Gippsland Lakes & Catchment Taskforce

Economic Impact of the 2008 Blue Green Algal Bloom on the Gippsland Tourism Industry

Report - April 2009

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Gippsland Lakes & Catchment Taskforce

EAST GIPPSLAND SHIRE COUNCIL

WELLINGTON SHIRE COUNCIL

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Contents

Report Snapshot

Economic Impact of Algal Bloom 2008

- Direct Economic Impact: - $18.2 million
- Direct and Indirect Economic Impact, including Multiplier (industry output): -$26.6 million
- Direct and Indirect Economic Impact, including Multiplier (gross product): -$17.5 million
- Net Impact on Victorian Economy: -$6.7 million
- The annualised Direct and Indirect Employment Impact (including multiplier): 306 jobs
- Net Employment Impact on the Victorian Economy: 90 jobs

Future Impact of Algal Blooms (20 year horizon)

- Direct and Indirect Mean Economic Impact (including multiplier): -$256 million
- Annualised Direct and Indirect Mean Employment Impact (including multiplier): 6,000 jobs

1. Executive Summary

The need for this project resulted from a massive Blue Green Algae bloom that built up in the Gippsland Lakes in late December 2007. The outbreak was of the *Synococcocus* species. Public warnings were issued and signage erected at over 100 sites around the lakes. The whole of the Gippsland Lakes including Lakes Victoria and King and the waters around Lakes Entrance were heavily affected.

The Blue Green Algae bloom continued at densities above the trigger levels set by authorities until 19 May 2008 when it was decided to take down signage and inform the public that the bloom was officially considered over. Many tourism operators and tourism related businesses complained about the impact being 'over dramatised' in the media and the resultant impact on their businesses.

A survey questionnaire was prepared and distributed to industry participants. A number of Shire databases were combined to provide a list of industry participants for the survey. A total of 46 completed survey responses were returned, being a response rate of 17%.

SURVEY RESULTS

- 28 participants responded that there had been a negative impact on their business by the Algal Bloom;
- The impact ranged between a decrease of 10%-30% in turnover, depending on the type of business. A number of answers were qualified as many participants struggled to quantify the decrease as businesses were still recovering from the bushfires;
- Only 14 of the participants had any mitigation strategies in place. 27 participants responded that they had no strategies to deal with the impact of the Algal Bloom;
- 30 participants responded that they did not believe they were well supported by the Blue Green Algae Incident Management Team and the Tourism Response and Recovery Group;
- Approximately one half of the participants believed there would be an ongoing impact of the Algal Bloom on their businesses;
- In response to a question about business responses to a future highly toxic Algal Bloom, 23 participants advised that they would implement mitigation strategies;
- The impact on businesses by a highly toxic Algal Bloom in the future elicited a wide range of responses from participants, ranging from 3.5%-100% impact on business.

ECONOMIC IMPACTS

- The direct economic impact of the Algal Bloom was calculated to be approximately $18,210,478;
- The direct and indirect, including multiplier effect (industry output) economic impact of the Algal Bloom was calculated to be $26.6 million and 306 jobs (full time and part time);
- The direct and indirect, including multiplier effect (gross product) economic impact of the Algal Bloom was calculated to be $26.6 million

- Taking account of the increase in expenditure in other parts of Victoria and the leakage of expenditure to other states, the net impact on the Victorian economy was a loss of $6.7 million and 90 jobs;

- Forecasting to a 20 year horizon, the direct and indirect mean economic impact is $256 million and a mean employment Impact (including multiplier): 6,000 jobs

RECOMMENDATIONS

Communication

The response organisations (e.g. D.S.E., Shires) need to communicate through organisations that the industry recognises. The obvious organisation would be Destination Gippsland.

- *It is recommended that a protocol be developed between Destination Gippsland, D.S.E. and the Shires to provide information to the tourism industry in the event of future Algal Blooms*
- *It is recommended that there is a greater use of technology in the event of an Algal Bloom. One example might be the use of websites and blogs to communicate up to date information to industry. Media can also be referred to these sites*
- *To ensure adequate distribution of information, it is recommended that Destination Gippsland establish/maintain a comprehensive database of operators. This database can be used to disseminate information during Blooms*

Mitigation Strategies

In the survey completed by industry participants, 65% of respondents advised that they had not implemented any mitigation strategies to offset the impact of the Algal Bloom. This is an area that warrants further attention.

- *It is recommended that the Shires and Regional Development Victoria investigate the potential for conducting Risk Management Planning sessions with industry*
- *Given that Algal Blooms are termed a natural occurrence (possibly disaster), Algal Blooms should be included as part of the Community Economic Development Project. This project that is developing strategies to assist small businesses in the event of natural disasters*
- *It is recommended that Destination Gippsland be approached to develop a marketing response to Algal Blooms, similar to those developed for bushfires and floods*

R & D Lobbying

It became apparent through the research that there is a need for greater research into Algal Blooms and what actions/responses are required to minimise the number or severity of the Blooms. This issue was raised in terms of support for further organic industry development.

> *It is recommended that the information and statistics compiled in this report be provided to Regional Development Victoria and appropriate Federal Government Agencies to lobby for additional research and industry development funding.*

2. Introduction and Background

2.1 Introduction

The following report provides a summary and analysis of data collected from a survey of tourism industry participants in the East Gippsland and Wellington Shires. Specifically, the industry participants are located in areas adjacent to the Gippsland Lakes and provide facilities and services to tourists that use the Lakes.

A total of 288 surveys were distributed to tourism industry participants in the following towns:

- Lakes Entrance
- Metung
- Paynesville
- Loch Sport

Of those surveys distributed, 18 were returned marked 'wrong address' or 'business no longer operating'.

A total of 46 completed surveys were returned, giving a response rate of approximately 17%. Whilst this number of responses is not ideal, it does provide an adequate number of responses to draw conclusions.

Importantly, the responses represented a wide range of tourism businesses. These included accommodation, restaurants/cafes, cruises/tours, retail and specific businesses, such as fishing equipment, museum. Community craft centre and a BTA.

2.2 Background

The need for this project resulted from a massive Blue Green Algae bloom that built up in the Gippsland Lakes in late December 2007 and was declared on Friday January 4. The outbreak was of the *Synococcocus* species and not of the more toxic variety that has previously affected the lakes system (*Nodularia spp.*), but because of its size and its density being above prescribed trigger levels, public warnings were issued and signage erected at over 100 sites around the lakes.

People were warned against swimming and engaging in other water-based activities in the lakes, and to shower if they came into contact with the algae. Risks were 'skin irritation' and 'respiratory reactions' potentially affecting up to 20% of people contacting the algae. Fishing was still permitted including collection of molluscs and other filter species.

The whole of the Gippsland Lakes including Lakes Victoria and King and the waters around Lakes Entrance were heavily affected. Lake Wellington was less affected but does not have significant levels of tourist businesses or amenities other than at Loch Sport.

The Bloom impacted on the tourism industry which, up until the time of the Bloom, had been building as a very good season. In addition, the fishing in the area was the best it had been in many years.

To manage the bloom an Incident Management Team was set up under the auspices of the Department of Sustainability & Environment. A Gippsland Tourism Response and Recovery Group was established with an objective to monitor and minimise the economic impact of the outbreak to the tourism industry and with a view to managing recovery actions.

The Blue Green Algae bloom continued at densities above the trigger levels set by the Incident Management Team until 19 May 2008 when it was decided to take down signage and inform the public that the bloom was officially considered over.

Many tourism operators and tourism related businesses complained about the impact being 'over dramatised' in the media and the resultant impact on their businesses.

It was agreed by East Gippsland and Wellington Shire Councils and the Department of Sustainability and Environment, that the impact of the Bloom should be estimated and to use economic modelling to estimate future impacts of Algal Blooms, differentiating between the toxic and highly toxic blooms.

3. Objectives

The results of the survey provide pertinent information that will not only assist the East Gippsland and Wellington Shire Councils and the Gippsland Lakes Taskforce to plan for the management of future blooms, but also to lobby appropriate agencies and organisations that can provide assistance to the industry.

The key objectives of the survey included gathering information that:

- Identified the number of businesses impacted by the 2008 algal bloom
- Could estimate the impact on the tourism businesses
- Attempted to document the impact by analysis of previous years
- Identified mitigation strategies implemented by the businesses
- Documented future mitigation strategies
- Identified areas for improvement and opportunities.

4. Methodology

The survey questionnaire was prepared by Nexus and N.I.E.I.R. with input from members of the steering committee. A number of databases were combined to provide a list of industry participants for survey.

The survey was distributed to those on the databases, together with a reply paid envelope. After the close of responses a number of follow-up telephone calls were undertaken by Nexus. As detailed above, a total of 46 completed survey responses were returned, being a response rate of 17%

5. Survey Response Analysis

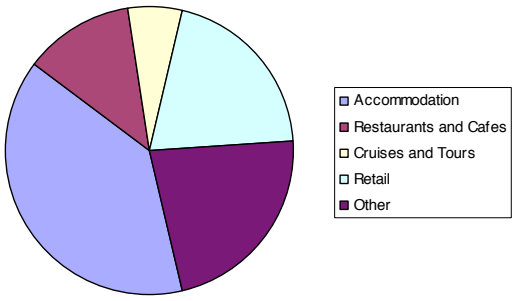
5.1 Types and Sizes of Tourism Industry Businesses

The respondents to the survey were asked to identify the type of business they operated. It is important to note that the survey provided five options for respondents to nominate and a number of respondents ticked more than one box. Therefore, the number of businesses appears to be higher (49 businesses) than the 46 responses.

The responses were:

- 19 accommodation businesses
- 6 restaurants and cafes
- 3 cruise and/or tour operators
- 10 retail businesses.
- 11 listed as 'Other' – these included a community craft centre, the Lakes Entrance Business and Tourism Association, a museum and a horse riding establishment.

Chart 1: Type of Tourism Businesses



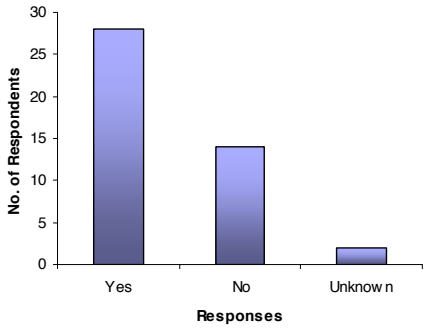
The sizes of the businesses operated by respondents varied enormously and can not be categorised into any particular key groupings. A list of the businesses is contained in the survey results – See Appendix A.

5.2 Impact of 2008 Blue Green Algal Bloom

When asked whether the 2008 algal bloom had a negative impact on their business, the following responses were received:

Table 1: Negative Impact on Business

Total Sample	46
Total responses	44
Total YES	28
Total NO	14
Total Unknown	2



It is interesting to note that 14 respondents reported that the algal bloom had not impacted on their businesses. A review of the surveys for these respondents found that a number of the businesses, whilst located in the Gippsland Lakes area, did not rely on water based activities, such as horse riding.

In addition, whilst not detailed in the surveys, it would appear that a number of businesses catered for markets that did not use the lakes, but enjoyed the water views and surrounding environment. This would be relevant for markets such as older people and the higher end users.

The question was quite specific in relation to impact. It would be interesting to know whether there was a flow-on effect that impacted those businesses that reported 'No'

5.3 Quantification of Impact

The survey asked respondents who indicated that the algal bloom had a negative impact on their business to quantify the impact. The only lead for answering the question was a reference to dollar turnover, bed night decline or percentage loss of business.

This question drew a wide range of responses, ranging from specific dollar amounts to vague thoughts of impact. To enable an estimation of the economic impact, answers to the question have been cross referenced with the type and size of the business. This cross referencing has enabled some broad categories to be developed. These categories are:

- Accommodation Camping/Caravan Park & 3-3.5 star rating
- Accommodation 4-4.5 star rating/B&B's
- Boat Charter/cruising
- Marine services
- Restaurants/cafes

After a review of the responses to the surveys, the following percentage impacts (negative) have been estimated for the above categories:

- Accommodation Camping/Caravan Park & 3-3.5 star rating: 20%
- Accommodation 4-4.5 star rating/ B&B's: 10%
- Boat Charter/cruising: 20%
- Marine services: 30%
- Restaurants/cafes:15%

The above estimates are not precise as each business responded to their particular circumstances and some businesses were impacted to a greater level than other businesses. However, the estimates are an average across the particular categories and provide a guide for estimating the impact.

5.4 Trend Comparison

The survey asked respondents to provide a comparison of the impact to the same periods in 2007 and 2006. As with the earlier question, the only leads to responses were bed night decline, dollar or percentage turnover losses. Only 17 respondents answered this question (N=46), which indicates an unwillingness or inability to answer the question.

From the responses received it is not possible to quantify the impact of the algal bloom using historical data for 2006 and 2007. The reason for this difficulty is that in 2006 there were significant and sustained bushfires and in 2007 there was the major flood. Both of these events impacted on the survey area (to a lesser degree in Loch Sport) and had significant impacts on businesses. As one respondent stated *'I don't know where the impact of the fires ended and the*

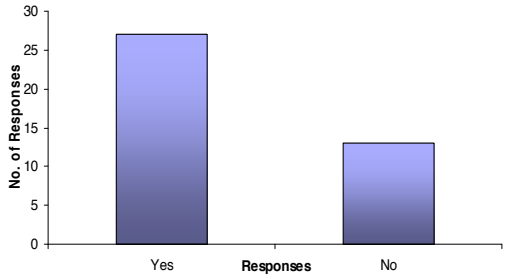
floods started, then when the floods ended and the algal bloom started – it has been continuous impacts!'

From the responses the impact is best viewed as a corollary of 5.3. The interesting point that can be noted here is that the bushfires were far more significant in impact than the algal bloom across the survey area.

5.5 Impact on other businesses

Total Sample	46
Total responses	40
Total **YES**	27
Total **NO**	13

Table 2: Respondents Knowledge of Impact on Other Businesses



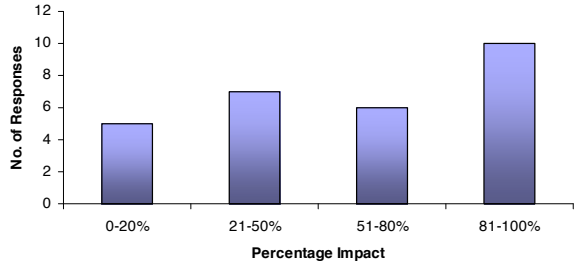
When asked whether the respondents had any knowledge of other local businesses being impacted negatively, 27 respondents answered yes to the question. The majority of responses referred to accommodation businesses and fishing supplies and a number referred to all businesses in the town.

It is very interesting that 13 respondents answered 'no' to the question. A cross check revealed that 5 of those respondents had indicated that the algal bloom had impacted negatively on their businesses. The remainder had indicated that the algal bloom had not impacted on their business, and presumably therefore had not impacted on any other businesses.

As a follow-up to the above question, the survey asked respondents to estimate the percentage impact on businesses in their locality that were negatively impacted by the algal bloom. 29 respondents answered this question (2 more than the above question) with the breakdown as follows:

Percentage Impact	Number of Responses
0-20%	**5**
21-50%	**7**
51-80%	**6**
81-100%	**10**

Table 3: Respondents Percentage Impact of Algal Bloom on Other Businesses

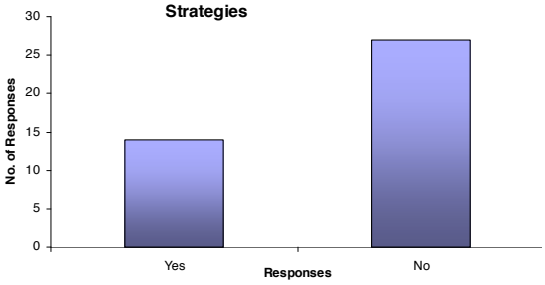


5.6 Mitigation Strategies

Apart from requesting information on the impact of the algal bloom, the survey sought information from respondents in relation to mitigation strategies to minimise the impact of the algal bloom on their businesses. When asked whether the business implemented any actions to minimise the impact of the recent algal bloom, the responses were:

Total Sample	46
Total responses	41
Total **YES**	14
Total **NO**	27

Table 4: Business Implementation of Mitigation Strategies



Of the responses in the affirmative, most cited communication as the key strategy. This included contacting customers, promoting non water based activities, greater advertising and reassuring about safety.

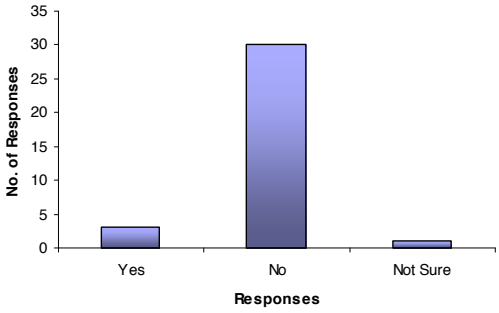
Importantly, 27 respondents (approximately 65%) implemented no action(s) to mitigate the impact of the algal bloom. This is an area that needs further investigation.

5.7 Support by Blue Green Algae Incident Management Team and Tourism Response and Recovery Group

The survey asked respondents to indicate whether they thought the industry was well supported by the Blue Green Algae Incident Management Team and the Tourism Response and Recovery Group. Of all the questions in the survey, this one received the most emphatic response.

Total Sample	**46**
Total responses	**34**
Total YES	**3**
Total NO	**30**
Total Not Sure	**1**

Table 5: Support of Industry by Agencies



In addition to the number of 'No' responses, there were a number of comments that respondents did not know who these agencies were and what their roles were. This issue is particularly important in the context of communication.

When prompted to provide suggestions as to how the agencies should support the industry, the common themes were:

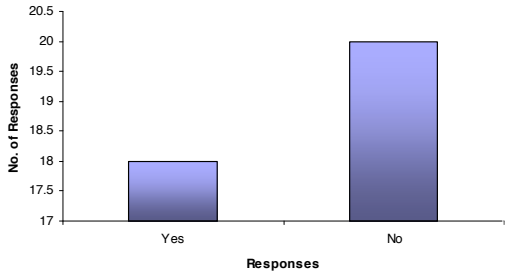
- Too much negative publicity, no counter to the negative publicity
- Lack of communication – during and after the event
- Need for education about different types of algal blooms – education for media, industry and community

5.8 Ongoing Impact of Algal Bloom

Apart from the immediate impact of cancellations, the survey sought information on what the ongoing impact of the algal bloom would be on business. When asked whether there had been any ongoing impact on business, the responses were:

Total Sample	**46**
Total responses	**38**
Total YES	**18**
Total NO	**20**

Table 6: Ongoing Impact of Algal Bloom



The responses to this question were very interesting, in that the proportion of 'No' responses were greater than the number of 'Yes' responses. This may indicate that respondents do not believe the algal bloom will have a medium term impact on their businesses. It may also indicate that they are not sure what the impact will be.

Of the 'Yes' responses, there was no consistency as to an expected percentage impact on the businesses. Percentage numbers varied between 5 and 30 percent. A couple of respondents (non accommodation) stated that there were no tourists coming to the area and therefore their businesses.

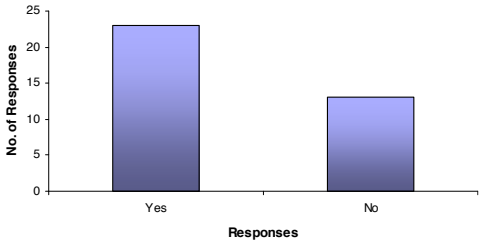
When asked to quantify the potential impact of the ongoing impact, only one business provided a forecast financial impact.

5.9 Future Scenarios

In relation to future planning by businesses, the survey included a section that provided a scenario of a highly toxic blue green algal bloom in the Lakes. Respondents were asked to consider what they would implement any actions to minimise the impact.

Total Sample	**46**
Total responses	**36***
Total YES	**23**
Total NO	**13**

Table 7: Businesses Intention to Take Action to Minimise Impact



*4 additional responses were received with comments

The responses to this question were positive in that approximately 65% of respondents had a plan to try and mitigate the impact of a major bloom. These responses included actions such as:

- Change market focus – e.g. more local than tourists

- Greater promotion of non water based activities
- Lobby for greater scientific research / more action by authorities
- Cost reduction

There were a number of responses that demonstrated the businesses would be monitoring the impact. These included:

- Cost reduction strategies
- Relocate business temporarily
- Shut down for the period
- Seek work outside the region till bloom passes

The survey then asked respondents to consider what the impact would be on the business. As with earlier questions, the only leads to answering the question were bed night decline, dollar or percentage turnover loss.

A wide range of responses were provided for this question, ranging from 3.5% to 100%

5.10 Other Comments

A large number of comments were provided and can be seen on Page 22 of this report. Contained within these comments are many good suggestions and ideas.

6. Economic Impact

6.1 Introduction

The information used to estimate an impact has been collected via the industry survey, discussion with stakeholders and industry representatives and credible industry reports.

As stated at the outset it is an estimate of the impact from information gathered. A more definitive economic impact using proprietary modelling that requires a greater depth of analysis is being prepared in parallel to this report by N.I.E.I.R. A copy of the N.I.E.I.R. modelling system is attached, marked Appendix B.

6.2 Tourism Industry Impact

The information prepared in section 5.3 is used to determine the occupancy decline/visitation activity in the period of the 2008 algal bloom, that being January – May.

Respondent Decline

The categories and level of impact, as reported by respondents to the survey, are:

- Accommodation Camping/Caravan Park & 3-3.5 star rating: 20%
- Accommodation 4-4.5 star rating Include Bed and Breakfasts): 10%
- Boat Charter/cruising: 20%
- Marine services: 30%
- Restaurants/cafes:15%

It is interesting to note that the statistics recorded by the Visitor Information Centre staff advised the following figures for the Lakes Entrance and Bairnsdale V.I.C.'s:

- January – May 2007; 101,211
- January – May 2008; 95,326

This represents a difference of 5,885 visitors – 5.8%. The percentage difference between 2007 and 2008 is well below that advised by respondents.

Domestic and International Overnight Visitors

The National Visitor Survey for year March 2007-March 2008, conducted by Tourism Research Australia, estimated that the 'Lakes Region' had 1,885,000 domestic visitor nights.

The 'Lakes Region' aligns with the boundaries of the East Gippsland Shire, and therefore includes non coastal areas such as Omeo and Buchan and coastal areas outside the scope of this study, such as Mallacoota. In addition, the region does not include Wellington Shire townships that abut the Gippsland Lakes, such as Loch Sport.

Whist this geographical area is not totally accurate in terms of the geographical study area, for the purposes of this analysis, the Steering Committee agreed that the additional visitor nights in the Lakes Region compensates for the nights missed in Wellington Shire locations.

In relation to international visitors, TRA estimated the number of international visitors to the region at 32,674 for the year ended 2008.

Domestic Day Trip Visitation

In addition to the domestic and international visitors that stay overnight, there are the visitors that visit the region as a 'day trip'. In the period March 2007-March 2008, there were 453,000 day trip visitors to the Lakes Region.

The breakdown of seasonal overnight visitation numbers has been calculated by Tourism Victoria for the region (Regional Profiles for year ending 2005) as follows:

- Summer 38%
- Autumn 27%
- Winter 13%
- Spring 23%

The period of the algal bloom was throughout the summer period and most of the autumn period However, given the bloom period excluded most of the December visitation numbers, a conservative estimate for the percentage of annual visitation to the region in which the algal bloom impacted would be 55%.

Using this estimate, the number of visitors to the region in the period impacted by the algal bloom would be:

- 1,885,000 domestic visitor nights x 55% = 1,036,750
- 32,674 international visitors x 55% = 17,970
- 453,000 day trip visitors x 55% = 249,150 visitors

To enable an accurate assessment it is also necessary to break down the profile of the visitors. The Gippsland Sustainable Tourism Report identified the following profile for visitors to the region:

- 12% of visitors stay in budget accommodation, caravan parks/camping grounds
- 24% of visitors stay in good hotels, resorts, motels or motor inns
- 16% of visitors stay in rented houses, apartments or flats
- 1% stay in bed and breakfasts

Occupancy

The January to July period includes the peak occupancy times for the region. The Coordinator of the Visitor Information Centres advised that that in the Christmas week and following week, occupancy levels are 100%. From the middle of January the occupancy levels drop to about 50-60%, then go back up for the Easter holiday period.

Given the above occupancy levels, a conservative estimate for the average occupancy levels for the period is 70%

Visitor Spend

The average spend for the different types of visitors are as follows:

- Day Trip Visitor – There are a range of different estimates for the amount day trip visitors spend. For example, the GSTP Report estimated the spend to be $69 per day, Tourism Victoria estimates the spend to be $88 per day and TRA estimates the spend to be $97 per day.

  For the purpose of this report, an average of the two lower estimates has been calculated to be $79 per day. This amount will be used

- Domestic Overnight Visitor – the GSTP report estimated the daily spend per night for the domestic overnight visitor to be $96 per person. This figure includes accommodation, meals and spending.
- International Visitors – TRA calculates the average visit is 2.8 days. Using these figures, it is estimated that international visitors spend approximately $122 per day.

IMPACT CALCULATION

1,036,750 domestic visitor nights at $96 =	$99,528,000
17,970 international visitors spending $122 =	$ 2,192,340
249,150 day trip visitors spending $79 =	$19,682,850
Total spend by visitors in a normal period	$121,403,190

Decline in business activity due to Algal Bloom – approximately 15%

$121,403,190 x 15% decline = $18,210,478

Total Direct Economic Impact to Tourism Industry: $18,210,478

6.3 Economic Value of Tourism to the Gippsland Lakes Region

It is estimated that for a 12 month period, the visitor direct expenditure on the Gippsland Lakes would be in the vicinity of $186 million. This amount has then been increased by the tourism multiplier as determined by NIEIR

On this basis, the economic value of the tourism industry to the Gippsland Lakes region is estimated to be around **$272 million**.

7. Economic Analysis and Future Modelling

This Section has been prepared by Dr. Peter Brain, N.I.E.I.R.

7.1 Summary of Economic Analysis

The economic analysis for the 2007-08 algal bloom event begins with the direct expenditure impact estimate of $18.2 million.

Assumption One: Seventy-five per cent of the direct expenditure impact is assumed to be directly allocated to East Gippsland LGA and 25 per cent to Wellington LGA.

The economic analysis is carried out on a Victoria-wide basis. Therefore, what is important is what happens to expenditures when visitors are deterred from the Lakes Region. The assumption is that visitors that would otherwise have gone to the Lakes Region travel to elsewhere in Victoria or interstate, mainly New South Wales. This applies whether the place of residence of the deterred visitor is Victoria, in other States or overseas.

Assumption Two: Seventy per cent of the lost visitor expenditure of $18.2 million is applied in Victoria, mainly non-metropolitan Victoria. The remaining expenditure is applied interstate.

Using N.I.E.I.R.'s combined multi-regional input-output model of the Victorian LGAs, the lost expenditures are allocated to industries in East Gippsland and Wellington in accordance with the average structure of visitor expenditure derived from tourism expenditure surveys.

The impact on East Gippsland LGA industry output and employment is shown in Table 8. For East Gippsland Shire the decline in industry output is $21 million, or 1 per cent of East Gippsland total industry output. However, as the contribution is spread over six months the impact will be double, or 2 per cent of total output, during the duration of the algal bloom event.

If oil and gas is included in Wellington's industry output, the impact on the Wellington Shire's economy is negligible. However, if it is excluded, on the basis that most of the income generated by the oil and gas industry in Wellington flows out of Wellington, the negative impact of the $6 million (Table 9) decline in output will be 0.3 per cent of output on an annual basis, or 0.6 per cent during the duration of the event.

From the two tables, total employment declines by 236 in East Gippsland on an annual basis, or by over 400 during the event. The employment estimates are in numbers, that is, full time and part time. Full time equivalent would be around 20 per cent lower.

The annual employment decline in Wellington Shire is 70.

From Table 10, the other LGAs of Victoria gain 216 jobs and $11 million in output. Victoria's total gross product and employment falls because of the leakage of expenditure interstate.

The next question is what the expected loss from algal bloom events is over a 20 year horizon, beginning in 2007-08. Because of the uncertainty the analysis

is carried out using probability distributions around key inputs, beginning with the probability of occurrence of an algal bloom event.

Assumption Three: For any given year there is a one in three probability of an algal bloom event (Figure 1).

Assumption Four: Given an algal bloom event has occurred there is a one in three chance that the event will be toxic (Figure 2).

The study provides a range of estimates of the cost of a toxic event relative to the non-toxic 2007-08 event. Hence, a probability distribution is used to reflect the uncertainty and the results are given in Figure 3. The distribution indicates that the mean is 2.3 of the non-toxic case, or a cost of $2.3 x 18.2), or $42 million. The maximum is four times the non-toxic cost. However, the maximum has zero chance of being exceeded.

The cost of an event will not stop with the event itself. There will be echo effects as visitors in the next season are deterred on the basis of a high expectation that an algal bloom event may occur again.

Assumption Five: In the year after an event the cost of an event is assumed at one third of the original cost, while after two years the cost is 0.35 x 0.33, or 0.1 of the original cost because of poor usage and lost visitors. The echo costs are assumed to occur over four years with the continuation of the above rate of decline.

Figures 4(a) and 4(b) give the outcomes of jointly all the probability distributions specified above. Thus, from Figure 4(b), there is a 5 per cent probability that the total cost will be greater than 14.3 times the single non-toxic event cost of $18.2 million. There is a 5 per cent probability that it will be less than 5.28 times the non-toxic single event cost.

Figures 5(a) and 5(b) are the same as the corresponding Figure 4 outcomes, except the relativities are considered to $m by multiplying the results from Figure 4 by $18.2 million.

Table 11 combines the results from Tables 8 and 9 and Figure 4 to obtain the probability outcomes for loss of production for the two Shires combined. The mean loss of production is $256 million with a maximum loss of $533 million and a minimum of $41 million. The best case is one where there is no algal bloom event over the next 19 years, which has zero probability.

Table 12 does the same for employment. The mean expenditure is a “stand down” of 6,000 employment positions for around six months. The maximum with zero probability of being exceeded is a stand down of 12,000. If this occurred there would be substantial permanent loss of capacity from the industry.

7.2 Tables and Diagrams Explanations

Table 8 shows the total impact (direct and indirect impact) of the 2008 algal bloom occurrence on the local government area of East Gippsland, employment falls by 236 and total industry output falls by $21 million.
The largest impact occurs for accommodation and restaurants with a fall of employment of 165 and a fall of industry output of $11 million

Table 8	Impact of 2008 algal bloom occurrence on East Gippsland LGA employment and industry output	
	Employment – annual impact (number)	**Industry output (2008 $m)**
Agriculture	-3.7	-0.4
Services to agriculture, forestry and fishing	-1.5	-0.3
Coal mining, oil and gas	0.0	0.0
Other mining	0.0	-0.1
Services to mining	0.0	0.0
Food, beverage and tobacco	-1.8	-0.6
Textile, clothing, footwear and leather	0.0	0.0
Wood and paper product	-0.5	-0.1
Printing, publishing and recorded media	-0.7	-0.1
Chemicals and petroleum	0.0	0.0
Non metallic minerals	0.0	0.0
Metal product manufacturing	-0.1	0.0
Machinery and equipment	0.0	0.0
Other manufacturing	-0.1	0.0
Electricity and gas	-0.4	-0.2
Water	-0.3	-0.2
General construction	-1.4	-0.2
Basic material wholesaling	-0.8	-0.2
Machinery wholesaling	-0.5	-0.1
Household good wholesaling	-1.5	-0.2
Food retailing	-6.4	-0.3
Household good retailing	-7.1	-0.4
Motor vehicle retailing and services	-4.3	-0.4
Accommodation and restaurants	-165.5	-11.1
Road transport	-1.3	-0.2
Rail	0.0	0.0
Water transport	-0.3	-0.1
Air	-1.0	-0.6
Other trans	0.0	0.0
Services to transport	-0.5	0.0
Storage	0.0	0.0
Communication services	-1.9	-0.3
Finance	-1.3	-0.2
Insurance	-0.3	0.0
Services to finance and insurance	-0.2	0.0
Ownership of dwellings	0.0	-0.7
Property services	-0.8	-1.0
Business services	-4.5	-0.5
Government administration	-0.6	-0.1
Defence	0.0	0.0
Education	-1.5	-0.1
Health services	-3.2	-0.2
Community services	-0.4	0.0
Film, radio and television services	-0.8	-0.1
Libraries, museums and the arts	-6.2	-0.3
Sport and recreation	-11.5	-1.5
Personal services	-2.1	-0.1
Other services plus private households	-1.3	-0.1
Total	**-236.4**	**-21**

Table 9	Impact of 2008 Algal Bloom occurrence on Wellington LGA employment and industry output	
	Employment – Annual impact (number)	**Industry output (2008 $m)**
Agriculture	-0.8	-0.1
Services to agriculture, forestry and fishing	-0.4	-0.1
Coal mining, oil and gas	0.0	-0.2
Other mining	0.0	0.0
Services to mining	0.0	0.0
Food, beverage and tobacco	-0.1	-0.1
Textile, clothing, footwear and leather	0.0	0.0
Wood and paper product	0.0	0.0
Printing, publishing and recorded media	0.0	0.0
Chemicals and petroleum	0.0	0.0
Non metallic minerals	0.0	0.0
Metal product manufacturing	0.0	0.0
Machinery and equipment	0.0	0.0
Other manufacturing	0.0	0.0
Electricity and gas	-0.1	0.0
Water	-0.1	0.0
General construction	-0.2	0.0
Basic material wholesaling	-0.1	0.0
Machinery wholesaling	0.0	0.0
Household good wholesaling	-0.1	0.0
Food retailing	-0.7	0.0
Household good retailing	-1.5	-0.1
Motor vehicle retailing and services	-0.6	-0.1
Accommodation and restaurants	-57.1	-3.7
Road transport	-0.1	0.0
Rail	0.0	0.0
Water transport	-0.2	0.0
Air	-0.5	-0.2
Other trans	0.0	0.0
Services to transport	0.0	0.0
Storage	0.0	0.0
Communication services	-0.3	0.0
Finance	-0.2	0.0
Insurance	0.0	0.0
Services to finance and insurance	0.0	0.0
Ownership of dwellings	0.0	-0.1
Property services	-0.1	-0.1
Business services	-0.4	0.0
Government administration	0.0	0.0
Defence	0.0	0.0
Education	-0.1	0.0
Health services	-0.3	0.0
Community services	-0.1	0.0
Film, radio and television services	-0.3	0.0
Libraries, museums and the arts	-1.0	-0.1
Sport and recreation	-3.7	-0.5
Personal services	-0.2	0.0
Other services plus private households	-0.1	0.0
Total	**-69.6**	**-5.6**

Table 9 shows the total impact (direct and indirect impact) of the 2008 Algal Bloom occurrence on the local government area of East Gippsland, employment falls by 236 and total industry output falls by $21 million. The largest impact occurs for accommodation and restaurants with a fall of employment of 57 and a fall of industry output of $3.7 million.

Table 10	Impact of 2008 Algal Bloom occurrence on rest of Victorian employment and industry output	
	Employment – annual impact (number)	**Gross product (2008 $m)**
East Gippsland and Wellington	-306.0	-17.5
Other Victorian LGA	216.3	10.8
Total Victoria	-89.8	-6.7

Table 10 shows the cumulative employment loss for the East Gippsland and Wellington LGA's and the cumulative loss for Gross Product, that is the value added component of the industry out put for and employment for both local government areas, being $17.5 million and 306 employment positions respectively.

In terms of employment it is estimated 216 jobs lost to East Gippsland and Wellington LGAs move to other parts of Victoria as visitors change their destination. The total loss of jobs out of Victoria is estimated at 90 positions

In terms of gross product $10.8 million of the $17.5 million of gross product loss to East Gippsland and Wellington LGAs moves to other parts of Victoria, the remaining $6.7 million of gross product is lost from the State.

Tables 11 and 12 show the probability distribution of loss of industry output.

Table 11 shows the probability distribution of loss of industry output over a 20 year period for the East Gippsland and Wellington shires. The results of the modelling give a mean that shows a loss of production would be $256 million. The minimum of $41 million assumes that there is no Algal Bloom event in the period but factors in the 'echo' effect of the 2008 Algal Bloom event.

The maximum loss of industry output over the 20 year period is shown to be $533 million; the minimum case has a zero probability of occurring.

Table 11	East Gippsland and Wellington LGA's: Probability distribution of loss in industry output over 20 year period (2008 $m)		
Statistics		Percentile	
Minimum	-40.6	0.05	
Maximum	-533.3	0.10	-140
Mean	-255.6	0.15	-163
Std Dev	-72.9	0.20	-180
Variance	-200.5	0.25	-194
Skewness	-6.5	0.30	-205
Kurtosis	-80.9	0.35	-216
Median	-253.1	0.40	-225
Mode	-235.7	0.45	-235
		0.50	-243
		0.55	-253
		0.60	-262
		0.65	-271
		0.70	-280
		0.75	-293
		0.80	-303
		0.85	-314
		0.90	-330
		0.95	-351

Table 12 shows the probability distribution of interruption to employment over a 20 year period for the EG and well shires. The results of the modelling give a mean that shows a loss of employment of 5,898 positions. The minimum of 936 positions assumes that there is no Algal Bloom event in the period but factors in the 'echo' effect of the 2008 Algal Bloom event.

The maximum loss of employment over the 20 year period is shown to be over 12,303, which has a zero probability of being exceeded.

Table 12	East Gippsland and Wellington LGA's : Probability cumulative distribution of employment loss interruptions for six month intervals over 20 year period – number		
Statistics		Percentile	
Minimum	-936.6	0.05	-3228.9
Maximum	-12303.6	0.10	-3766.9
Mean	-5898.1	0.15	-4161.0
Std Dev	-1682.6	0.20	-4478.9
Variance	-4626.1	0.25	-4737.6
Skewness	-150.0	0.30	-4977.2
Kurtosis	-1865.7	0.35	-5193.3
Median	-5838.7	0.40	-5422.7
Mode	-5437.7	0.45	-5617.5
		0.50	-5838.7
		0.55	-6047.4
		0.60	-6260.0
		0.65	-6470.4
		0.70	-6754.1
		0.75	-6984.4
		0.80	-7246.7
		0.85	-7624.4
		0.90	-8100.8
		0.95	-8742.3

Figure 1: The probability of an algal Bloom event

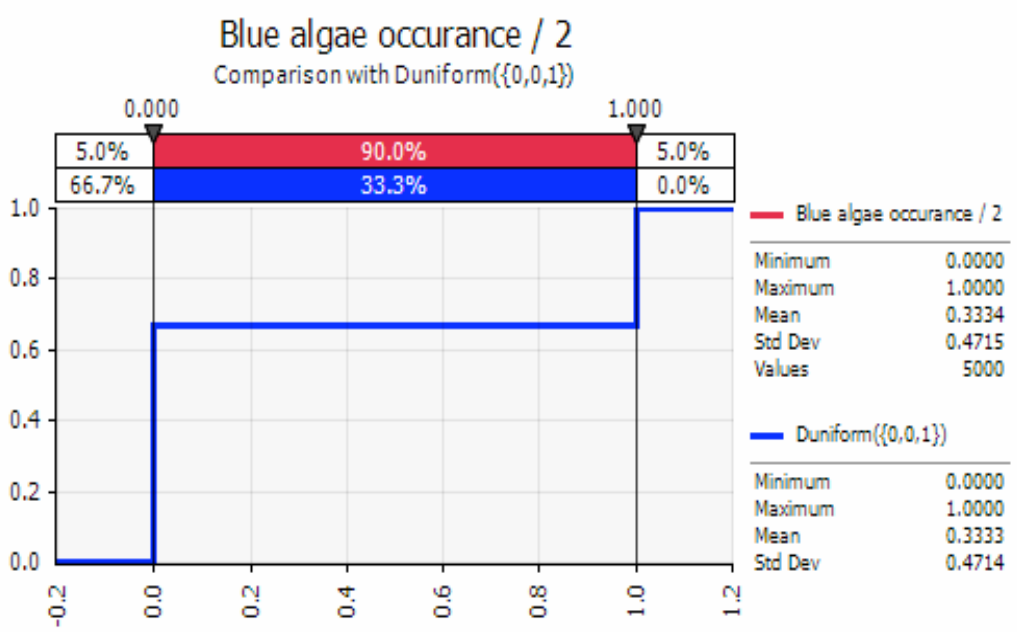


Figure 2: The probability of a toxic algal bloom event given an algal bloom has occurred

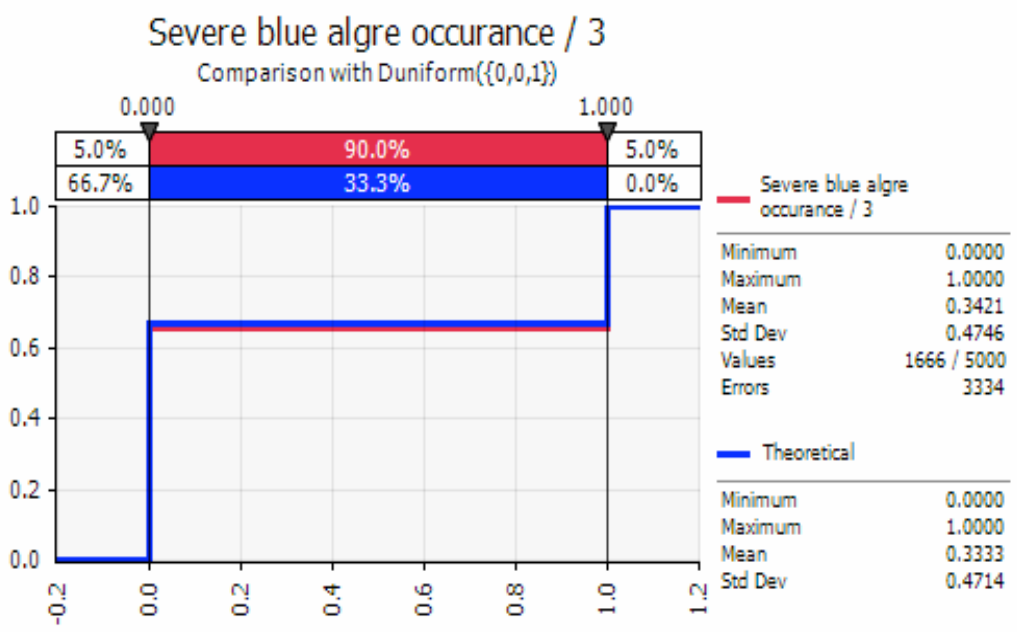
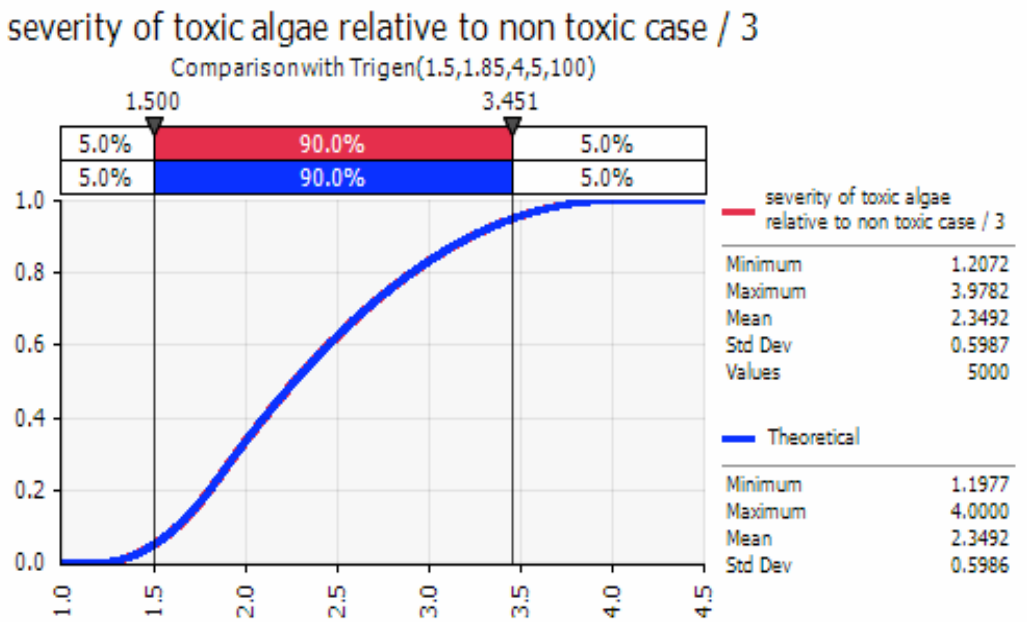


Figure 3: Severity of toxic algal bloom event relative to non-toxic case



Explanation of Probability Distributions

Two types of probability distributions are employed in the analysis. The first is a distribution of outcomes by frequency (or relative probability). From this the second distribution or cumulative probability distribution is derived.

Figure 4(a) and Figure 4(b) will be used as examples. The probability distributions are drawn from a 1000 iterations. Each iteration involves a random selection from the input distributions, The key input distributions are figure 1 to figure 3. From figure 4(a) then of the 1000 draws around 150 odd would show a total undiscounted cost relative to a single non toxic event of around 10 to 1. That is around 7 events of which between 2 and 3 would be toxic.

Again from figure 4(a) approximately 30 of the results would indicate a ratio of 5 to 1 or say 4 events of which one would be toxic. At the other end of the spectrum about 10 events would generate a ratio of around 17.

From the frequency distribution results in figure 4(a) the cumulative probability distribution in figure 4(b) is derived. This shows that over a twenty year period there is a five percent probability that the ratio will be less than 5.28. The expected result or the result at the 0.5 y axis point is approximately 10 which correspond closely with the peak in figure 4(a).

At the 95% benchmark in figure 4(b) there is a 5% probability that there will be an event over a twenty year period with an outcome is a ratio equal to or greater than 14.28. This is derived from the frequency outcomes at the riht hand tail if the distribution in figure 4(a).

Figure 4(a): Probability distribution of total undiscounted cost of algal bloom events over 20 year horizon to 2028 relative to single event non-toxic cost

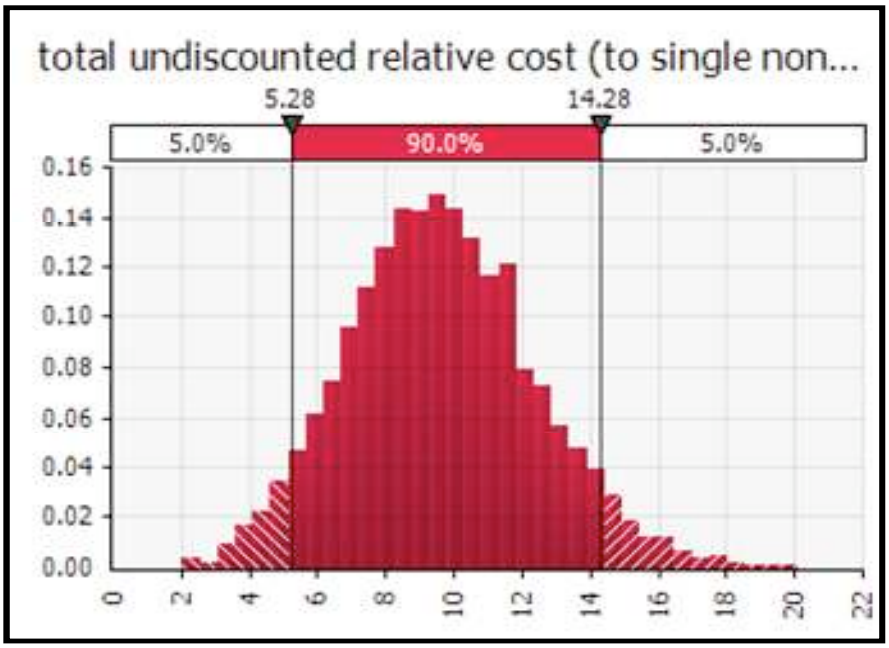


Figure 4(b): Cumulative probability distribution of total undiscounted cost of algal bloom events over 20 year horizon to 2028 relative to single event non-toxic cost

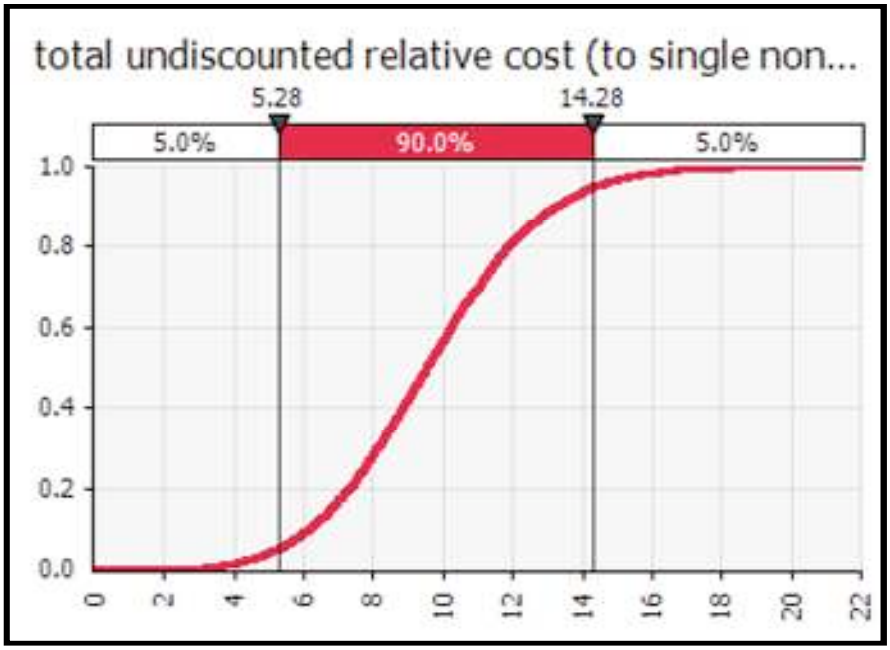


Figure 5(a): Probability distribution of total undiscounted cost of algal bloom events over 20 year horizon to 2028 in 2008 $m

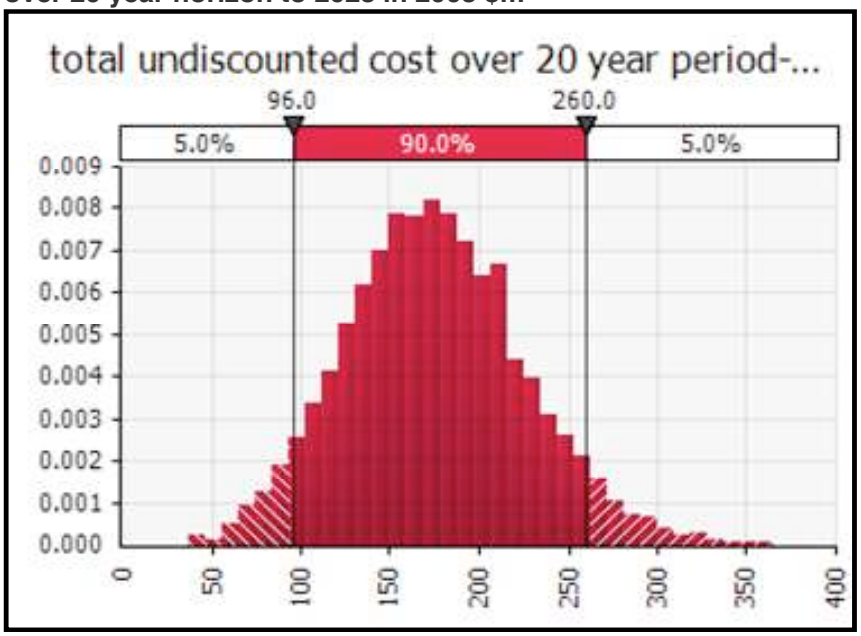
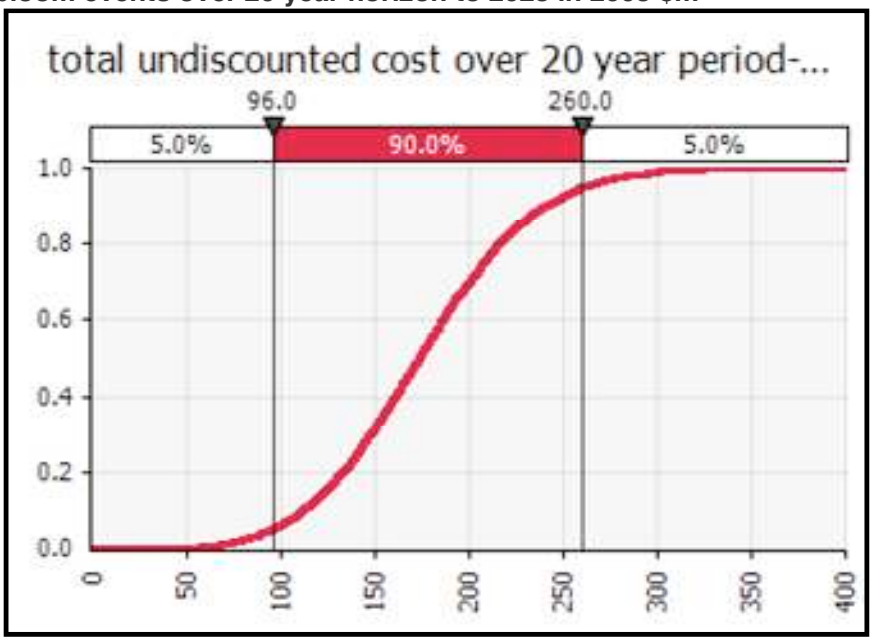


Figure 5(b): Cumulative probability distribution of total undiscounted cost of algae bloom events over 20 year horizon to 2028 in 2008 $m



8. Recommendations

8.1 Communication

- The response organisations (e.g. D.S.E., Shires) need to communicate through organisations that the industry recognises. The obvious organisation would be the peak tourism organisation.
  - ***It is recommended that a protocol be developed between the peak tourism organisation, D.S.E. and the Shires to provide information to the tourism industry in the event of future Algal Blooms***
  - ***It is recommended that there is a greater use of technology in the event of an Algal Bloom. One example might be the use of websites and blogs to communicate up to date information to industry. Media can also be referred to these sites***
  - ***To ensure adequate distribution of information, it is recommended that the peak tourism organisation establish/maintain a comprehensive database of operators. This database can be used to disseminate information during Blooms***

8.2 Mitigation Strategies

- In the survey completed by industry participants, 65% of respondents advised that they had not implemented any mitigation strategies to offset the impact of the Algal Bloom. This is an area that warrants further attention.
  - ***It is recommended that the Shires and Regional Development Victoria investigate the potential for conducting Risk Management Planning sessions with industry***
  - ***Given that Algal Blooms are termed a natural occurrence (possibly disaster), Algal Blooms should be included as part of the Community Economic Development Project. This project that is developing strategies to assist small businesses in the event of natural disasters***
  - ***It is recommended that the peak tourism organisation be approached to develop a marketing response to Algal Blooms, similar to those developed for bushfires and floods***

8.3 R & D Lobbying

- It became apparent through the research that there is a need for greater research into Algal Blooms and what actions/responses are required to minimise the number or severity of the Blooms. This issue was raised in terms of support for further organic industry development.

  It is recommended that the information and statistics compiled in this report be provided to State Government agencies and appropriate Federal Government Agencies to lobby for additional research and industry development funding.

8.4 Ongoing Assessment

- This project has created a process and methodology for assessing the economic impact of an Algal Bloom on the Lakes Region. This process and methodology should be used in the future when Algal Blooms occur so as to enable comparison and trend analysis.

  It is recommended that the economic modelling developed by NIEIR by used in the event of future Algal Blooms. The consistency of data analysis can then be used to compare impacts and undertake trend analysis

Appendix A: Survey Results

Gippsland Lakes Blue Green Algal Bloom Tourism Industry Survey Results

1. What type of tourism related business do you operate?

Accommodation	19
Restaurant/Café	6
Cruises/Tours	3
Retail	10
Other:	(2) boat club, (15) Real Estate (16) Model Railway (25&45) Boat builders (27) BTA (31) Paddle Boats (32) Museum (35) Horse Riding (37) Community Craft Centre (43) Cinema

2. Please describe your business (e.g. size, no. of beds, seating capacity, products)

1. Cottages, 2 lodges, 8 onsite vans, 10 powered sites, unlimited unpowered
2. Boat club
3. Real Estate
4. 160 sits, 2 cabins, 1 van (each sleeps 5)
5. Retail fish shop
6. 40 room motel attached to a licenced RSL Club
7. 19 site caravan park
8. Bakery – bread, rolls, pastries, sandwiches, coffee
9. 3x1 bedroom units & 1x2 bedroom unit
10. 14 charter boats, 4 day boats
11. 28 bed motel
12. Traditional B&B – 4 beds
13. 120 sites
14. 4 x 2 bedroom fully self contained units
15. Real Estate
16. Tourist and children's birthday parties – to ride a miniature steam train
17. Florist, crafts, nursery, antiques, café
19. 10 Log Cabins
20 Marine sales and repairs, boat storage
21. 22 cabins and 80+ campsites
22. Real Estate
24. 22 room motel & 50 seat restaurant
25. Timber boatbuilding and repair
26. Caravan park, cabins, camp sites, annual sites
27. Business and Tourism Association

28. 10 couples
29. Florist, giftlines
30. 137 rooms, 50 seat restaurant, day spa
31. A large number of paddle boats, aquabikes, canoes, paddle skis, catamarans & other watercraft
32. Sea shell museum, aquarium, marine display plus retail gifts, shop
33. Medium sized supermarket
34. 200 seat bistro, Australian/Chinese cuisine
35. Horse experience specializing in beginners and confidence building
36. 30 passenger charter boat
37. Community Craft Centre selling local crafts, staffed by volunteers – profits back to community
38. 88 beds, school camp
39. Fresh fruit and vegetables, gourmet products (retail and wholesale)
40. Café
41. 6 holiday units
42. Cruise boat / ski-tour boat
43. Year round cinema – 137 seats
44. Retail store for tourist and fishermen's needs – live bait mechanical repairs and parts, driveway fuels
45. 6 passenger vessel / boat building, repairs and maintenance
46. 27 beds

2008 Blue Green Algal Bloom

3. Did the recent Blue Green Algal Bloom (January-May 2008) have a negative impact on your business?

Yes	28	No	14	Unknown	2

3(a) If yes, can you quantify the impact (e.g. bed night decline, $ turnover loss, $% turnover loss)?

3. Negative media results in people buying elsewhere
4. $800 bookings cancellation
8. Sales were 5% lower than previous summer
10. 20% down on charter numbers and income
11. 5-10%
12. 25%
14. 47 nights - $2,205
15. Tourist went home early – 20% turnover loss
16. Tourists cancelled booking 'holidays' and school camp bookings at Banksia because no water activities
19. Hard to judge – approximately 5% - phone calls enquiries all questioned the cleanliness of the lakes
20. 50% loss in service and repairs; 40% loss in boat storage
21. Small amount
22. Decline in sales

24. Bed night decline

26. $1,000's

29. 20%

31. 20% loss of turnover

34. Lunch trade; -9.1% Dinner trade; -12.5%

36. 20% reduction in ongoing booking – cancellations and phone calls

37. Decline in turnover due to less tourists and locals able to swim in lake or fish

38. Not really, we could sail so we changed activities

41. 30% turnover loss

42. $9,000

44. Overall loss in $ - $68,000 (28%)

45. A huge decline in general/annual maintenance. As there is no shellfish growth, there is no need for anti-fouling, etc. – slippings are well down. We have been lucky enough to keep trading as there have been several major restorations we have attained, which have kept the wheels turning, but slippings are well down

3(b) If yes, can you provide a comparison of the impact to the same period in 2007 and in 2006 (e.g. bed night decline, $turnover loss, $% turnover loss)?

	2006	2007	2008
1.	Last years figures down on the year before because of bushfires. Only 1 phone call re algal bloom last year		
4.	Not here	No answer	don't know yet
7.	Use 2007 as a 100% base year, cannot determine if 2008 was affected		
	90.1%	100%	97%
12.	on 07		25% down
15.			20% down
24.		20% down	10%down
26.	down		15-20%
28.	91 b/nights (7.3%; $32,850)	29 b/nights (1.1%; $4,950)	Nil
	▲ Due to health problem		
30.	Resort occupancy is growing at approximately 20% per annum		
33.	Best year for trade over period	-5.1% on 06 (bushfires)	-1.2% on 06
34.	Lunch -5.6%	- 9.0%	- 9.1%
	Dinner + 4.3%	- 6.0%	- 12.5%
36.	$40,000	$51,000	$38,200
37.		Bushfires – 20% down on previous year	
42. (algae)		$4,500 loss (due to bushfires)	$9,000 loss
43. 2007		19% less than 2006 (Jan-May period)	Same as
44. (28%)	$50,000 (24%)	$58,000 (26%)	$68,000
45.	90%	70%	20%

4. Do you know of any other businesses that were negatively impacted by the recent Blue Green Algal Bloom?

Yes 27 No 13

4(a) If yes, please advise what type of businesses?

1. Loch Sport Caravan Park
3. Cafes, hotel, general store and supermarket
4. Shops in Loch Sport
8. Accommodation

10. All businesses that have a lakes focus – and then all related businesses and contractors
11. Bait shops, fishing tackle
12. Almost all hospitality and other accommodation houses
14. Accommodation and Fishing supplies businesses
15. Accommodation houses
16. Scholl camps at Banksia Peninsular
20. All businesses in Paynesville
21. Restaurants
22. Wine bar, hotel, boat repairs
24. Motels
25. Tourist accommodation, hospitality, retail
26. Bait outlets, hire boats
27. Accommodation, restaurants
29. Boat chandlery, storage & maintenance, restaurants, accommodation, bait shop
30. All to some degree
31. Boat shops, fishing gear outlets
36. Petrol retailer next door
39. Accommodation services
42. School camps – Duck Arm
44. Takeaway food, supermarket, building supplies, bakery, Sunday market, garden supplies, nursery
45. Other slipping facilities are suffering the same fate

5. What percentage of businesses in your locality do you think were negatively impacted by the recent Blue Green Algal Bloom?

1.	Don't know	25.	50%
3.	75%	26.	Everyone – it flows on
4.	100%	27.	80%
8.	90%	28.	5%
9.	10%	29.	100%
10.	30%	30.	100%
11.	50%	31.	30%
12.	75%	32.	65%
15.	50%	34.	50%
16.	80%	36.	20%
19.	5-10%	41.	100%
20.	100%	42.	20%
21.	30%	44.	100%
22.	100%	45.	50-70% in some form or other
24.	100%		

6. Did your business implement any actions to minimise the impact of the recent Blue Green Algal Bloom?

Yes 14 No 27

7. Not directly, however the focus of my business has changed to acknowledge generally falling tourism in the region

6(a) If yes, what were these actions?

3. Inform people the bloom would break up and would not be long term – more seasonal
4. Kept people aware of facts e.g. boating, fishing – no problems
10. Regular email broadcasts to people with bookings and to database generally, maintained an info page on our website
12. Reassuring prospective guests by email and by speaking to them
14. Advise boat owners to thoroughly wash boats before entering other waterways
15. Informed tourist and prospective home buyers of all the good points of the area
19. Used information sent to us
20. Told visitors that the algal bloom was not dangerous
22. More advertising
24. Talked it down
26. Fast talking
38. Changed activities on camp
42. Gather correct and accurate information to better educate our customers
44. Find other employment to supplement cashflow
45. Seeking large boat restorations and seeking work elsewhere outside our normal operations

7. Do you consider that the tourism industry was well supported during the recent Blue Green Algal Bloom by the Blue Green Algae Incident Management Team and the Tourism Response and Recovery Group?

Yes 3 (19, 21,27) No 30 Not sure 1

7(a) If yes, please give examples?

12. Not until the damage was set in
19. Team approach and only one spokesperson

Answered outside Yes/No option: Although understand health risk advice needs to be out, but feel it was too much doom and gloom. Needs to be balanced and not alarm people away from area

7(a) If no, please give suggestions?

1. Monitor the algal bloom and give reports over the media
3. Bad media hype, signs in parks, etc gave negative message to public

4. Wasn't even informed when algal bloom had gone

6. Insufficient publicity on a statewide basis to counter negative publicity in press/radio/tv

7. Whilst the bloom reports were useful, they gave little incentive for tourists to visit the region. No-one including locals would consume fish caught in the lakes during the bloom

9. More positive advertising for the lakes

10. Destination Gippsland's Chris Buckingham noted in media that it was pleasing to get through the season with no natural disasters. Plus total silence from EGSC through the season

11. We need 'plus positive' advertising to counter the negative

12. Its hard to know how long these things will last but more positive press should be given, particularly to Melbourne

14. I would have liked more regular updates of the situation

15. Bad publicity on the ABC; one Saturday morning 6.30am show – that day the tourists moved out in droves

16. More work should be done to prevent it.

17. Too much negative publicity for Lakes Entrance

20. Who the bloody hell are they!

22. Never ever had contact from them

24. What could they do?

26. Positive media campaign showing the good areas/activities

29. More interactive support and advice is required. As far as we knew, the whole issue was just being ignored

32. Too much bad publicity!! Lakes Entrance was not strictly affected by the toxic blue green algae, but a green algal bloom caused by weather conditions

33. Don't know the above groups

36. Bloom not dangerous – still sold commercial fish caught in lakes

37. Haven't heard anything from the Shire till this survey

39. Need to show other positive aspects of lakes area

41. We have never heard of these teams

42. We felt that the blue green alga was over sensationalized. People were not correctly informed about the fact that it was a totally different non toxic species that had very minimal risk to a small percentage of people (as we can confirm). We must present all the facts so that people can make their own decision about the risks involved. As proved to be the case from our experience and health workers, there were very few negative health problems from this species

44. It was advised through TV and newspapers and radio not to enter the water or take fish – regularly over the holidays

45. We have never heard of these groups. We never had any communication from either group indicating what changes had been implemented

46. Insufficient information in the media

8. Has there been any ongoing impact of the recent Blue Green Algal Bloom on your business (e.g. cancellation of repeat bookings)?

Yes 18 No 20

8(a) If yes, please describe these impacts (e.g. $, %)

4. Don't know yet – Will see during summer
6. Lower room nights on a year to date basis
10. Bookings 20% down – many phone calls asking about the condition of the lakes
12. With the fires, floods and algae, it's hard to know where one stops and the other starts
15. Business down at least 20%
16. No tourists
20. 25% loss of business
22. Negative response from buyers
24. 10% down
26. People go elsewhere; it's hard to get them back
29. Tourist numbers still down
30. Cannot quantify – all boat operators ask the question – a % would go elsewhere
36. Frequently asked questions
38. 5%
41. No repeat bookings from last Christmas due to algae
42. People, especially school groups are becoming nervous
44. 2008-2009 $81,000 (35%)
45. 80% impact on annual maintenance

8(b) Can you quantify the impacts?

12. This has been the poorest year we have had in 7 years of operation.
15. Uncertainty of when the Lakes will recover and are the relative authorities doing anything about it – or just talking and monitoring it
20. Loss in storage, servicing and repairs
26. Significant
36. Loss of income
38. Sailing groups are not re-booking
42. $3,000-4,500 to ski business
44. A very noticeable impact on the existing business

Future Highly Toxic Blue Green Algal Bloom (Scenario Planning)

The Scenario:

A widespread highly toxic Blue Green Algal Bloom would see the banning of all water based tourism activities such as boating, swimming and fishing. Potentially, the collection and sale of all seafood products would cease. It would in all likelihood be accompanied by negative and high profile coverage in the metropolitan media. Tourism visitation would almost certainly fall sharply and take some time to recover after the bloom had ended.

9. Would your business implement any actions to minimise the impact of a highly toxic Blue Green Algal Bloom on your business?

Yes 23 No 13

Comments:
3. How can you take action?
4. Like what?
10. What would you suggest?
12. Doubtful

10(a) If yes, what would be these actions?

5. Promote that wild caught ocean fish unaffected
7. Switch to offering primarily permanent accommodation – this is almost complete
8. More ongoing support from locals rather than tourists
11. Advertising
12. If people are coming specifically for the water activities, then nothing would work well
14. I would need to know what we could do first before making any assumptions of what we would do
15. Get Council, authorities and government to act
16. Scientific study to prevent it from starting, by spraying from the air
19. Promote non water activities. Promote fact that we have a pool and close to other waterways
20. We might as well shut the doors
26. Contribute to the causes, i.e. drought management; contain bushfires to prevent defoliation allowing floods to bring down the nutrients causing the algae
28. Always willing to help out if possible. Have an awareness campaign, community education
31. Total closure of the business
32. A scientific survey done fast and recommendations by a scientific team be implemented if possible
34. Downsize staffing to cope with reduction in tourism
35. Advertise that we are not water based
36. Now entrance is wide and open – algae is only found in few areas; saltwater inflows clear water
39. Our business relies on tourist season supplying restaurants, cafes, etc
41. We would participate if there was anything we could do
42. If no boating, then our business would have a holiday or leave the area. Ski school could be mobilized to other areas
43. Concentrate on local market
44. Other employment to supplement the business and may be open on weekends only.
45. We would seek work outside the area until work here could exist again
46. Inform accurately

11. Can you estimate what the impact would be on your business (e.g. Bed night decline, $ turnover loss, $% turnover loss) if a highly toxic Blue Green Algal Bloom occurred in the future?

1. I wouldn't like to see it return. But there's nothing you can do to stop it. Yes, I imagine it will affect all businesses
3. The blooms are seasonal at Loch Sport. They are not as severe as at the eastern end or middle section of the lakes.
4. Over peak summer period, possibly 80%
7. With the changes I have implemented – nil
8. 5-10%
9. 50-60%
10. Given your scenario, we would probably have to close the business
11. If this scenario was to happen, maybe 80% loss
12. 25-30%
14. We would expect at least 50% loss as a majority of our clients are fishermen
15. Turnover down and not just because of interest rates and fuel prices
19. 20-60% - depending on severity, length, time of year (e.g. January 60%, Feb/Mar 20%)
20. 100%
22. 70% drop in sales
24. No, but not good
26. From the past estimates 50-60% of income for duration of the bloom
28. 1% reduction in occupancy = $4,600. Hence we build our business on an all year around basis to minimise the effect beyond our control
29. 30-60% decline
30. Could be up to $500,000 in potential turnover. I am budgeting a $1million risk in turnover per annum for the next 3 years
31. 100% of my income and my livelihood gone
32. Probably 70% decline of tourists to Lakes Entrance with young children – seniors do not swim. Also a decline of 100% of fishermen (amateur anglers) to the region
33. If event occurred at xmas or Easter, impact would be 3.5% less to annual turnover
34. The 2007 floods impacted our business by 18% (total business). I would assume that tourism would not be so dramatic; therefore a range estimate would be 10%
36. 20% - misinformation by journalists
37. There would be a significant decline in turnover if the numbers of tourists are down because of the lake being hazardous for swimmers, boating and fishing
38. 5-10% decrease in turnover
41. 100% affected
42. Complete loss for enterprise cruises – down $150,000; ski boats (aquamania) down $20,000
43. Probably about 50%
44. Will only increase (the deficit) on previous figures
45. A huge downturn in revenue – perhaps up to 50% loss
46. 10-20% loss

12. Are there any other comments you would like to make in relation to the impact of Blue Green Algal Blooms on the tourism industry?

1. I can't suggest much as the algal bloom happens due to the condition of the lakes

2. Don't consider this survey relevant to our operations. The last and current algal bloom isn't a toxic blue green algal bloom and doesn't impact on our activities

3. The negative media hype and the impression that the bloom will last forever is bad. The message should get out that the bloom will break up over time.

4. It would be nice if there were more preventative measures put in place to minimise future blooms

5. It is important to note that William Carstairs recorded algal blooms in his journal as early as the 1890's

7. It is impossible to qualify/quantify the impacts of algal blooms on tourism from accommodation industry operators – many factors are currently affecting our business. The complete answer must be with the potential customer.

10. The algal bloom existed last year without comment until government departments returned from their Christmas break. Up till this time people continued to use the lakes without ill effect. It is more likely that the warning signs are to protect bureaucrats, especially human development, than they are to protect the public. There is very little attempt by any government departments to be positive or to understand the plight of the tourism industry. The problem can be fixed – ban chemicals and super phosphates on farms and release more water from the Thompson, but no government department is willing to take the giant steps necessary.

11. All negative publicity turns visitors' eyes elsewhere, e.g. ross river fever on the Murray. More people come here to be near the water. Algae here, people go elsewhere, resulting in loss to whole area

12. Since we are small and enjoy a good percentage of overseas visitors, we feel we are able to absorb the impact more than those depending on local and Melbourne based visitors. However, 25% in turnover cannot be absorbed every time there is a bloom

15. There seems to be no reports of what has caused the problem (could it be the fire retardant which stopped the Mitchell river from settling after the floods) and could a lot of it be instable sediments

19. Maintain one spokesperson; promote region as waterbased plus hinterland; keep the key spokesperson in the region, but also keep a strong voice in Melbourne media, ie, talk back, alternative holiday activities, fishshops sell all fish, not just local fish

20. The public should be informed, not scare them

24. Control media coverage of the area

26. Better management of the causes, i.e. drought, bushfires, floods

27. Not really, it has all been said before. It needs a big commitment for the state government that is unlikely to be forthcoming

28. Spend more on promoting the region for the period from June-December. Too many businesses close during the winter – especially restaurants. Create itineraries of what to see, do e.g. soft adventure, guide bus tours on a daily basis, etc.

29. January – May period is extremely conservative. As the lakes were still not cleared in late August, isolation of the Lindenow flats would seem to be a major priority.

31. Keeping all media informed of the positive aspect of the algae, in other words, nothing negative in the press as I feel this does more damage to general tourism in East Gippsland

32. Please make sure the species of algal bloom you are discussing is the toxic blue green variety. Contact SEAMEC at Bullock Island, Lakes Entrance for confirmation.

Liaison with fully trained marine biologists and affiliated scientists of prime importance to establish cause/treatment and toxicity levels.

33. Curtail media coverage

34. If the blue green algae were to occur in the future, a targeted approach to combat negative media throughout Victoria must be implemented

36. Not all blooms are dangerous – part of food chain to support fish food chain. Not all areas are affected. Blooms are larger in Metung, Paynesville, Jones Bay, Lakes Entrance affected for short period of time.

37. We get a spin-off from the tourist buses visiting the area. These buses would cease if the algae was prevalent

39. Our business can only survive if tourism in this area grows. We need more positive advertising of other attractions in this area.

41. There seems to be a lot of discussion on the algal bloom but there doesn't seem to be anything done to minimise it

42. Where was the information about the real facts? I don't mean information sheets that seemed to be written so that the writers were legally covered by its wording. All these documents appear to give worst case scenarios and are not truly representative of the practical and the actual situations – e.g. we skied over 1,000 children and experienced only one child with a minor rash.

Idea: Use the tactic and wordings similar to the following: "To minimise the possibility of skin/eye irritation to water users, it is recommended that the following steps should be taken ……" The appearance of liability covering signs can over dramatize the whole scenario as well. To the unaware, they appear to say that it is illegal or life threatening to those who use the water. Why not place the correct information on the signs

43. Softer announcements on nationwide media. Immediate announcements once danger is over.

44. If the lakes system is allowed to die, that will be the end of tourism as it was known

45. Please send the results of this report to this address. I am happy to fill in this survey as it is high time the health of the Gippsland Lakes are maintained and addressed accordingly

Appendix B: N.I.E.I.R. Modelling System

National Institute's (NIEIR's) regional modelling system

NIEIR's regional models have been built to meet specific client requirements. The regional modelling system has been developed to the stage where it covers all significant regions of Australia. NIEIR's regional modelling system and database is the framework from which the client's objectives will be achieved.

An overview of the R-IMP econometric model

NIEIR's regional modelling system consists of two model segments, namely:

- R-IMP; and
- RHIS.

The RHIS system is a modelling and data base system which generates detailed household socio-demographic and expenditure structure down to the CCD (a Census Collector District contains on average 180 households) level.
The R-IMP model for each region has an integrated econometric model combining industry and household segments. The household segments consist of both data and equations. The maximum level of disaggregation from the R-IMP model is the Statistical Local Area (SLA) level (very approximately 16,000 households). This means that the household sector of R-IMP is obtained by aggregating the RHIS data base into the appropriate R-IMP regional dimension.
Below the SLA level the use of RHIS is restricted to a stand-alone mode which, in turn, means restriction to household sector analysis. Regional wide analysis (that is taking into account both household with industry interaction) is restricted to the R-IMP geographical dimension. That is, full model interaction is restricted to the SLA level.

General model description

The model is a traditional, annual, multi-sector, dynamic (distributed lags), demand focused (national, state and regional accounts identities and balances) econometric model with strong supply influence and interaction. The model is anchored in real time projections of the national, state and regional economies.

Geographical dimension

In the country areas the model is currently restricted to the Statistical Sub-Division (SSD) and Statistical Division (SD) level. The exception is New South Wales where most of the significant SLA regions have been modelled including all the SLAs in the Western Division.
For South Australia and Western Australia the modelling is carried out at the Statistical Sub-Division and Statistical Division levels.

The industry data base

For a number of series there is a good time series dimension, especially in relation to the building industry indicators.
The business register is the basic source of data for industry activity at the SLA level, which is used to interpolate between Census employment benchmarks. The employment benchmarks are converted to output estimates by using Industry Census information (output per employee) adjusted by firm size.
The industry data benchmarks (employment and output) are developed at the Australian Bureau of Statistics Input-Output Table 107 industry classification. The industry definitions are shown in Table 1. For New South Wales regions the full 4-digit ANZSIC industry definitions are available. That is, at the 465 industry level.

The freight flow framework

The freight flow framework between regions (that is SLAs or SSDs) is estimated by updating AustRoads' 1988-89 origin-destination benchmarks. Given:

- industry output by region;
- port (and airport) exports and imports by industry/commodity; and
- freight flow annual control totals by road, rail, sea and air,

The inter-regional freight flows are estimated by interactive adjustment (RAS) techniques. The adjustment is continued until balance is achieved with the control totals.

Input-output framework

Given the regional trade estimates input-output relationships are developed for each region (SLA, etc.). The starting point for estimation is the latest National Technological (that is indirect allocation of imports) matrix. The key constraints used in the estimation of the input-output relationships are:

- industry output;
- trade flows; and
- consumer demand from the SpendInfo data base (the 400 expenditure estimates are aggregated into the 107 industry input-output classification).

Imports are the residual to derive input-output balance by industry.

Table 1 Regional industry output definitions

1	Sheep
2	Grains
3	Beef cattle
4	Dairy cattle
5	Pigs
6	Poultry
7	Other agriculture
8	Services to agric.; hunting
9	Forestry and logging
10	Commercial fishing
11	Coal; oil and gas
12	Iron ores
13	Non-ferrous metal ores
14	Other mining
15	Services to mining
16	Meat and meat products
17	Dairy products
18	Fruit and vegetable products
19	Oils and fats
20	Flour and cereal foods
21	Bakery products
22	Confectionery
23	Other food products
24	Soft drinks, cordials, syrups
25	Beer and malt
26	Wine and spirits
27	Tobacco products
28	Textile fibres, yarns etc
29	Textile products
30	Knitting mill products
31	Clothing
32	Footwear
33	Leather and leather products
34	Sawmill products
35	Other wood products
36	Pulp, paper and paperboard
37	Paper bags and products
38	Printing; services to printing
39	Publishing; recorded media etc
40	Petroleum and coal products
41	Basic chemicals
42	Paints
43	Pharmaceuticals etc
44	Soap and detergents
45	Cosmetics and toiletries
46	Other chemical products
47	Rubber products
48	Plastic products
49	Glass and glass products
50	Ceramic products
51	Cement, lime and concrete slurry
52	Plaster; other concrete products
53	Non-metallic min. products nec
54	Iron and steel
55	Basic non-ferrous metals etc
56	Structural metal products
57	Sheet metal products
58	Fabricated metal products
59	Motor vehicles and parts etc
60	Ships and boats
61	Railway equipment
62	Aircraft
63	Scientific etc equipment
64	Electronic equipment
65	Household appliances
66	Other electrical equipment
67	Agricultural, mining etc machinery
68	Other machinery and equipment
69	Prefabricated buildings
70	Furniture
71	Other manufacturing
72	Electricity
73	Gas
74	Water, sewerage and drainage
75	Residential building
76	Other construction
77	Wholesale trade
78	Retail trade
79	Mechanical repairs
80	Other repairs
81	Accommodation, cafes & restaurants
82	Road transport
83	Rail, pipeline, other transport
84	Water transport
85	Air and space transport
86	Services to transport; storage
87	Communication services
88	Banking
89	Non-bank finance
90	Financial asset investors
91	Insurance
92	Services to finance etc
93	Ownership of dwellings
94	Other property services
95	Scientific research etc
96	Legal, accounting etc services
97	Other business services
98	Government administration
99	Defence
100	Education
101	Health services
102	Community services
103	Motion picture, radio etc
104	Libraries, museums, arts
105	Sport, gambling etc
106	Personal services
107	Other services

Parameter estimation: industry level

The annual national and state IMP model has a wide range of estimated econometric functions, covering:

- price formation;
- investment formation;
- employment;
- imports;
- exports;
- wage generation, etc.,

at the three- and four-digit industry level.
The parameters from the national and state econometric formations are carried down to the appropriate industry and the regional level. The parameter/elasticities are generated by direct aggregation or model simulation exercises.
The data benchmarks are used to calibrate the constant terms, or overall elasticity correction factors, of the indirectly estimated functions.

Household modelling

The expenditure equations for the household sector are estimated from cross-section data from the RHIS system and time series estimates. The RHIS data base allows these functions to include a wide variety of socio-demographic magnitudes as independent variables.

The data base

A summary of the data series for the regional model are shown in Chart 1. The data base is used to estimate, inter alia:

- population and other demographic series;
- dwelling commencements;
- housing stock;
- employment;
- gross output by industry;
- exports and imports by industry;
- gross regional product;
- industry supply;
- private consumption expenditure by category; and
- tourist expenditure.

Microsimulation techniques are used to interpolate between Census benchmarks. The industry structure of the data base, which is equivalent to the model industry structure and input and output framework, is given in Chart 2.

Chart 1: Regional modelling – data sources

Data source (periodicity)	Type of data
Census of population and housing (every five years)	Population, income distribution, employment/occupation data, labour force and industry data.
Business register (irregular approximately every two years)	Establishments and employment by industry, establishment size data.
Manufacturing census and surveys (annual)	Establishments, employment and turnover (irregular).
Agricultural census (annual)	Establishments, gross value of production by commodity, area data.
Mining census (annual)	Not available below state level in some states. Data available on establishments, turnover, employment.
Retail census (irregular)	Irregular (every five years). Establishments, employment, turnover and floorspace.
Labour force survey (annual)	Labour force aggregates (employment, unemployment) for "labour force survey defined" regions.
Tourist accommodation (annual)	Establishments, bed spaces, takings, employment for selected SLAs.
Building activity/approvals (annual)	Number and value of dwelling approvals. Value and floorspace of non-residential building approvals by type.
Income tax data by postcode	Household income by type
Government departments	Education, health/hospital, data.
Survey of motor vehicle use	Motor vehicle use, goods carried etc.
Local government	Rateable properties, planning information.
Housing income and expenditure survey*	Household income and expenditure by disaggregated consumption type.

Note: * NE (NIEIR) uses its Regional and Household Information System (RHIS) to estimate this down to the CCD level. NE (NIEIR) can then aggregate upwards to get household consumption for any metropolitan region. Much of this data is now only available by purchase from the ABS.

The causal structure

The causal structure of the regional model is straight forward. The major "bottom-up" interaction with the national and State models is via the export demand function by industry at the regional level.
The regional industry structure is anchored in the input-output framework, with exports from the region together with:

- regional household consumption expenditure;
- dwelling expenditure;
- non-dwelling construction investment;
- equipment investment; and
- public sector expenditures, determining industry supply.

This means that the regional model contains information for:

- population and demographic status;

- dwelling stock;
- dwelling investment expenditures;
- capital stock by industry;
- regional imports; and
- employment.

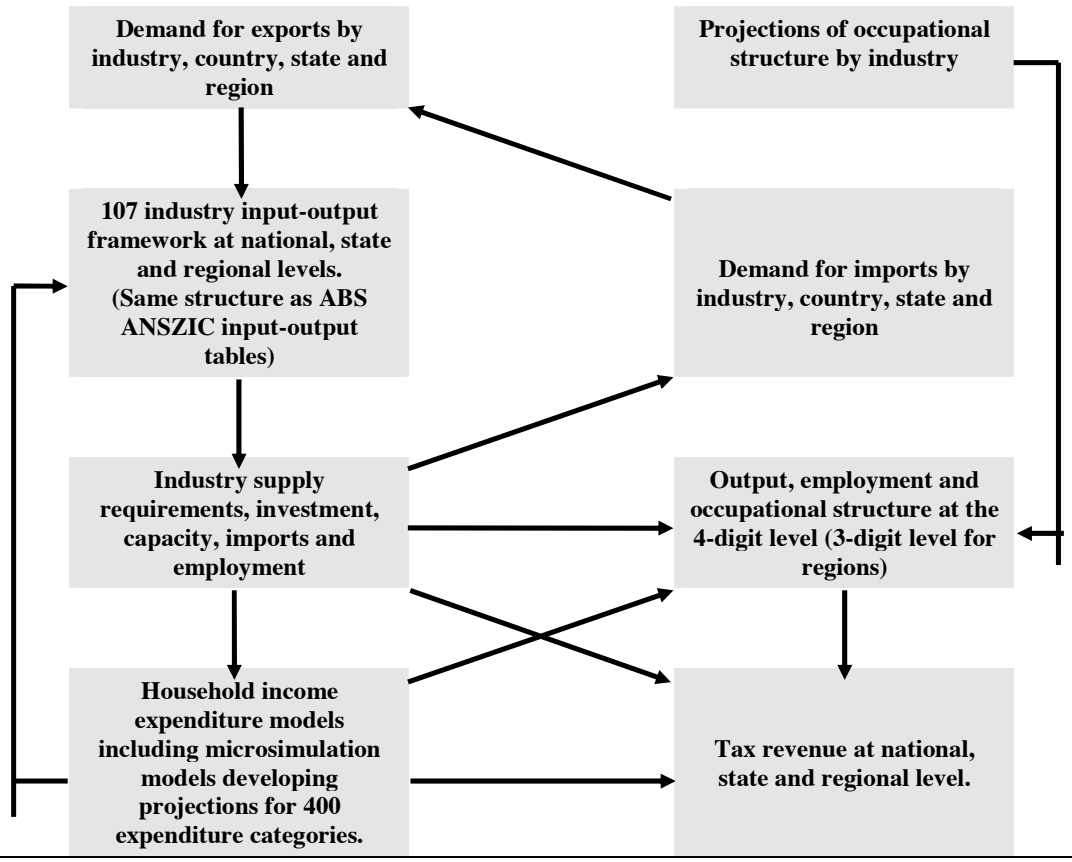
Historical data of exports and imports into the region are estimated from the freight flow data.

Two different estimates of total employment in a region are generated. One is the total number of employment positions generated in the region. The other is the number of the residents in the region that are employed. Journey to work data is used to estimate the propensity of the local residents to obtain employment positions in their own region and in other regions and the propensity of residents in other regions to obtain employment within the area.

If appropriate this aspect of the model's structure can be used to determine how a road or other transport project can influence the propensity of residents to obtain employment outside the region.

As noted earlier, (with the exclusion of the household sector), many of the key industry response parameters are taken from time series parameter estimates included in NE's (NIEIR's) State and national models. How NE's (NIEIR's) suite of models input into the regional model is depicted in Chart 2.

Chart 2: The core causal structure of National Economics' (NIEIR's) regional modelling system



The Regional and Household Information System (RHIS)

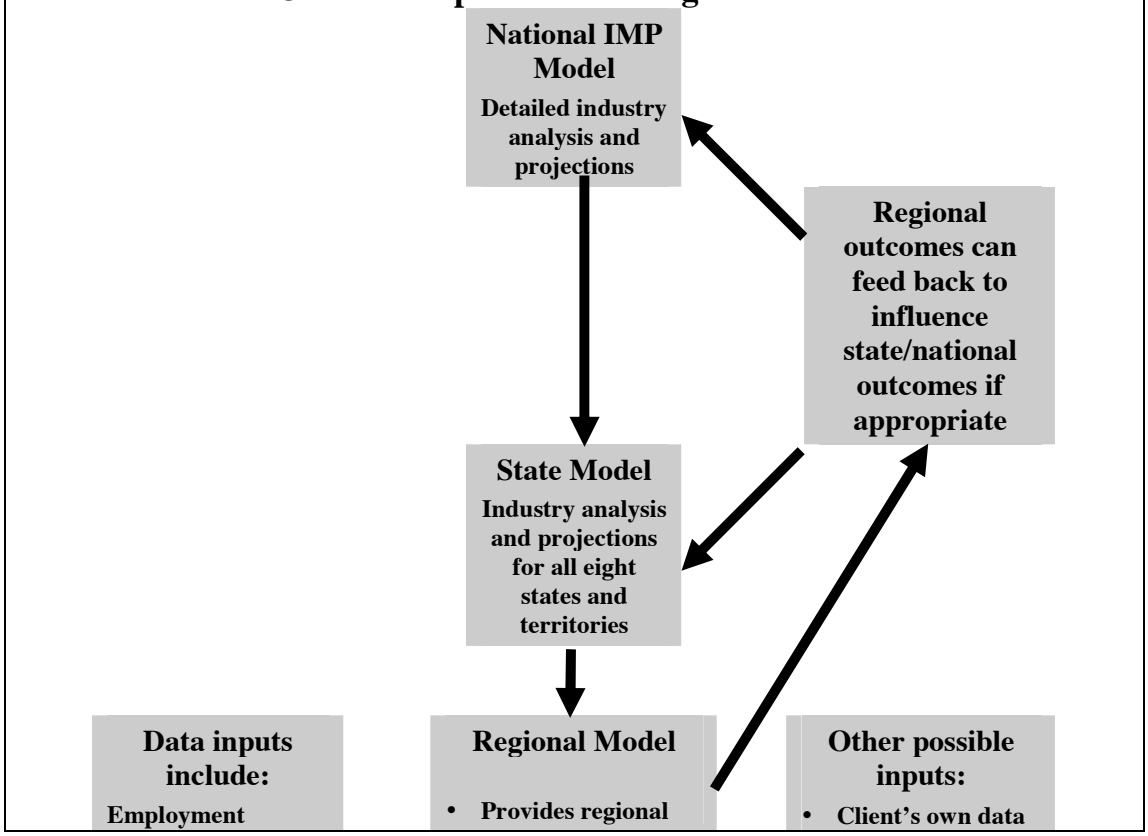
The RHIS/SPENDINFO system forms the household/consumption at the heart of the regional modelling system. The RHIS system consists of an integrated household micro data base. This micro data base contains, for each household/person:

- their socioeconomic characteristics such as age, sex, marital status, labour force status, number of children, number of cars, income from various sources, etc.;
- detailed expenditure (down to 400 expenditure categories) information, including spending on bus/tram, train, various motor vehicle operating expenses, taxi, holiday travel etc.

The RHIS system has been developed from the 1991 and 2001 Population Census, the Labour Force Survey, the Australian Bureau of Statistics (ABS) Income and Expenditure Survey and additional data sources, using microsimulation techniques. The RHIS system can be made an even more powerful tool for normal analysis by combining it with Urban Travel Survey data collected by state transport research bodies. This allows a very sophisticated approach to be taken to estimating the impact of household time savings.

The microsimulation system not only provides the latest demand estimates for the calculation of regional freight and input-output relationships, it also provides the equations (linked to the appropriate socio-demographic drivers, income, age, household structure, etc.) to form the expenditure equations in the regional model structure.

Chart 3: Inputs into the regional model



Output **Population** **Tourism** **Building activity** **Income structure** **Retail sales**	**forecasts based upon regional data, state aggregates and regional modelling techniques**	**base** • **Specialist information** • **Specific regional detail**