Australian Government

Bureau of Rural Sciences

Community perceptions of aquaculture: Related social research

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Executive Summary

Understanding community perceptions helps build sustainable industries

The Community Perceptions of Aquaculture Project will help build a sustainable aquaculture industry by providing information about how to improve the social acceptability of aquaculture.

Social research on public attitudes towards natural resource management and the mining, fishing and aquaculture industries provide important insights

This report is a literature review that informed the overall project design, in particular the interview and survey instruments. It identifies important social research in water use and allocation, forest, ecosystem and coastal management, and the mining, fishing and aquaculture industries. This body of work shows that:

- Diverse and conflicting community expectations exist about how to most effectively allocate and manage natural resources and achieve favourable and equitable social, economic and environmental outcomes
- Industries dependent on coastal and marine environments can benefit from recognising that the Australian public values these settings highly and that there is growing support for integrated coastal management regimes
- Industries subject to controversy and public conflict can share insights about improving their social acceptability
- Public concerns about risks posed to the environment and human health can influence consumer purchases of fishing and aquaculture products and could increase community resistance to aquaculture development

The broader public values the environment, supports industries' use of environmentally friendly practices, and has low awareness of aquaculture issues

Research suggests the broader public favours the environment over economic priorities in considerations of resource management trade-offs. However, these views can differ in rural or regional communities where local economies rely on resource-dependent industries and may vary according to socio-demographic variables.

Where there are public concerns about particular industries' environmental performance, there is likely to be support for stronger environmental protection measures.

Recent surveys suggest that the general public sees aquaculture as a more environmentally friendly alternative to wild-catch fishing. These surveys also found low awareness of some of the public health and environmental issues challenging aquaculture.

Public support for improving governments' regulatory and resource management roles

Research has found that the public supports a strong role for government in protecting the environment, including the need to strengthen environmental regulations, management and planning programs and community consultation and participation mechanisms.

Understanding how risk is perceived and what influences the public's trust can improve communications with a range of stakeholders

A range of social, political and other factors affect risk perceptions. Differences between 'expert' and 'lay public' risk perceptions often result in an over reliance on older risk communication models. 'Experts' use increasing amounts of formal, science-based evidence to convince the public that the risk is negligible and/or under control and rely on one-way (versus participative) communications. There is substantial evidence to show that this approach actually invites public suspicion.

Some sources of information about risk are more trusted than others, and advantageous characteristics for an information provider include:

- Independence from government and commercial organisations;
- Being dedicated to public interests;
- Having high levels of knowledge; and
- Being open and honest.

Effective risk management, natural resource management and industry development requires greater investment in building capacity for 'layered' communications with stakeholders and communities

The necessary considerations for communicating with the public about risk and natural resource development and management are similar. There has been a decline of public trust in government, industry and technology. There are also diverse 'publics' with a range of knowledge about and interests in these topics.

Consequently, communications strategies and programs should:

- Be 'layered' - the top layer aims to raise awareness of an industry or resource management program and the 'lower' layer provides a more interactive approach that meaningfully engages interested communities, groups and individuals and builds mutual trust;
- Have on-ground components delivered by personnel with community engagement expertise;
- Include information provision components that utilise credible sources and focus on delivering consistent, truthful messages; and
- Be regularly evaluated to detect changes in public perceptions and to continually improve agency capacity for delivery.

Contents

Introduction

Community perceptions of aquaculture project

The Community Perceptions of Aquaculture Project is building a critically important knowledge base about the values that communities and other stakeholders attach to marine and coastal aquaculture. The broad objective of the study is to underpin the long-term viability of aquaculture by helping government, stakeholders and communities to:

- Understand the range of different perspectives held about aquaculture;
- Develop policies and programs that are responsive to a wide range of interests; and
- Improve participation, consultation and communication processes.

This study involved two case studies of aquaculture in key aquaculture regions: the Eyre Peninsula, South Australia and the Port Phillip Bay, Victoria. Primary data was collected through a total of 66 in-depth interviews with State and Local government agency staff, aquaculture industry representatives, researchers, conservation organisations, and community members. Mail surveys have been undertaken to 500 households in each selected aquaculture region.

The Community Perceptions of Aquaculture Project has produced several reports. The primary data discussed above has been collated into two separate case study reports (Mazur et al. 2004; Mazur et al. in preparation). The final report will integrate those findings and crystallise study implications and recommendations. This report is a literature review conducted for the project. It informed the research, in particular the design of the interview and survey instruments.

The challenge of sustainability

Achieving Ecologically Sustainable Development (ESD) is thought to be the overriding strategic issue and challenge for global aquaculture. It requires shifting current perceptions of aquaculture development and management, and highlights the need to find ways of farming that achieve a balance between food security and the environmental and resource costs of production (FAO 2002:23).

It is now recognised in Australia and internationally that there are mixed opinions about aquaculture that need to be considered. For example, it has been argued that aquaculture's ecological footprint is not sustainable, given its current and potential environmental impacts (Black 2001: 199; Naylor et al. 2001; Pauly et al. 2002; Meffe 1992). In addition, aquaculturalists often have to deal with issues about access to and the use of natural resources (PMSEIC 2002; FAO 2002). These differences of opinion can lead to conflict, which has a negative impact on the industry. It is therefore, especially pertinent and timely to seek a greater understanding of how stakeholders and communities perceive aquaculture.

The different values people hold about the environment and their varied beliefs about appropriate human relationships with natural systems are at the heart of debates about how to best develop and manage natural resources (Taylor & Braithewaite 1996; Shindler & Brunson 1999; Connelly & Knuth 2002; Creighton et al. 1997). These varied perspectives, in turn, inform how people define what are the most important problems requiring attention. The process of 'framing' problems in a particular way influences how they are understood by others, who will participate in solving such 'problems' and how, and what values will be favoured by the resulting actions and solutions (Clark et al. 2000; Harding 1998; Swaffield 1998). Yet, insufficient time and effort is devoted to appreciating the different ways that communities and officials frame problems and the need to build mutual understanding of 'the problem' at hand (Bardwell 1991).

These challenges can be seen in the divergent views people hold about ESD, such as:

- What amount of scientific uncertainty warrants application of the precautionary principle;
- What are acceptable environmental impacts;
- How much resource depletion is too much; and
- How do we determine the needs of the next generation? (Harding 1998: 35)

For some, answering these questions satisfactorily might come from seeing ESD as being more about maintaining and enhancing economic growth, because the environment is valued for the economic functions it provides. Others might place greater importance on the ecological components of ESD than on economic development. Even where the same information is provided, people holding different value positions can come to different conclusions about how natural resources are best developed and/or managed (Harding 1998). These points illustrate how difficult it can be to apply ESD to 'real world' management settings (Harding 1998), such as building a viable aquaculture industry.

By recognising the spectrum of 'value positions' or 'world views' in society, governments and industries can better understand why people respond in different ways to aquaculture development and management. In turn, this understanding can help increase aquaculture's public acceptability. Yet, there have been few comprehensive studies in Australia or overseas that specifically examine perceptions of and attitudes towards aquaculture.

There is, however, a vast amount of related work, which examines public attitudes to industry, risk, natural resource management, coastal management, and commercial fishing. These works are pertinent, because they embody challenges that are comparable to those involved in developing an aquaculture industry. That is, there are numerous and vigorous debates and conflict and controversy over the most effective ways to develop and manage resources and to communicate with and involve the public in decision-making.

This report reviews a selection of that work and several studies on stakeholder and public perspectives on aquaculture. While this review does not claim to be exhaustive, it does identify some key issues, which are of relevance to policy makers and stakeholders interested in the aquaculture industry.

Attitudes to natural resource management

Water use and allocation

There are significant challenges in water resource management for policy makers and urban and rural communities. These include diverse and often conflicting community expectations about how to most effectively allocate (and manage) this scarce resource and of decisions that lead to positive and equitable environmental, social and economic outcomes. Similar issues have been raised in debates about aquaculture's use of shared marine and coastal waters, such as the appropriateness of 'privatising' public resources and what are the most effective ways to ensure those resources are not damaged in the process.

Nancarrow and Syme (2001) undertook a stakeholder profiling survey to assist the Murray-Darling Basin Commission (MDBC) to determine environmental flows and water quality objectives. They interviewed 38 stakeholders and conducted 321 telephone interviews with stakeholder groups. Several areas of high agreement across the sample included:

- The right of the community to have input into water allocation;
- The moral responsibility of upstream users to consider the interests of downstream users;
- The same rights of the natural environment to water as people;
- Effective planning requires some personal sacrifices;
- The need to act before exact environmental knowledge is collected;
- Non-monetary values of water;
- Shared ownership of water and the need to manage it according to the overall public good; and
- Unconstrained water markets are inappropriate allocation tools (Nancarrow and Syme 2001:i).

Nancarrow and Syme (2001) also found that interviewees generally believed that public involvement was required (regionally and broader) to make good decisions about environmental flows in the Murray River. Some respondents wanted to be personally involved, while other simply wanted to be kept informed. There was strong support for local level public involvement activities. Respondents' major information requirements tended to be generalised and aimed at keeping them updated with current events and actions being taken to address river health. Some requested information about specific topics, and most preferred to receive information through the post or email.

In a telephone survey of 88 stakeholders in a regional agricultural community, Nancarrow and Syme (1999) found divided opinion about priority preferences for water between human uses and the environment. Respondents' were split on whether:

- Water can only be allocated for human use if basic environmental sustainability has been achieved; and
- When it comes to water allocation, the environment is a secondary consideration to people.

They suggested that further discussion with the community on the ways they define sustainability is needed.

Forest and ecosystem management

There are substantive challenges to managing forests and other natural systems in ways that allow for economic development and ecosystem health, not least of which are the range of views about the most effective and appropriate ways to do so. Determinants of what is deemed 'acceptable' include how the public and decision makers value certain environments and interact on these issues. Similar issues are the focus of debates about how to best develop and manage aquaculture in a sustainable manner.

Tarrant et al (2003) developed a scale to measure how the public values forests. They have found changes in resource management paradigms, which have resulted in part from changes in public values of forests and their management. They measured a decline in importance assigned to economic

forest values among the general public and a concomitant increase in non-economic values, such as ecosystem protection and amenities. They found that the public favours a balance of economic and environmental imperatives – recognising the necessity of having a mix of uses for forests – but still strongly favoured the environment as a priority.

As part of a broad strategy to balance social, economic and ecological factors of forest management, Shindler et al. (2002b) conducted a mail survey of nearly 1,000 households in the Pacific Northwest of the United States. The survey was conducted to elicit information about the public's awareness and understanding of the ecological health of public forests, preferences for receiving information, and trust in forest managers. They found that respondents tended to:

- Have a general perception that forests in the Pacific Northwest are healthy, with some forests being seen at greater risk;
- Be familiar with many terms and current issues associated with ecosystem health, but specific knowledge about forest systems was much lower;
- Use aesthetic conditions as important indicators of healthy forests;
- Favour a balanced set of economic and environmental priorities, showing a leaning towards favouring environmental conditions: but more urban residents (45%) favoured the environment than did rural respondents (30%);
- Give strong support for greater management intervention: 87% agreed on the need for long-term active management to maintain forest health, but there was greater uncertainty about how to do so;
- Prefer more interactive forms of information exchange, but allocated much lower credibility ratings to public meetings and planning workshops than to other forms of exchange;
- Not believe that managers performed well when explaining government actions, not believe that public input had much influence on the formation of management plans, and felt that scientific perspectives need to inform forest management decisions more; and
- Be evenly divided about how much they trusted the government agencies to make good management decisions about forests (Schindler et al. 2002).

Shindler et al. (2002b) recommended that forest management agencies attend to the following principles when designing public communication processes:

- *Build knowledge among stakeholders* – to improve the public's real ability to participate and support management options. Layered communications are necessary to target a diverse public and should be delivered in formats tailored to particular settings and by individuals with local knowledge, credibility and community engagement expertise.
- *Address uncertainty and risk* - there is uncertainty about ecosystem function and concerns about risks associated with different management options that agencies and communities need to work through. The public will seek information about how serious, certain and soon risks are, as well as how certain professional are about solutions. Solutions and information need to address local conditions and include local communities.
- *Focus on agency – public interactions as well as information provision* – given low trust in government, need to avoid confusing information provision with public understanding and eventual support. Scientific and/or economic merits of plans will have little impacts without trust among stakeholders. Communications plans must devote attention to how people develop understanding and to providing opportunities for interaction in local settings.

In a similar study, Shindler and Toman (2002) conducted a survey in 1996 and again in 2001 to evaluate different forms of information provided by the US Forest Service about their ecosystem management strategies. Gaining public support has challenged the Service, given some of the risks and uncertainties associated with modern practices. Shindler and Toman (2002) found that:

- When it came to economic and environmental priorities in management approaches, 42% of respondents favoured a balance, while 39% preferred economic priorities;
- Respondents paid more attention to information from forest industries and less attention to information coming from government;

- Respondents felt that the quality of Forest Service information had declined;
- Respondents preferred more interactive forms of information provision (eg. programs, visitor centres, guided tours, conversations with agency staff);
- 65% of respondents supported the value of public participation, 25% were neutral and 11% thought it of little value; and most respondents felt the public should provide suggestions or serve on advisory boards that review/comment on decisions;
- While there was an increase in support for public input into forest planning, fewer respondents believed that the Forest Service was open to that input or used it in decision-making; and
- Fewer citizens trust the Forest Service to implement responsible effective fire management program

Based on these findings, Shindler and Toman (2002) recommended that engagement with communities be based on:

- *Capitalising on existing public knowledge and support for particular management actions* – residents of this rural community were well informed and capable of judging the trade-offs of different management alternatives. Acceptance of managers' decisions depends on their relevance to public concerns and contexts. Projects can serve as opportunities to address concerns and to shape opinions about alternatives;
- *Focus on relations with citizens* – given the erosion of agency-public relations, it is unwise to dismiss public concerns. Efforts should be made to identify broad, national and locally-specific concerns to be targeted; increase opportunities for the public to have more meaningful roles; address institutional arrangements to better deliver community consultation and participation programs; and clarify roles of government and the public in processes; and
- *Development of comprehensive communications strategy* – information is necessary but insufficient to change public responses given the suite of factors influencing public judgements; it requires focus on types and content of information but also on the how's and why's of communication.

Connelly and Knuth (2002) share this interest in building better understandings between communities and resource managers. Their study focused on comparing how regional and local officials perceived community residents' views about natural resource management. Their survey found that:

- Local and regional officials all valued using ecosystem-based principles, but they had varied views about specific actions to implement ecosystem restoration programs;
- Officials were not in complete 'agreement' with residents; and
- Officials generally could not predict accurately the views of local residents – they consistently underestimated the importance residents placed on environmental protection and overestimated the importance of economic development to residents.

Connelly and Knuth (2002) concluded that a lack of shared understanding about resource management approaches leads to conflict among stakeholder groups. Given that local and regional officials have considerable influence on many resource management processes, it becomes critically important that they have a good understanding of community views and concerns. They supported the use of collaborative approaches that bring together the varied interests and identify acceptable trade-offs and shared aspirations.

Coastal management

A viable aquaculture industry is reliant upon healthy marine and coastal ecosystems that are highly valued and used by a variety of stakeholders and communities. Given that aquaculture is a relatively new industry, there are concerns about its impacts on other users and strong expectations that it be effectively integrated into coastal management systems (Stead et al. 2002). Therefore, it is valuable to understand some of the beliefs and expectations that the public holds about marine and coastal environments.

The 1999 Mid-Term Review of the Natural Heritage Trust (PPK Environment & Infrastructure 1999) included focus groups where participants rated the relative priority of coastal and marine issues.

Coastal development, the associated pollution and pressures on beaches and foreshores, and invasion by exotic marine organisms were identified as the highest priority issues. In comparison, aquaculture and marine reserves were rated as less of a priority. However, marine and coastal groups who often do have strong interest in these issues were underrepresented in the focus group sessions.

In its assessment report, *Communities Connecting with the Ocean*, The National Oceans Office (NOO) identified values and aspirations of the community living within 50 km of the coast of the South-east Marine Region, and of national and regional conservation groups. A mix of methods was used, including a telephone survey of 1300 people in a stratified random sample of the coastal community, a postal survey of marine-focused community-interest groups, and workshops with key national and regional conservation organisations.

The telephone survey found that the community has a strong affinity with the coast (53% visited the coast at least once a fortnight). Few were aware of the Commonwealth's role in managing the region (44%), and a majority (82%) knew either 'little' or 'basically nothing' about the South-east Marine Region itself. When asked about the different uses of marine and coastal environments in the Region, a majority of respondents were aware of commercial fishing (86%) and recreational fishing (78%). A majority of respondents (59%) felt that the Federal Government did not spend enough money looking after the deeper oceans.

The NOO Survey found that respondents who reported 'knowing a lot' or 'knowing a moderate amount' were more likely to visit the coast, be more interested in information, think the Federal Government spending is insufficient and be aware of conservation uses for the Region. Those who reported 'knowing a lot' also placed a higher importance on community involvement in planning. Respondents who said they 'knew a moderate amount' were generally more interested than other subgroups in caring for the marine environment, spending more on reefs and banning foreign fishing. Respondents who reported they 'knew basically nothing' had less desire to see additional spending on the region, were less likely to care about the deeper ocean as the land. They were also less interested in community involvement in planning and less likely to think the overall management of the Region was poor (NOO 2002).

The NOO's mail survey of community groups found that education-focused groups reported the highest level of knowledge about coastal management. Respondent groups' highest level of acceptance of different uses in the Region was for conservation, while international commercial fishing was rated the lowest. Respondents groups were strongly focused on improving protection of the marine environment and sustainability. The most frequently listed priorities were increased education leading to community stewardship, improved management and stronger regulations, and greater research as a priority action.

During the NOO's workshop for key regional and national conservation organisations, respondents formulated the following values they wished to see reflected in the management of the Region:

- Comprehensive, adequate and representative system of large (no-take) fully protected marine parks/reserves;
- A pollution-free marine environment;
- Biodiversity conservation as a non-negotiable cornerstone of planning and management;
- Reversal of onus of proof for proposed uses;
- Regional marine planning directing industry policy and planning;
- Regulated standards for environmental quality and industry activity;
- Informed and engaged communities;
- Ecosystem-based management that takes into account the land/water interface; and
- Comprehensive ecosystem monitoring and assessment (NOO 2002: 13).

Industry surveys

Mining

In recent times, the mining industry has been the subject of controversy and public conflict over similar issues as those challenging the aquaculture industry, namely questions about its social and environmental sustainability. The mining industry is seeking to improve its social acceptability and has taken a strong interest in better understanding public opinion about itself. There are useful insights for the aquaculture industry in terms of how the mining industry has measured public opinion, as well as what communities think about this industry.

Aslin & Byron (2003) reviewed the findings of three surveys of Western Australian attitudes to mining, conducted for the Chamber of Minerals and Energy of Western Australia in 1992, 1997 and 1999 (Chamber of Minerals and Energy, WA, 1997; Market Equity 1999). Their review is summarised in Table 1 and shows that the mining industry's image has improved somewhat since the initial implementation of a public affairs strategy.

Table 1. Summary of mining industry survey findings (Aslin & Byron 2003: 18-19)

Survey Features	Findings
Chamber of Minerals & Energy 1997 - To follow up baseline survey undertaken in 1992 and to measure effectiveness of public affairs strategy	Overall: reduced controversy and public conflict since 1992 baseline survey - More (92%) respondents believed industry provided a lot of jobs - Less (23%) agreed industry basically did what it liked, irrespective of government - More (62%) industry was responsible for environmental rehabilitation - 50% of general community viewed industry as credible source of information - Women and educators were more sceptical about industry - Mass media were the major public sources of information, despite being rated as less reliable - Mass media increased in importance as source of information between 1992 and 1997 - Public showed no increase in understanding of government role in regulating industry and increased scepticism regarding effectiveness of EPA to regulate
Chamber of Minerals & Energy 1999 - Sample of 401 regional and metropolitan residents of WA	- Respondents placed a higher priority on broader social and environmental issues (environment, education, health and safety) than on more economically-oriented ones like taxation and employment - 76% rated environment as 'important – high priority' - 80% rated the mining industry's environmental performance as 'important – high priority', while comparable figures for industry job creation, economic contribution and international competitiveness were 73%, 69% and 60% respectively - 62% of respondents indicated they thought that current laws did not provide protection (66% of metropolitan residents indicated lack of confidence in current laws as compared with 53% of regional residents) - 80% rated industry's contribution to the economy, job creation and export earnings as 'very strong' or 'strong', while 42% rated its environmental responsibility as 'very strong' or 'strong', and only 43% rated its credibility as 'very strong' or 'strong' - Metropolitan residents, women, and those aged 18–34 were least likely to see the industry as environmentally responsible - As for previous surveys, the mass media were the public's major sources of information (80% use newspapers, 60% television, 33% friends and relatives, 24% radio and 21% magazines) - The most credible information sources were the library (rated as 'somewhat credible' or 'very credible' by 67% of respondents); the Chamber of Minerals and Energy (50%); school (47%); newspapers (42%); and mining companies (41%) - Approximately half the respondents indicated they would like to know more about the industry and were most interested in broad factual information about what was being mined and where and what environmental management steps were being taken - Many respondents did not actively seek this information, nor did they use the most credible information sources regularly

However, the public prioritised environmental considerations over economic issues. Respondents supported the industry's social benefits, such as its economic contribution, but were concerned to see stronger governmental and industry environmental protection measures. Respondents relied heavily on the mass media, despite rating its credibility lower than other sources of information. The community

appeared to be no more knowledgeable about government's role in assuring the environmental and social acceptability of mining since the 1992 survey, but their scepticism had increased. While approximately half the respondents were interested in more general and environmental information about the industry, they did not necessarily actively seek it from more credible sources. Some sections of the community were more critical of the industry's environmental performance than others.

The key recommendations to flow from the 1992 and 1997 surveys were that information provision:

- Should be aimed at improving industry credibility and should prioritise environmental management issues, and promoting an honest industry by ensuring consistent and truthful messages come from all sectors and sources;
- Distribute better factual general knowledge about mining industry actions and directions using short newspaper articles and TV or radio news programs;
- Building industry credibility through use of television documentaries, detailed newspaper articles, better use of mining network, site visits where feasible, and localised approaches for country centres;
- Use industry sources to reduce 'facelessness' of industry and to support an 'honest industry' (Chamber of Minerals & Energy 1992, 1997).

The surveys also recommended that community expectations of being involved in new mining developments be solicited through:

- Regionalised public involvement;
- Regular representative social surveys; and
- Methods for particular public involvement programs being selected in conjunction with stakeholders and matched to particular situations and settings (Chamber of Minerals & Energy 1992, 1997).

Finally, the surveys noted that improved community understanding of government decision-making processes related to mining could be achieved through:

- Greater efforts by the mining industry to encourage public understanding of government environmental requirements; and
- Industry-government partnerships to deliver community education on environmental protection procedures.

Commercial fishing

Aquaculture is considered a sector of the broader fishing and seafood industry. Consequently, public views about the fishing industry will provide valuable information to the aquaculture industry, particularly given the potential for views about industry sustainability to influence consumer behaviour and community acceptance of aquaculture development.

United States

The Len Blackstone Ad Group conducted a survey for the United States' National Fisheries Institute (NFI), to measure consumer concern about environmental issues associated with fishing and to determine how their concerns might effect purchasing behaviour (Blackstone 2001 cited in Aslin & Byron 2003: 17). The NFI was concerned that environmental concerns might limit the sales and consumption of seafood, given that wholesalers' purchases can be influenced by their perceptions of consumers' environmental attitudes.

The survey involved 1,550 telephone interviews across the US. Four out of ten respondents agreed that fish/seafood was overfished or depleted, while 50% indicated they 'didn't know'. Forty-four percent of respondents said they 'didn't know' if the fishing industry was well regulated, while approximately a quarter of respondents agreed (27%) and disagreed (24%). When asked if they felt that the fishing industry acted responsibly towards environmental controversies, 44% of respondents said they 'didn't know' and 28% disagreed.

Australia
Aslin & Byron (2003) used a telephone survey of 1,004 Australian adults randomly sampled from the electronic white pages telephone directory to examine Australian public perceptions, knowledge and attitudes of the fishing industry. Responses highlighted significant concerns about how Australia's fishing industry is managed, and particularly about how commercial fishing and its impacts on the marine environment are controlled. Forty percent agreed that overall Australia's fishing industry was well managed. Eighty-eight per cent agreed that strong controls on commercial fishing are needed to protect the environment, and 75% indicated there should be more marine protected areas. Furthermore, there was strong support for a greater community role in fisheries management.

The survey highlighted generally low levels of knowledge about the industry – 25% of the sample thought they were knowledgeable, which contrasted with respondents having high levels of interest in finding out more about the industry. The media were the most common sources of information about the fishing industry. Aslin and Byron (2003) noted that these results support other survey findings that show that unless people have a special interest, they tend to obtain their information from incidental exposure to relevant items in the mass media. Government and industry tend not to be important information sources for most people (Aslin & Byron 2003).

Aquaculture
There have been some surveys, which have a specific focus on aquaculture. These surveys vary in scale (national and regional), method (telephone, mail, interviews) and cover a range of topics (consumer preferences and behaviour, perceptions of aquaculture planning and management), aquaculture's sustainability and environmental benefits and impacts.

United States
The NFI Survey of attitudes to the fishing industry mentioned earlier also included some questions about aquaculture.

Nearly half the respondents thought aquaculture was a good alternative to wild-catch fishing and only 4% thought it was a bad alternative, however, 28% said they 'didn't know'. Few respondents were aware of issues associated with aquaculture like feed quality (21% aware), use of antibiotics (16%), or farmed stocks escaping and breeding with wild stocks (14%). But a higher percentage of respondents (one third) agreed that escaped salmon would damage natural stocks of fish, while 44% 'didn't know'. Over half of respondents (56%) 'didn't know' whether aquaculture contributed to the pollution of the ocean.

About a third of respondents (34%) disagreed with the statement that there were no differences between wild and farm-raised fish, while 45% indicated they 'didn't know'. In addition, 26% of respondents indicated they preferred wild caught fish to those raised in farms. When asked about eco-labelling to assure purchasers the product had been harvested sustainably, about one in three respondents claimed they were aware of this kind of labelling.

Australia
As part of their national survey of public perceptions of commercial fishing, Aslin & Byron (2003) asked respondents to rate how sustainable they thought the various fishing industry sectors were. A greater percentage of respondents (77%) rated fish farming or aquaculture as sustainable than did for traditional fishing by Indigenous Australians (64%), recreational fishing (56%), or commercial fishing (25%). Men were more likely to say that fish farming or aquaculture was sustainable (Aslin & Byron 2003).

Queensland
A survey was conducted in Bowen, Queensland as part of a community consultation process recommended by the QLD Department of State Development (Wilson 2001). The survey sought information about a community's views regarding the development of an aquaculture industry in their region. The survey covered 204 Bowen residents and 23 key stakeholders or opinion leaders.

A majority of residents in the Bowen Region were generally supportive of aquaculture development in the region (88%) and in Queensland (86%). The survey found that:

- Residents were more aware of new aquaculture developments than for other industries;
- Rated aquaculture as an 'important' industry sector for the region;
- When speaking to aquaculture's benefits, most frequently mentioned 'employment' (49%); followed by export benefits (26%), and boosting the local economy (25%);
- Over half (55%) saw no disadvantages with the industry; and
- The main disadvantages of the industry were focused on the industry's potential negative environmental impacts (17.6%).

The survey found that most people (54%) relied on the local newspaper to receive information about aquaculture. The survey was also used to elicit information about the Bowen Community's information needs. They found that people placed high importance on receiving regular information on the industry's and on specific projects concerning:

- Environmental impacts (e.g. water use and quality, impacts on fish breeding grounds);
- The number of jobs and job opportunities;
- Economic viability;
- Locations of existing and new projects;
- Environmental monitoring and regulations processes; and
- Organisational details and people involved.

The top priorities for the aquaculture industry identified by respondents were:

- Assessing the environmental impacts;
- Creating employment and employment opportunities;
- Ensuring its economic viability;
- Using local industries and materials;
- Securing export and domestic markets; and
- Educating and informing the public.

South Australia
A number of research projects were undertaken in SA in the mid to late 1990's, which examined community and stakeholder views on coastal aquaculture. In assessing the adequacy of management and planning framework for coastal, sea-based aquaculture, Clarke (1996) examined the perceptions of 26 key Government, industry and community stakeholders. When asked about aquaculture's *benefits*, respondents referred to:

- Improved economic and industrial base for the State;
- Increased regional employment opportunities;
- Increased export spending;
- Attracting investment;
- Funding for research and monitoring of the marine environment; and
- Reducing the pressure on wild stocks.

Table 2 summarises Clarke's (1996) findings when discussing aquaculture's *challenges* with interview respondents. The data show contrasting views about how well aquaculture was being planned and managed in SA with respondents generally divided evenly across 'good', 'fair' and 'poor' ratings.

Table 2. Findings from a study of SA aquaculture stakeholder perceptions (Source: Clarke 1996)

Type of processes	Perceived strengths	Perceived weaknesses
Administration & Approvals	- Streamlined, simplified, quicker	- Effort laudable but incomplete - Lack of agency expertise
Approvals	- Clearer, simplified, quicker	- Quality of information - Delayed industry development - Lacks clarity - Intense development pressures compromises rigour
Management Plans	- Good, well developed concept	- Lacking technical detail & rigour - Insufficient integration with other coastal uses
Site Selection		- Lack application of technical information and 'ground trusting' leading to poor site choices - Overly informed by industry interests
Regulations	- Stringent, comprehensive, effective	- Inadequate controls - Lacking compliance/ reinforcement of license conditions - Lack of resources for compliance - Lacking codes of practice
Monitoring	- Presence of monitoring framework - Scientific agency involvement	- Lack of/ inadequacy of monitoring activity - Lack of independent science - Industry pressure to develop - Insufficient information to shift practices
Integration w/ other uses/ users	- Sound public consultation - Good policy & administrative coordination	- Planning approach limited and fails to meet ICM requirements - Lacking support for multiple-use planning, marine protected areas - Lacking consideration of land access & infrastructure
Public consultation	- Effective	- Unclear outcomes/ changes to practices resulting from consultation - Community capacity building needs to be addressed

Carvalho (1998) also examined perceptions and values associated with the planning and management aspects of coastal aquaculture in SA. The survey was designed to elicit information about community participation in the process of coastal aquaculture planning and management, knowledge and skills regarding coastal aquaculture issues, and satisfaction with planning and management processes. The survey targeted those with strong interests in coastal management and/or the aquaculture industry and who subscribed to the Marine and Coastal Community Network newsletter *Southern Ripples*. A total of 116 responses were received, with the highest proportion of respondents from metropolitan Adelaide (40%), the Eyre Peninsula (18%) and the far West Coast (13.8%).

A majority of respondents were dissatisfied with:

- Overall planning and management processes;
- The use of aquaculture zones in particular, on the basis of user conflicts generated, inadequate application of biological criteria; and
- Public consultation processes for aquaculture management plans.

Risk perceptions

To date, research has shown that public concerns about aquaculture often focus on potential *long-term* environmental and human health impacts from aquaculture, many of which remain unknown. Given this uncertainty and that the sustainable development of aquaculture entails effective risk management, studies on how 'risk' is perceived are also highly relevant to aquaculture. A number of studies have already cited declining levels of public trust in institutions responsible for managing the risks associated with science and technology, namely governments and industry (Shindler & Brunson 1999; Randall 2002; Petts & Leach 2000). Therefore, it is particularly helpful to review some of the research on how people perceive risk, how they manage and live with it, because some communities may deem that aquaculture's (environmental and health) risks and associated management strategies are unacceptable.

Slovic (1999) has found that factors such as gender, race, political worldviews, affiliation, emotional affect, and trust are strongly correlated with risk judgements and that these factors apply both to

experts and non-experts alike. In a study of 1,512 American citizens' perceptions of risks from certain environmental and health issues, Flynn, Slovic and Mertz (1994 cited in Slovic 1999: 692) found that male respondents tended to judge risks as smaller and less problematic than did female respondents, given their tendency to place greater trust in institutions and authorities.

Botterill and Mazur (2003) reviewed a selection of research on risk and risk perception and found that numerous factors influence how risk is perceived, including:

- The psychological aspects of decision-making are important to risk perceptions (e.g. formed opinions are more difficult to change; activities with demonstrable benefits can facilitate greater receptivity to risk; an event is judged more probable if its occurrence, or something similar, can be readily recalled);
- The characteristics of the risk - different types of risk generate different reactions (e.g. voluntary activities are deemed less 'risky' than involuntary ones, new risks are viewed differently from familiar ones)(see Table 3);
- The social construction of risk - all people use speculative frameworks to make sense of the world and selective judgement in their responses to risk. These 'non rational' factors partly explain differences between the way 'the public' and 'experts' perceive risks, and why 'experts' who rely on providing more expert/science-based evidence to 'convince' the public about something, often find this approach fails.
- The general public often focuses more on unknown effects of risky activities; significantly negative consequences, irrespective of the 'low probability'; what the 'experts' do NOT know and why the 'experts' cannot agree.

Beckwith et al's (1999) study demonstrated that both the characteristics of risk (see Table 3) *and* the socio-political context of decision-making influence how people respond to risk issues. Beckwith et al (1999) presented scenarios of a government decision to close down an asbestos mining town due to concerns about potential health effects on residents as a result of previous mining activities in the area. Respondents were asked to rate the importance of certain risk characteristics in determining the acceptability of government decisions, and to identify any additional considerations. Those who accepted the government decision relied largely on the characteristics of the asbestos risk, while the unaccepting group relied on the characteristics of the decision itself. For the unaccepting group, the issue determining the acceptability of the decision was freedom of choice to determine one's own fate. That is, the government's decision would have effectively removed a town resident's right to choose, so this group saw the decision as unacceptable. Beckwith et al (1999) point out that even in situations where people can actually agree about the facts about a risk, they can still disagree about what is an acceptable course of action in response to those facts.

Table 3. Risk characteristics than can influence an individual's risk perception

Catastrophe potential	Dread
Severity of consequence	Degree of media attention
Familiarity with the hazard	Accident track record
Scientific understanding of the hazard	Equity and fairness
Whether effects are delayed or immediate	Perceived benefits
Degree of personal control	Reversibility of negative effects
Whether the risk is voluntary or not	Personal stake or exposure level
Effects on children	Quality of evidence
Effects on future generations	Man made versus natural hazards
Probability of negative effects	Victim identity
Number of people exposed	Whether effects would be fatal
Trust in the risk manager	Personal understanding of the hazard

Source: Beckwith et al. 1999: 51

Technology and risk

A recent study was undertaken of Australian public perceptions of new technologies, including trust in institutions that provide information about new technologies (Gilding and Critchley 2003). The survey of 1000 Australians and six focus groups found that:

- Australians are uncertain about whether or not science and technology are out of control; and believe that they should be regulated by governments;

- Most Australians strongly trust the CSIRO, universities, hospitals and scientists for information, are somewhat trusting of small business, the environment movement, and the public service, but do not trust governments, major companies, or the media;
- Australians are more comfortable with some technologies than others, but are uncomfortable with biological engineering technologies; and
- The strongest predictor of comfort with new technologies was age: the younger respondents were more comfortable than older respondents; and other predictors were religion, life satisfaction, education and gender.

GMOs

In response to the ongoing controversy related to the use of Genetically Modified Organisms (GMOs), the British Government accepted the advice of the Agriculture and Environment Biotechnology Commission (AEBC) and is facilitating a broad national debate on GM. The report, *GM Nation*, summarises the findings of 675 public meetings, a survey of 36,000 respondents, a series of focus groups and public emails. The key messages to emerge are:

- *People are generally uneasy about GM issues* – especially those relating to food safety, environmental impacts and broader social and political issues. Negative attitudes were stronger and represented majority views of those actively participating in GM debates. While respondents from the sample of the general population had strong anxieties about environmental and health risks from GM, they were somewhat less emphatic and definite. They confirmed they had low knowledge about GM and were more willing to accept that GM may offer some benefits;
- *The more people engage in GM issues, the harder their attitudes and deeper their concerns* – the more respondents choose to learn about GM the more convinced they are that no one knows enough about the long-term effects of GM on human health and the environment;
- *There is widespread mistrust of government and multi-national companies* – respondents felt that companies were motivated more by profits than by the public interest and are suspicious of information or science which comes from or is funded by these companies;
- *There is a broad desire to know more and for further research to be done* – from those actively involved to the general public, most people expressed a strong interest to be better informed about GM from sources they could trust; and
- *An open debate about GM has been welcomed* – despite widespread suspicion that the debate's results would be ignored by government, people were glad it had happened and expressed their appreciation to express their views, hear other views, ask questions and acquire new information and that they were able to participate in discussions (GM-PDSB 2003).

Public communications and perceptions of credibility

Effective communication with the public about different kinds of risk largely depends on how particular sources of information are perceived by communities. This matter is of particular relevance to the aquaculture proponents and policy makers who are seeking to improve the industry's social acceptability.

Hunt et al. (1999) surveyed 600 citizens to test the degree of trust the 'lay public' has in various possible sources of information about radiation risks. Participants were asked directly about the degree to which they would trust information about radiation risks from a variety of sources. They also asked respondents to rate how biased they felt these sources were and the degree of knowledge they believed each source had about the risks from radiation. These sources included friends/family, news media, the medical community, NGOs, government agencies and Ministers. Government Ministers and Tabloid Newspapers recorded significantly lower trust ratings and higher reporting bias ratings than the 15 other sources, while local GPs, representatives of the medical community, and university scientists received relatively high trust ratings and low reporting bias ratings. Hunt et al.'s (1999: 179) results suggested that the most advantageous characteristics for an organisation communicating about risk are:

- Independence from government and commercial organisations;

- High levels of technical expertise; and
- Specifically dedicated to the interests of the public.

They also concluded that greater trust might be placed on an organisation that is seen to be biased towards the target audience's interests. Measuring trust needs to consider perceptions of truthfulness and expertise.

Given the long-term decline in public confidence and trust in traditional social institutions (government and industry, in particular), Peters et al. (1997) surveyed a random selection of residents of six American communities that had an active chemical industry, a hazardous waste site, and active local environmental group(s) to identify how people's perceptions of knowledge and expertise, openness and honesty, and concern and care influence their trust in and views about the credibility of industry, governments and citizens groups.

Peters et al. (1997) identified several key variables that influence people's judgements about trust and credibility of certain institutions, and those varied for the three selected institutions (see Table 4). For *industry*, the thing that would increase public perceptions of trust and credibility most was whether people perceived industry as being 'concerned and caring'. For *government*, the key variable was public perceptions of 'commitment'. And for *citizen groups*, the leading variable was perceived knowledge and expertise. Peters et al. (1997) suggest that these findings are consistent with stereotypes where:

- Industry is perceived to care and be concerned only about profits and minimally about public health/safety; and
- Citizen groups, most often drawn from the general public, are perceived to lack specialised knowledge of public health/safety.

They concluded that defying a negative stereotype is crucial to improving public perceptions of trust and credibility.

Table 4. Key determinants of trust and credibility in industry, government and citizens groups

Industry	Government	Citizen Groups
1. Concern and care*	1. Commitment*	1. Knowledge and expertise*
2. Information received	2. Knowledge and expertise	2. Commitment
3. Information disclosure	3. Concern and care	3. Information receipt
4. Openness and honesty	4. Income	4. Openness and honesty

Source: Peters et al 1997
** leading explanatory variables*

Perceived risk and aquaculture

Kaiser & Stead (2002) considered the impacts of a European agricultural crisis (the moratorium on the introduction of new GM-foods, the negative effects on consumer preferences regarding BSE) and possible scenarios for consumer rejection of aquaculture products on the same or similar scale. They note that people are asking whether agriculture has betrayed them and are questioning the whole concept of industrial food production. Given how only minor incidents can undermine the trust needed for survival in quality markets, they assert that the aquaculture industry could be even more vulnerable and exposed to similar concerns. While few of the industry's products are differentiated from products from capture fisheries, if consumers were made aware, the resulting attitude may often be concern or scepticism. They point to problems of European aquaculture in the form of reactions to the use of antibiotics in salmon production or to the debate about persistent organic pollutants in marine aquaculture. While they acknowledge the effects of these conflicts has been limited temporary, they warn against complacency that future events would go the same way (Kaiser & Stead 2002).

Summary

The Community Perceptions of Aquaculture Project is helping to build a sustainable and viable aquaculture industry by providing information about how to improve the social acceptability of aquaculture. The literature review identifies important trends in aquaculture and related industries and areas of resource management about community and stakeholder perspectives and the influence of those views on outcomes.

Sustainability is a key challenge for aquaculture. There are strong community expectations of, and formal government commitments to, growing and managing the aquaculture industry according to the principles of ESD. However, ESD remains a challenge because the different values and beliefs systems operating in society means that ESD is subject to varying interpretations about what kinds of activities are truly 'sustainable' and how we can best balance the social, economic and environmental priorities of resource use. These differences of opinion can lead to conflict and make it difficult to apply ESD to on-ground situations.

The situation is far from hopeless, and devoting time to identifying community and stakeholder values and beliefs about issues such as ESD provides significant opportunities to improve the quality of decision-making by:

- Supporting the public's 'right to know';
- Proactively identifying community concerns, which in turn increases public acceptance of management decisions; and
- Allowing for informed discussion of issues, resulting from mutual learning and recognition of participant interests (Shindler et al. 2002a).

This report has reviewed several social research studies of community and stakeholder views about industry and natural resource management that are applicable to aquaculture situations:

- *Water use and allocation* – Similar to aquaculture, there are diverse and conflicting community expectations about how to most effectively allocate and manage this scarce resource and about which decisions lead to favourable and equitable social and environmental outcomes;
- *Forest and ecosystem management* – There are considerable challenges to finding management regimes for forests and other natural systems that utilise ecological principles and achieve appropriate balance of economic and environmental values;
- *Coastal management* – Aquaculture, and many other industries, rely on healthy marine and coastal environments, and these places are highly valued by the Australian public. There are growing expectations that aquaculture will contribute to integrated coastal management, so it is important to understand public views about management of these areas;
- *Mining* – The mining industry has been subject to controversy and public conflict over how sustainable it is. Its efforts to improve its social acceptability provide valuable insights for how the aquaculture industry might address similar public concerns;
- *Fishing industry* - Aquaculture is a sector of the fishing industry, so public views about the sustainability of fishing are relevant. These views could influence consumer purchases of fishing and aquaculture products and community acceptance of aquaculture's development and management practices; and
- *Aquaculture industry* - Some social surveys have been undertaken since the late 1990s that have a particular focus on aquaculture. They contain valuable information about how regional communities and the broader public perceive aquaculture's sustainability and the effectiveness of planning, regulatory and management regimes.

Valuing environment, economy and sustainability

Several of the studies reviewed provide information about how the public values natural environments, what positions they would take for weighing up different priorities, and how those priorities influence their views about certain industries and resource management approaches.

Table 5 shows the key findings of several social surveys of public attitudes to resource use and management. The data suggest that when making trade-offs in balancing economic and environmental priorities, the broader public seems to favour environmental priorities. This choice may differ somewhat in rural or regional communities where there is a higher reliance of the local/regional economy on resource-dependent industries to provide for jobs, and therefore greater interest in those types of (potential and actual) economic benefits. Of course, there are limits to how much these data can be generalised to all people and situations.

Table 5. Data on public values and perceptions

Research Foci	Select Findings
Water	
Nancarrow & Syme (2001)	• High levels of agreement among respondents about the intrinsic values of water and the need for using the precautionary principle
Nancarrow & Syme (1999)	• Community split on whether to prioritise environmental requirements over human needs or 'vice-versa' when allocating water uses
Connelly & Knuth (2002)	• Local and regional officials consistently over-estimated the value residents placed on economic development, while underestimating value of environmental protection to residents
Forests	
Tarrant et al (2003)	• Paradigm shift in management due to broader change in public values where people support a balance, but place greater emphasis on environmental values of forests versus economic values
Shindler et al (2002b)	• The public favour a balance of economic and environmental priorities, but more urban residents favoured environmental priorities (45%) than did rural residents (30%)
Shindler & Toman (2002)	• 42% of respondents wanted a balance between economic and environmental priorities, with 39% preferring *economic* priorities
Mining	
Chamber of Minerals and Energy 1992 - 1999	• The public prioritised industry's social and environmental obligations and contributions (environmental protection, education, health, safety) over its more economically-oriented ones (employment, economic competitiveness) • Public concerned to see stronger environmental protection measures from industry
Coastal management	
NOO 2002	• The overall Australian community has a strong affinity for the coast; and community groups were more accepting of conservation uses for coastal environments than for commercial fishing
Aquaculture	
Wilson (2001)	• Regional QLD community's top priorities for aquaculture industry development were environmental impact assessment, employment, economic viability, using local resources, educating and informing the public • Key benefits from industry most often identified were employment, then exports, contributions to local economy; key disadvantages were potential environmental impacts
Clarke (1996)	• South Australian stakeholders identify aquaculture's main benefits as: economic and employment opportunities, increased environmental research/monitoring activity, and reducing pressure on wild stocks

The findings of this review suggest that there are mixed opinions about the sustainability of certain industries. The series of social surveys undertaken by the Chamber of Minerals and Energy (1992, 1997, 1999) showed that the public wanted to see stronger environmental protection measures for the mining industry, which may suggest they have some concerns that the industry imposes some detrimental impact on the environment. However, it is worth noting that the surveys also show an improvement in the industry's overall image. The general public's views about aquaculture's sustainability might be better. In the United States, half of the respondents to a national survey agreed that aquaculture is a good alternative to wild-catch fishing, although they had low awareness of some environmental and public health issues challenging the industry (e.g. feed quality, use of antibiotics, fish escapes)(Blackstone 2001). In Australia, a greater percentage of respondents to a national survey rated aquaculture as 'sustainable' than they did for Indigenous Australian fishing, recreational fishing,

and commercial fishing. Men were more likely to rate aquaculture as 'sustainable' than women (Aslin & Byron 2003).

Perceptions of governments' resource management approaches

Table 6 summarises some of the research on public judgements of governments' approaches to resource management and to their interactions with the public. The data suggest that alongside public support for the overall benefits that primary and other industries provide, there is also:

- Support for government's regulatory role, as well as a perceived need to improve this role and governments' planning and management functions; and
- Strong support for the community's right to contribute to decision-making and the need to improve governments' public consultation and participation mechanisms.

Table 6. Data showing public views about governments' resource management regimes

Research	Select Survey Findings
Forests	
Shindler et al. (2002b)	• Increased support for management intervention in forests, but public less sure about how that should happen
Shindler et al. (2002b)	• Communities have less faith in public meetings/planning workshops and question how much influence they have had on decision making through these activities; evenly divided on how much they trusted government to make good decisions about forest management
Shindler & Toman (2002)	• Majority support for public participation – but fewer believed government was open to their views or used input in decision-making; lower trust in government to implement responsible management
Water	
Nancarrow & Syme (2001)	• Strong community expectations that communities share ownership of water (directly and indirectly) and have the right to have input into managing water for the overall public good • Public input improves quality of decisions
Mining	
Chamber of Minerals & Energy 1992 - 1999	• Public concerned to see stronger environmental protection measures from both government and industry
Coastal management	
NOO (2002)	• Regional and national conservation groups concerned to see strong regulatory systems for industry activity and ecosystem-based management
Fishing	
Blackstone (2001)	• 40% of respondents agreed that there was overfishing/depletion of fish/seafood stocks and supplies, and half of respondent 'didn't know' • A quarter of respondents felt that the fishing industry was not well-regulated and 40% 'didn't know'
Aslin & Byron (2003)	• Survey shows that Australians are concerned about how the fishing industry is managed; a majority support strong controls to protect environment
Aquaculture	
Clarke (1996)	• Respondents showed divided opinions about the quality of State Government planning and management for aquaculture
Carvalho (1998)	• Respondents with particular coastal management interests were dissatisfied with the State Government's planning, management and use of zones given the resulting conflicts and inadequate use of marine biology principles, and public consultation

Risk perceptions

Since public concerns are often focused on the risk that aquaculture will have negative (and possibly irreversible) impacts on the environment and human health, it is important to understand the different ways people perceive – and communicate about – different types of risk. Trends in Europe, North America and in Australia show declining levels of trust in industry, governments and science and technology (Shindler & Brunson 1999; Randall 2002; Petts & Leach 2000). For example, the European public has low trust in agriculture's use of biotechnology and has recently been concerned about the salmon industry and its technical practices. These views might cause consumers to reject aquaculture products (Kaiser & Stead 2002). In Australia, public concerns about science and technology could also affect consumers' behaviour, causing them to reject aquaculture products, as well as strengthening community opposition to aquaculture developments.

What is special about risk perception?
A fundamental point to be made about risk is that it is socially constructed (see Box 1), therefore, different factors will influence how risk is perceived, including:

- Particular characteristics of risk (e.g. is it voluntary, is it familiar, are consequences negative, reversible)(Finucane 2001; Merkhofer 1987);
- Psychological aspects of decision-making (e.g. formed opinions harder to change, if readily recalled judged more probable)(Finucane 2001); and
- Socio-political factors (e.g. gender, race, world views) (Slovic 1999).

For example, differences between the way 'experts' and the 'lay public' perceive risk often results in situations where 'experts' use increasing amounts of science-based evidence to 'convince' the public that the risk is either negligible and/or under control. There is substantial evidence to show that this approach actually invites public suspicion (Shindler & Brunson 1999; Randall 2002; Petts & Leach 2000). Therefore, one can safely assume that particular and different ways of communicating about risk will be required to address the divergent risks that people perceive in particular situations.

Box 1: The 'social construction' of risk

What do we mean when we say risk is 'socially-constructed'?

Terms like "risk management" and "acceptable levels of protection" assume a degree of understanding of the concept of risk, acceptance of how it is measured and some level of consensus on how it should be managed. These are bold assumptions, because 'risk' is *socially constructed*. That is, 'risk' does not exist 'out there,' independent of our minds and cultures, waiting to be measured. Instead, human beings have invented the concept *risk* to help them understand and cope with the dangers and uncertainties of life. All people, irrespective of their role in society use speculative frameworks to make sense of the world and selective judgement in their responses to risk. These so-called 'non rational' factors are not necessarily incorrect. However, there are likely to be significant differences in these understandings and responses, and such divergences are critical to understanding how best to manage and communicate about risk. One of the more significant differences discussed recently is that between 'the public' and 'experts'. For example, the Nairn Review found that the public, industry and governments do not agree on the objectives of quarantine and stakeholder roles in determining acceptable levels of risk. On going research by the BRS is finding important differences in the way communities, decision-makers and industry define the risks associated with aquaculture.

Source: Botterill & Mazur 2003

One of the more popular foci for risk perception research is science and technology, given their potential to impact on health and environment. These studies are relevant to aquaculture, because the industry uses complex science and technology (in some cases biotechnology), and there are concerns about how these activities might negatively impact on sensitive natural environments and human health. The use of GMOs in Europe has certainly attracted considerable public attention. The AEBC (2003) has found that Europeans:

- Are uneasy about GMOs, their environmental impacts, and the associated social and political controversy;
- Are increasingly convinced that no one knows enough about the long-term effects of GMOs; and
- Have low trust in governments and multi-national companies, who are perceived to be motivated by profits rather than public interest.

Similarly, Gilding and Critchely (2003) found that Australians:

- Are uncertain about science and technology;
- Are uncomfortable with biotechnology and want to see government regulate it;
- Have greater trust in scientific and research organisations (CSIRO, universities) than in governments, major companies and the media; and those
- Who are younger tend to be more trusting in science and technology.

In many cases, the socio-political context of decisions will influence how people feel about risks. Beckwith (1999) found that even where people can actually agree on the facts about a particular risk, they could still disagree about what is an acceptable course of action for dealing with those risks. People who rejected a government decision about how to address the health risks from asbestos, did so more on the basis that it effectively removed a town resident's right to choose, rather than on the nature of the asbestos risk itself.

Risk communication

A critical component for any risk management program should include effective risk communication strategies. Research suggests that the design and implementation of these strategies should be informed by understanding how public perceptions of credibility and trust in information sources and community engagement processes are formed and influenced.

The research in Europe demonstrated that the public had a broad desire to know *more* about GMOs, and wanted to see more research undertaken (AEBC 2003). The public also welcomed the British Government's support of an open public debate, and despite their suspicion that their input would be ignored; they welcomed the opportunity to express their opinion and hear other people's views (AEBC 2003).

Other research has shown that some sources of information about risk are more trusted than others, and that government has not fared well in recent times. Hunt et al. (1999) found that the most advantageous characteristics an information provider could have were: independence from government and commercial organisations; high levels of technical expertise; and being dedicated to interests of the public. Doctors and scientists rated higher in trust and lower in bias than did government ministers or tabloid newspapers. Similarly, Peters et al. (1997) found that perceptions of knowledge and expertise, openness and honesty, and concern and care of a particular institution influenced people's judgements of credibility and trust. Those interested in improving the public image need to demonstrate how they defy negative stereotypes (e.g. industry as self-interested, uncommitted governments).

Community engagement and resource management

The necessary considerations required for effective risk communication are very similar to situations where communities are informed about, consulted on and/or engaged in resource development and management. Table 7 lists some highlights of social research that examined public interests, knowledge, use and perceptions of different information sources.

That data suggests that it is important to acknowledge that there is no one 'public', instead there are many 'publics' who have varied levels of knowledge and interest in contemporary resource use and management issues. Some communities, groups and individuals will be more informed and/or more critical of certain industries and government practices than others. Where an industry has the potential to negatively impact the environment, both place-based and interest-based communities will be interested in information that clearly spells out what actions are in place to mitigate such risks, as well as the details of the industry's social and economic benefits. Where an industry has direct impacts on a particular place-based community, those residents may favour more interactive forms of information exchange.

An important point to be made is that not all sources of information are viewed as having equal credibility, and perceptions of credibility and trust are critical to effective communications among government officials, industry and members of the public. The data in Table 7 suggests that despite support for community engagement and a preference for more interactive communications, there is tangible dissatisfaction with governments' consultation mechanisms. There are indications that the public may trust *industry* information sources more than government and the popular media.

Table 7. Data showing public knowledge, interests and information sources

Research	Select Survey Findings
Knowledge & interest levels	

Shindler et al. (2002b)	• Communities are often familiar with forest management issues, but their specific scientific knowledge likely to be lower
Chamber of Minerals & Energy (1992-1999)	• Generally low knowledge levels about the mining industry • Some parts of the community are more critical of the mining industry's environmental performance than others
NOO (2002)	• Low levels of public knowledge about the South-East Marine region and governments' management roles • Highest level of awareness of coastal uses was for recreational and commercial fishing • Those who report knowing a lot about coastal management, were more likely to visit the coast, be more interested in receiving information, be aware of conservation uses, and to place higher importance on community involvement in coastal planning
Information requirements & sources	
Shindler et al. (2002b)	• Communities wanted more interactive forms of information exchange, but question effectiveness of current mechanisms
Shindler & Toman (2002)	• Communities were paying more attention to forest industry-based information than to government information sources • Communities felt that the quality of government information had declined and preferred more interactive forms of information
Chamber of Minerals & Energy (1992-1999)	• Respondents wanted to know more about what is being mined, where and what specific environmental management steps are being taken • Respondents rely heavily on the media for information, despite rating its as less credible; respondents did not actively seek information from more credible sources unless they had a special interest; • Industry's credibility as an information source had *increased*, but government and industry were not 'important' sources of information
Wilson (2001)	• Regional community respondents relied most heavily on the local newspaper for information about aquaculture; • They wanted regular information about: environmental impacts (water use & quality, impacts on fish breeding grounds), number of and type of jobs provided, economic viability, locations of new/existing projects, monitoring and regulatory processes, and organisational details and people involved.

The risk communication research, and the research in forest management, ecosystem management and mining demonstrate that the following work is needed to build trust among governments, industry and communities:

- 'Layer' communications strategies in order to most effectively target diverse 'publics';
- Given declines in public trust, avoid overemphasising information provision and focus on improving agency-public relationships and providing opportunities for communities to have meaningful input into decision-making;
- Recognise that communities, groups and individuals can be well informed, interested in and/or otherwise capable of judging trade-offs of different management options;
- Where needed build community capacity for participation (e.g. provide information to improve understanding of complexities of ecosystem management);
- Tailor participation methods to suit particular settings and situations;
- On-ground, interactive activities should be delivered by those with credibility, knowledge of local settings and issues; and community engagement expertise;
- Address community concerns about seriousness, uncertainty and when certain risks might be manifest;
- Utilise credible sources for information provision programs;
- For industry, information provision should focus on ensuring that consistent, truthful messages are delivered by all sectors to improve public image; and
- Include evaluation and monitoring components to assess performance of current information provision and public participation activities and institutional capacity to implement necessary changes (Shindler & Toman 2002; Shindler et al. 2002b; Chamber of Minerals & Energy 1997).

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