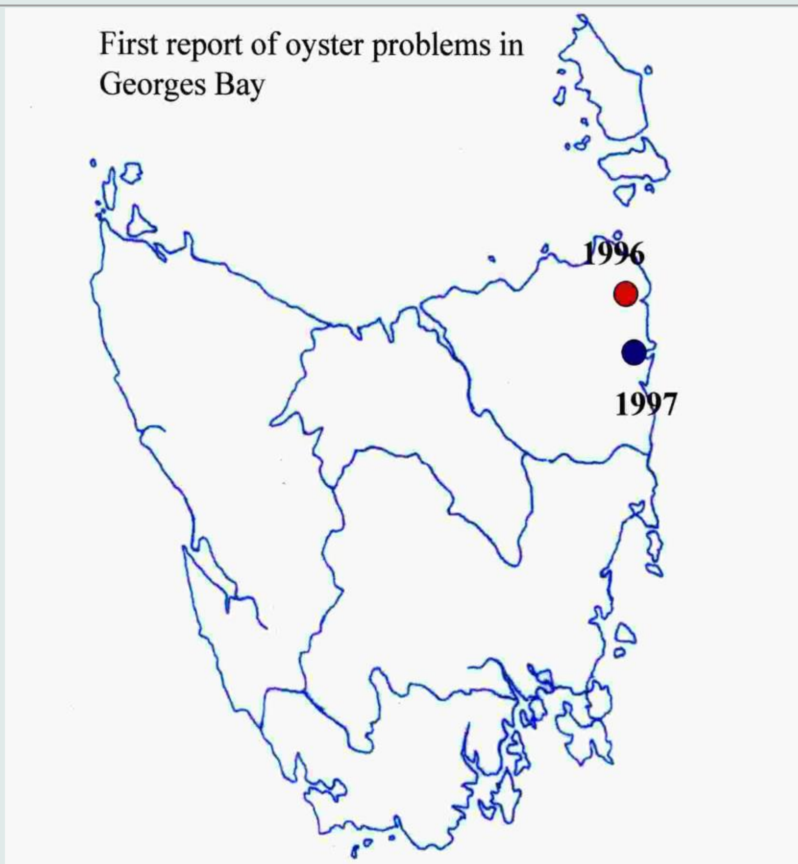
Summary of Biocides Reportedly Used to Protect Plantations

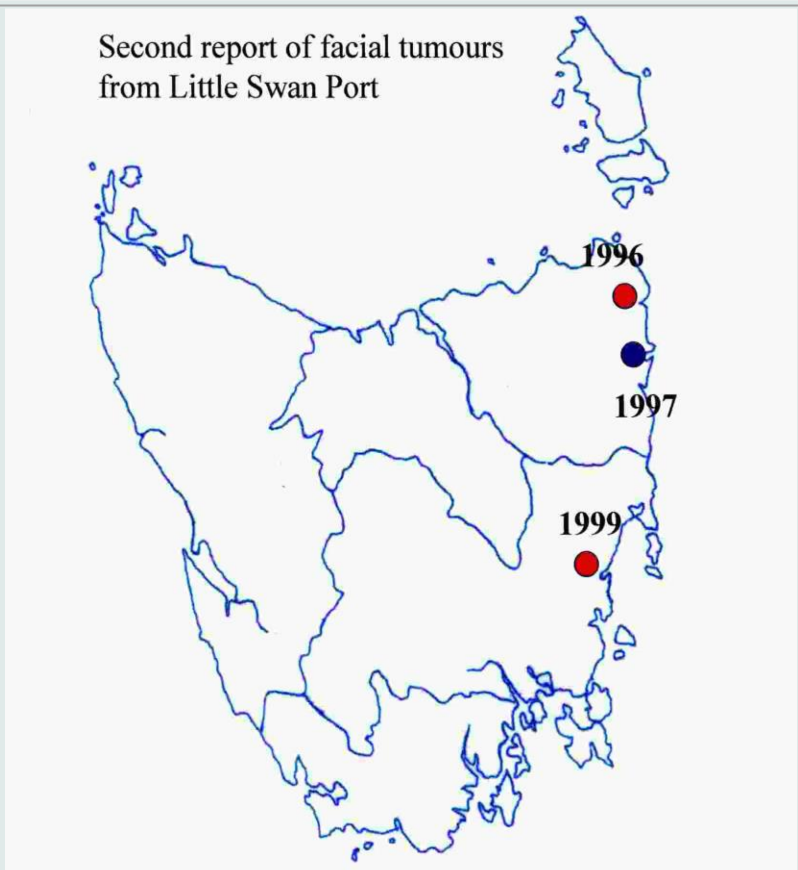
Chemical	Tumours	Description
Glyphosate	No	.
Sulfometuron Methyl	No	.
Clopyralid triisopropanolamine	No	.
Alphacypermethrin	No	.
Atrazine	Yes	Mammary Tumours
Simazine	Yes	Mammary Tumours
Terbacil (Paclobutrazol)	Unknown	.
Chlorothalonil	Yes	Stomach/Kidney
1080	Unknown	.
Carbaryl	Not Clear	Undescribed Tumours
Maldison	No	.
Chlorpyrifos	No	.
Dimethoate	No	Sensitiser
Dispersant/Detergents	.	.
Colour Key: Source of Information	.	.
Known to Council	.	.
Found at Crash Site	.	.

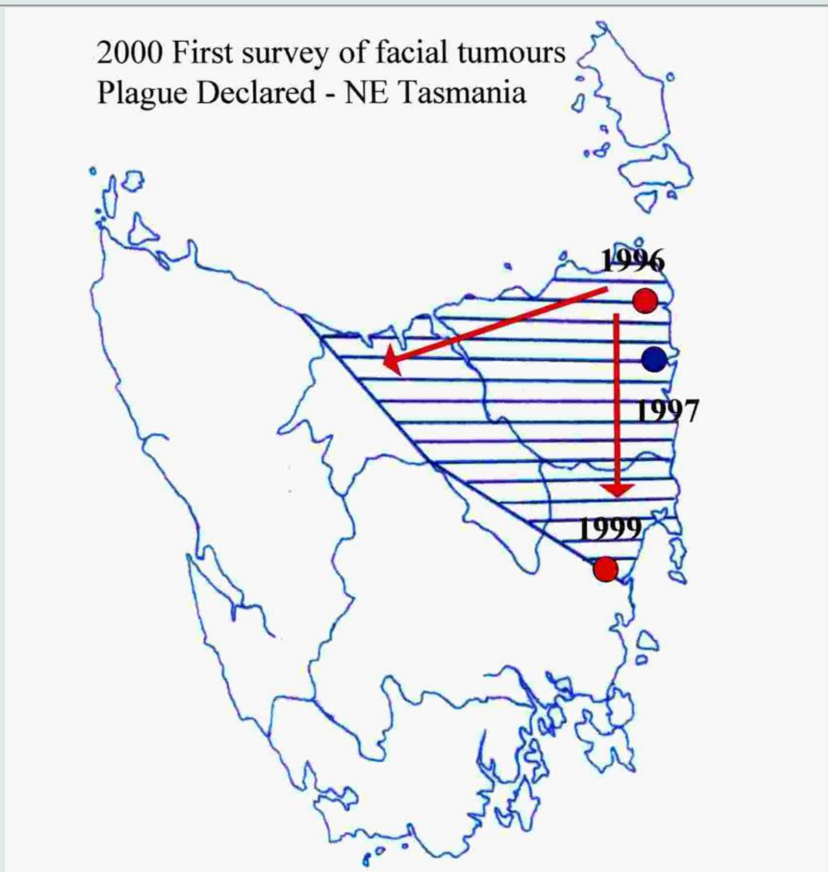
Known by Public	.	.
Obtained from West Australian	.	.
Forestry Web Site	.	.

Year	Tasmanian Devil	Pacific Oysters
1996	One diseased animal observed at Mt William National Park.	.
1997	.	Georges Bay oysters display abnormal growth and unexpected increase in mortality.
1999	One diseased animal observed at Little Swanport.	.
1999-2002	.	Georges Bay oysters display abnormal shell growth and unexpected increase in mortality that coincides with the season of increased rainfall.
2000-2001	Survey of North Eastern Tasmania finds the disease is in plague proportions west to Burnie and south to Freycinet perninsula. The disease is believed to be caused by a virus.	DPIWE and Dr Scammell commence investigation of oyster problems. They conclude TBT is a likely causal agent. TBT found to still be available in the market and is still in use. TBT legislation improved and commercial sources of TBT removed.
2002-2004	.	Ongoing mortality following rainfall. This mortality occurs during spring and summer.
2004	One third of the population (approximately 100,000 animals) are reportedly dead. In the centre of the affected area fifty animals were found in healthy condition in Narawantapu National Park with no affected animals in the States Wildlife Sanctuaries. Researchers dismiss the idea that the tumours are viral. No alternative explanation has been provided	Extensive mortality of intertidal filter feeders. Over 90% of the intertidal oyster crop is lost in Georges Bay. Fish, frogs and locusts were also affected. Filter feeder mortality reported to the north and south as far as Little Swan Port.

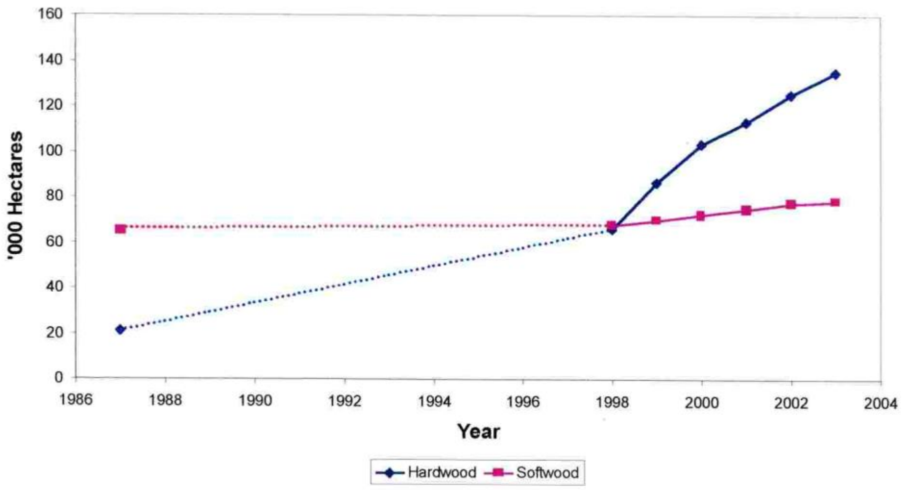

First report of facial tumours in one Tasmanian Devil
1996


First report of oyster problems in Georges Bay
1996
1997

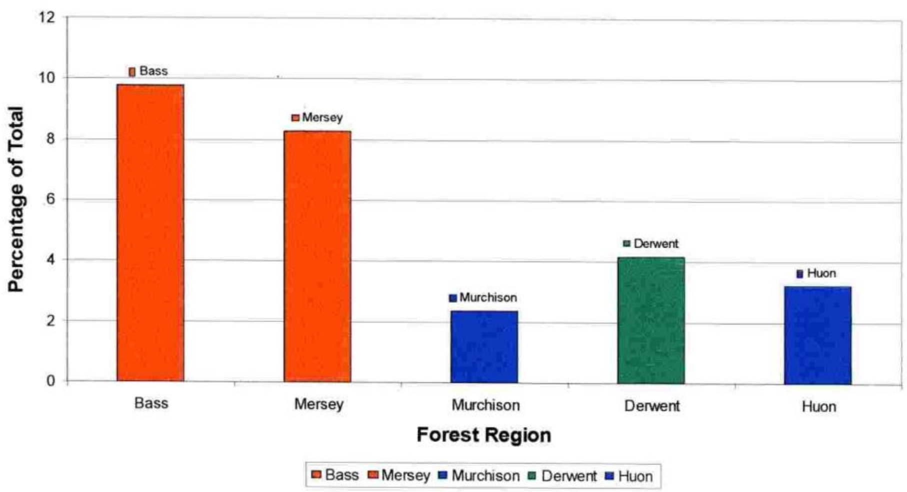

Second report of facial tumours
from Little Swan Port
1996
1997
1999

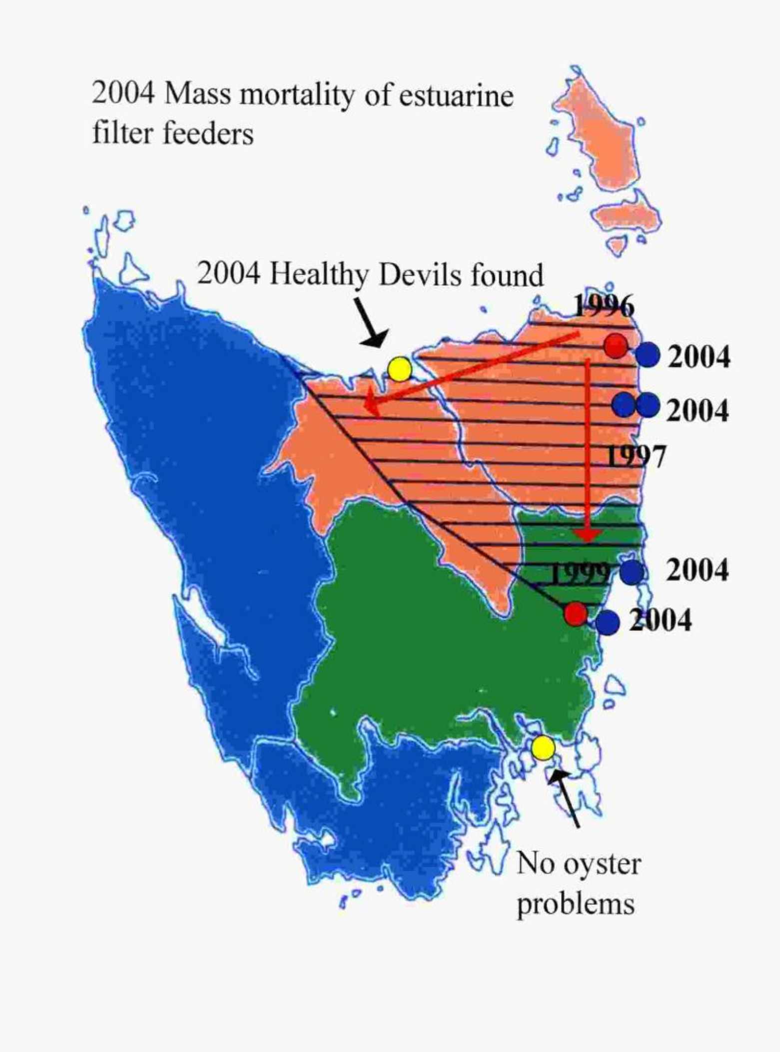

2000 First survey of facial tumours
Plague Declared - NE Tasmania
1996
1997
1999

Estimated Growth in Timber Plantations - Tasmania



Plantations on State Forest Land - As at June 2002 (ABS)





Human Health Issues
Between Georges Bay and the plantations in the Georges and Groom River catchment is the uptake pipe for the town water supply.

The intake is situated 1 to 2m below the River surface, approximately 4 km upstream of the oyster leases.

The depth of the intake pipe will protect the population from water insoluble chemicals but not from the soluble ones which may be distributed throughout the water column.

The water filtration plant is not equipped to remove these types of contaminants. Activated carbon has similarly been shown to be ineffective when dealing with contamination of town water supplies with Triazine herbicides, so it is unlikely that commonly used technology could deal successfully with this type of contamination.

Thus, there is a pathway for human exposure to water-soluble chemicals via the town water supply.

The risks associated with this pathway need to be immediately assessed.

Summary of Biocides Reportedly Used to Protect Plantations

Chemical	Function	Solubility	Tumours	Description
Glyphosate	Herbicide	Soluble	No	.
Sulfometuron Methyl	Herbicide	Soluble	No	.
Clopyralid triisopropanolamine	Herbicide	Soluble	No	.
Alphacypermethrin	Insecticide	Insoluble	No	.
Atrazine	Herbicide	Low Solubility	Yes	Mammary Tumours
Simazine	Herbicide	Low Solubility	Yes	Mammary Tumours
Terbacil (Paclobutrazol)	Growth Regulator	Unknown	Unknown	.
Chlorothalonil	Fungicide	Soluble	Yes	Stomach/Kidney
1080	Vertebrate Pesticide	Unknown	Unknown	.
Carbaryl	Insecticide	Soluble	Not Clear	Undescribed Tumours
Maldison	Insecticide	Partially	No	.
Chlorpyrifos	Insecticide	Insoluble	No	.
Dimethoate	Insecticide	Low Solubility	No	Sensitiser

Aerial Spraying – Senate Select Committee, July 1990
In July 1990 a report compiled by a Senate Select Committee was released covering the subject of Agricultural and Veterinary Chemicals in Australia. Aerial spraying and the hazards associated with that practice were specifically addressed in Chapter 16. Following are pertinent extracts of that report.

Page 209.

The Committee received considerable evidence expressing concern about the adverse social and environmental impact of spray drift from aerial spraying of agricultural chemicals. In this section of the report, the Committee considers aspects of the aerial agriculture industry, its regulation and evidence on adverse effects associated with the aerial spraying of chemicals. The Committee also considers evidence recommending the banning or phasing out of aerial spraying.

Evidence was presented to the Committee from both sides of the argument initially beginning with the Aerial Agricultural Association of Australia (AAAA) through to a variety of concerned parties. The AAAA argues that there was extensive regulation of aerial spraying practices and a low level of incidents (spray drift complaints) compared with the number of hours flown.

However, the sections of relevance to the Tasmanian situation relate to submissions regarding *Buffer Zones* and the *Use of Helicopters* on pages 214 and 215 of the report.

Page 214.

Buffer Zones

The Committee received recommendations calling for the establishment of buffer zones between residences or community facilities and cropping activities requiring aerial spraying. For example, some residents of Mungindi in north western New South Wales, recommended that there be a five kilometre buffer zone between cotton spraying and the boundaries of townships. The Queensland Graingrowers Association also supported the idea of buffer zones around new housing estates. In his submission, Mr J. Storie favoured a 300 metre buffer zone, as recommended in a New South Wales State Pollution Control Commission study of spray drift in the Namoi Valley.
The Committee was also advised that the New South Wales Government has introduced regulations specifying a buffer zone of 150 metres between areas being sprayed and domestic and public premises, including schools, parks and recreation areas. Within this zone, the application of pesticides from the air is prohibited without the written consent of the occupier of the dwelling or the person in charge of the public premises.

Page 215.

Use of Helicopters

A submission to the Committee recommended that the use of fixed wing aircraft should be banned and that only helicopters should be used for aerial spraying.

Other evidence provided to the Committee suggested that there was a greater likelihood of spray drift problems from the use of helicopters than from fixed wing aircraft currently in use. When asked why helicopters were not used in the cotton industry, Mr Ralph Schulze, Rural Director, Australian Cotton Foundation, stated:

The cost of flying and the fact that there is a down-draught. There has been work done at the Queensland Agricultural College on this particular subject. The loss to the atmosphere, behind a helicopter, for the type of spraying we want to do can be beyond the level of acceptance.

In discussing this issue, Mr James Watt, a member of the AAAA, explained that down-draught from helicopters could not be controlled to the same extent as it was from fixed wing aircraft. Mr Watt observed:

In agricultural flying the only way that helicopters can do the job properly is to fly as fast as they can forward and in effect behave much the same as a fixed wing aircraft.

With respect to buffer zones no submissions were made to suggest that they are not required. The inclusion of buffer zones around areas to be sprayed by aircraft was supported by representatives of agriculture and by the NSW State Pollution Control Commission. The only scientific investigation quoted suggested that the size of the zone should be 300m.

With respect to the use of helicopters it appears that there is reasonable concern from industry (AAAA and the cotton industry) because of the uncontrolled nature of the down-draught and subsequent loss to the atmosphere behind the helicopter.

Perhaps the most informative part of the Committees report is in its concluding statements on Page 217.

Page 217.

Extract from Conclusions

The Committee notes that in 1982 the regulation of aerial spraying was addressed by the House of Representative Standing Committee on Environment and Conservation in a report entitled Hazardous Chemicals. The Report stated:

There is wide scope for chemical mismanagement and hazard from aerial spraying with legislation being so fragmented and in many cases lacking. Uniform national legislation is necessary with the same provisions binding State and Territory legislation under the Air Navigation Orders. The Committee recommends that, after consultation with the States and the Northern Territory, comprehensive chemical safety provisions be incorporated in the Air Navigation Orders under the Air Navigation Legislation.

On the basis of evidence received during the present inquiry, it appears that this recommendation has not been implemented.

In the Committee's view, there is now an urgent need for a uniform national approach to the regulation of aerial spraying. The Committee considers that this approach must take account of the considerable concerns in the community about the adverse impact of spray drift from aerial application of agricultural chemicals.

The Committee recommends that the Australian Agricultural and Veterinary Chemicals Council consider every aspect of the social and environmental impact of aerial spraying. The Council, in consultation with the Civil Aviation Authority, representatives of the aerial agriculture industry and other interested parties, should develop a uniform, national approach to the regulation of aerial spraying of agricultural chemicals.

The Committee further recommends that, if its recommendation in relation to aerial spraying is not implemented fully, calls for the banning or phasing out of aerial spraying of agricultural chemicals should be supported.

Protecting The Public From Potentially Contaminated Oysters

We believe that there is a very strong possibility that the oysters are being exposed to chemicals that kill them following flood events. The Farmers have thus raised the issue, are the oysters safe to eat?

We know from past flood events that it takes approximately one week to kill the oysters. We also know that it takes about two weeks for the salt water to return to the Bay. Thus, if the oysters survive the initial event they have several days to clean themselves through the process of feeding.

Thus the oysters either die, or through the process of feeding, clean the contaminants out.

From Quality Assurance programs in both NSW and Tasmania we know that oysters exposed to 36 hours of depuration in clean sea-water will be free of sewage contamination found in flood water. Accordingly, the St Helen's Marine Farmers will not harvest until 72 hours after the return of oceanic waters to Georges Bay, until the problem has been clearly identified, ie. 72 hours after the Bay has returned to normal salinity of greater than 30 parts per thousand.

When the water reaches 30 parts per thousand Faecal contamination in oysters in Georges Bay is sufficiently reduced to allow re-sale of oysters. The industry plans to hold oysters for a further 72 hours after the time at which oysters are currently believed to be safe to eat.

Thirty six hours of cleaning reduces Faecal bacteria from in excess of 1 million to below two. A further 36 hours would dilute this by a factor of a further million and an additional 36 hours would reduce contamination by a factor of 1 million again.

We believe this will protect human consumers.

Conclusion and Recommendations

The St Helens Marine Farmers have been sustaining ongoing losses of oysters following heavy rainfall events since 1997. The size of the losses have been progressively increasing with the largest commercial loss in 2004. The situation for them cannot be sustained from a commercial point of view and as a consequence this report has been prepared.

Based on the information in this report the group believes that the most probable cause of oyster mortality is the aerial application of biocides in the upper catchment on hardwood plantations. The group also believes that there are other non-target organisms suffering as a result of the aerial spraying, these include other marine organisms, Tasmanian Devils and possibly the local human community.

To take the next step in the gathering of scientific information would require extensive scientific resources and take a considerable length of time prior to addressing the actual problem. The steps involved would be a combination of toxicity assessment following aerial spraying and subsequent rainfall events, and biological monitoring of non-target organisms. This process would take several years during which time the situation would remain unchanged.

The other alternative is to act in accordance with the precautionary principle and the recommendations of two Federal government committees.

The precautionary principle and its application have been defined as follows;

> **When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof.**
>
> **The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives including no action.**
> (Peter Montague, www.biotech-info.net/rachels_586.html)

We believe that there is sufficient information in this report to identify hazard and sufficient information to identify impacts. Of the explanations that have been examined over the last four years only one is consistent with the evidence that is currently available.

In accordance with the precautionary principle it is our recommendation that the practice of aerial spraying of biocides on Tasmanian plantations cease immediately until such practices can be shown to be safe.

Demonstration of a causal relationship will still be possible if aerial spraying stops now, via the use of a BACI experimental design (Before / After / Control / Impact). Under such a design it would be expected that oyster mortality would reduce following rainfall and eventually return to rates of mortality observed in non-affected areas.

References

Davies and Cook (1993), quoted from Davies et al. (1994) below,
Davies, P. E., L. S. J. Cook and J. L Barton (1994). Aust. J. Mar. Freshwater Res., 1994, ***45***, 209-26
Report of the Senate Select Committee on Agricultural and Veterinary Chemicals in Australia, July 1990, ISBN 0644 11869 5, pp 293