Managing conflicts in aquaculture
Experiences from overseas

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IXth Biennial Conference of the International Institute of Fisheries Economics and Trade, Tromsø, Norway, 8–11 July 1998

The Australian aquaculture sector is facing increasing conflict over access to sites. However, it is in a good position to learn from the experience of governments in other countries to resolve the issue. In this paper, the approaches adopted in some other countries to resolve resource conflicts over space are investigated in relation to aquaculture. Planning and zoning schemes are discussed in the context of allocating space at the macro level. In addition, various approaches used overseas to allocate site licences at the micro level are considered. It is noted that strategic planning at a macro level will be critical to avoid environmental degradation. National and regional planning strategies such as those used in Canada, New Zealand and Norway could be considered as potential approaches for Australian policy makers. However, these strategies must be flexible enough to accommodate changes in economic circumstances. In the past, local measures designed to allocate sites among individual users may have penalised the aquaculture sector in some countries. Policy makers need to develop a strategy for considering both the costs and the benefits of aquaculture development so the optimal use of resources can be ensured.

* An earlier version of this paper was presented at the National Agricultural and Resources Outlook Conference, Canberra, Australia, 4–6 February 1997.

ABARE project 1431
Introduction
Aquaculture in Australia is expanding rapidly. The value of Australian aquaculture increased by over 75 per cent over the five years to 1996-97 — up from $254 million to reach over $398 million (ABARE 1997), or around 25 per cent of the total value of Australia’s fisheries production. Furthermore, the prospects for the sector are for continued strong growth, particularly for traditional products such as pearls and recently developed products such as farmed tuna (Brown, van Landeghem and Schuele 1997).

The drawback to these developments is the increasing competition faced by aquaculture operators in accessing resources. Aquaculture operators may be in conflict with wild harvest fishermen over access to broodstock, for example, or with tourist and residential groups over access to sites.

In a recent review of the Australian aquaculture strategy, the Standing Committee on Fisheries and Aquaculture (1997) commented that Australia was in a good position to learn from the successes and failures in aquaculture around the world. The committee also recommended that policies be developed to improve the allocation of natural resources such as land and water. Subsequently, the Fisheries and Aquaculture Branch of the Department of Primary Industries and Energy asked ABARE to assess the policies adopted overseas to resolve resource access issues for aquaculture.

Some preliminary findings of the study and the implications for future Australian policies will be discussed in this paper. The discussion is limited to the approaches used to settle access to space.

Competition for space
The development of the aquaculture industry in Australia relies on access to suitable sites. The key criteria for site suitability include access to clean water and good local infrastructure. However, the site factors sought by aquaculture operators are also sought by other users and competition for access to sites is frequently intense.

The prospect of expanses of clean water in easy-to-reach locations make many potential aquaculture sites highly desirable for environmental and tourist purposes, for example. The result is that aquaculture development may be constrained by the loss of sites to these sectors. Many potential suitable prawn farming sites in New South Wales, for example, are designated as national parks or reserves, while suitable Queensland sites for growing kuruma prawns are limited because a number of appropriate coastal areas have been secured as fish habitat reserves and wetland reserves (Brown, van Landeghem and Schuele 1997).
Even if suitable sites for aquaculture are available, conflicts may arise between aquaculture and neighboring users of the resources. Some users are concerned that the development of aquaculture leads to a perceived loss of visual or environmental amenity. Loss of visual amenity may be associated with the construction of buildings, aboveground fish tanks, exposed plumbing, raft or rack structures, pontoons or floats, machinery, fencing and power lines (Mather 1993). Alternatively, some resource users may consider that aquaculture interferes with efficient navigation systems or conflicts with recreational activities such as swimming, diving, sailing and so on (Borel 1997).

Aquaculture may also be perceived as a source of environmental risk. The spread of Pacific oysters in Victoria, for example, has been linked with the risk of ‘adverse impacts on conservation values’ (Davis 1996). The result has been a statewide ban on the farming of Pacific oysters, thus removing all potential sites from production.

Aquaculture operations may be associated with some negative impacts, but they may also be susceptible to the effects of activities from other sectors. Aquaculturists in some regions may face problems caused by past agricultural practices — for example, pesticide and/or herbicide residue in soils, water and foods, or land and water degradation such as eutrophication of waterways and embayments, salination and erosion (O’Sullivan 1990). In the 1980s, oyster growers in north west Tasmania were adversely affected by poor water quality partly caused by dairy farming effluent discharges. The contamination of water after heavy rains resulted in temporary closure of oyster farms. Several oyster farms in the Duck River estuary were permanently closed in 1981 as a result of such contamination (Resource Assessment Commission 1993).

Use conflicts between aquaculture and other sectors are partly founded in poorly defined rights over resources. That is, it may not be clear who owns what and what forms of use they are entitled to exercise. Alternatively, it may be difficult for individuals to enforce and protect their rights. To reduce the conflicts between aquaculture and other operators in an area, it is therefore important to develop a strategy for improving the definition of use rights across competing users.

Australia’s overarching principles for policies determining use rights to natural resources are embodied in the federal strategy of ecologically sustainable development. This type of resource management is aimed at ensuring maximum benefits to the community, given ecological constraints. This involves identifying the ecological limits within which resource use can occur, then trading off the community benefits of one use against those of another use.

There is little national guidance on how to apply these principles to the allocation of rights among users in Australia. There is no coherent national strategy to determine the maximum number of uses for a piece of land, nor to determine which uses are appropriate. Neither
is there an explicit strategy to identify the tradeoffs between aquaculture operations and other sectors to ensure the maximum possible benefits from land use. The ban on Pacific oyster farming in Victoria, for example, is a response to the risks of environmental damage but there are no explicit guidelines to determine when the risks are low enough to lift the ban.

However, a variety of strategies have been developed in other countries to manage the use of resources targeted by aquaculture operators, among others. These strategies operate by implicitly or explicitly assigning rights to resources, with the intention of reducing resource conflicts. Such strategies may be useful to consider if aquaculture in Australia continues to expand in the future. The strategies used by some other countries are discussed below.

**Overseas experiences – the big picture**

Countries have developed a number of responses to the issue of allocating land among different uses. These vary from ‘reactive’ strategies such as those adopted for allocating land to aquaculture in Chinese Taipei in the 1980s, through to ‘proactive’ zoning strategies used in New Zealand and Canada.

**Chinese Taipei**

Chinese Taipei has a long history of aquaculture production. Aquaculture currently accounts for more than half the total value of fishery products in that country, with its aquaculture exports valued at over US$1326 million in 1993 (Council of Agriculture 1994). Unfortunately, the approach used to allocate land to aquaculture in Chinese Taipei highlights the risks of unconstrained development of an industry and the need for an overall plan to manage its development.

The expansion of Chinese Taipei’s aquaculture industry was largely unmanaged and uncontrolled until the 1990s. Water rights in Chinese Taipei were traditionally designated in terms of agriculture and human consumption only, so aquaculture’s use of fresh water was not explicitly controlled. Aquaculture operators frequently obtained groundwater without a permit and many farmers operated (and still do) without a licence (Liao, Lee and Hsiu 1995).

The combination of a rapidly expanding industry, continued removal of groundwater for aquaculture and a lack of conservation measures was highly detrimental to the environment. Liao, Lee and Hsiu (1995) noted that some areas experienced land subsidence and continual flooding during storms, while water quality deteriorated.

To reduce the use of freshwater in aquaculture, the Chinese Taipei government proposed a change in the use of aquaculture areas from inland freshwater culture to more marine
based culture. Following this, it proposed in 1994 that all freshwater aquaculture be terminated within three years. (Information on subsequent policy developments is not available.)

Suspensions in resource use, such as that proposed in Chinese Taipei, have the effect of all resource access being removed from selected resource users (from aquaculture operators in this case). They are used to control conflicts related to aquaculture because they have an immediate impact on the pattern of resource use. However, a blanket approach of terminating freshwater aquaculture production prevents the development of future forms of production which are not necessarily environmentally damaging, but which could still be highly profitable. Authorities that seek to reduce resource conflict by banning all possible forms of production may excessively constrain the future of the industry and lose valuable income to the community.

Furthermore, such policies may not be efficient because they are not developed to deal with the cause of the problem — that is, poorly defined use rights for resources. Aquaculture operators in Chinese Taipei still have the incentive to profit from overexploitation of the environment. Further, the switch of emphasis to marine based aquaculture has not been accompanied by suitable controls on its development. Licensing is the only existing regulation applying to aquaculture, and there are no output controls.

Thus, the environmental risks associated with aquaculture are still unmanaged, being merely relocated. Aquaculture may even generate new risks in the marine environment.

Compared with the reactive strategy for aquaculture development in Chinese Taipei, the approaches of other countries in allocating resource rights may be seen as more proactive — for example, the use of zoning or planning based systems.

**New Zealand**

New Zealand’s hierarchy of national, regional and district plans forms the basis of a ‘vision’ for achieving balanced social and economic development. The plans provide the direction for resource use by district and regional bodies; they outline the importance of preserving particular features of the natural landscape, for example.

Plan decision making focuses on intended outcomes rather than the regulation of resource use. An example is the restriction of industrial uses to certain areas of towns and cities. Industry was formerly not permitted in some areas simply because it was deemed an ‘industrial’ activity. Now the emphasis is on controlling the waste, noise and other side effects of the industry instead of controlling the actual activity. Thus, if a particular activity can meet a community’s environmental standards, that business should be able to operate in any area (Ministry for the Environment 1994), in theory at least.
As a result, rights to undertake any resource activity, aquaculture included, are allocated within a relatively dynamic environment. Providing operators can prove their ability to maintain certain standards, such as returning clean water to the sea or not infringing on coastal views, aquaculture operators may apply for use rights in available areas.

**Norway**

Compared with New Zealand, some other countries appear to operate more defined resource use plans for aquaculture. Norway’s LENKA program is used to determine the capacity of water courses to absorb pollution. The aim of the program (1987–90) was to determine the physical capacity of coastal areas to absorb the pressures of Norway’s main aquaculture interest — salmon farming (Ackerfors and Rosenthal 1996).

After dividing the coastline into zones, data were collected on the environmental conditions, existing uses, infrastructure and so on. The capacity of each zone was assessed and the suitability of each area was evaluated for possible conflict between aquaculture and other interested users.

The final map can now be used by resource planners to identify those zones most suitable for aquaculture — that is, where environmental conflicts are likely to be low. Areas with a high capacity to absorb aquaculture can be considered for planning and investment in the future.

**Canada**

The provincial government in British Columbia, Canada, undertook a series of coastal resources interest studies (CRIS) to identify areas along the coast with high or low potential for salmon farming and resource conflict. User groups and resource agencies mapped critical uses along the coast, planning all the information on a common map. Draft maps of finfish aquaculture opportunities were then prepared and presented at public open houses, followed by the publication of final opportunity maps (Ackerfors and Rosenthal 1996). Applications for aquaculture sites can then be considered in the light of this information and potential user conflicts can be identified and minimised.

**Problems with planning schemes**

The use of broad planning schemes to refine use rights to resources and to minimise conflict among users of the environment is intuitively appealing, although such schemes have their limitations. Norwegian-style resource capability plans are useful for determining whether aquaculture will ‘fit’ with existing resource uses, and they are relatively straightforward and easy to comprehend. Some approaches which are similar in principle are currently
used in some areas of Australia (for example, South Australia), although they are not applied at the national scale.

However, because such plans are primarily based on biological information, there is only limited scope for accommodating the values associated with aquaculture operations. Highly valuable aquaculture activities may be possible just outside certain environmental parameters in an area, for example. The inability of such plans to accommodate economic values may mean that small tradeoffs to the benefit of the community may be overlooked. Instead, there are likely to be benefits from extending zone systems to incorporate economic information, as with the CRIS (Canada). In this way, tradeoffs between competing uses can be more explicitly considered.

A second limitation to the use of capability plans is that they may not easily accommodate the advancements in technology associated with a rapidly developing industry such as aquaculture. An area may be designated as unsuitable for aquaculture because of the current level of pollution associated with farming, for example, but technological advances may mean that farming activities are later possible in the same area with reduced environmental effects.

An example is salmon farming in British Columbia, Canada, where the grow-out phase of the salmon is currently conducted using floating net cages. Water flows freely through the cages which house the salmon. Salmon production using net cages is associated with a variety of environmental risks, including waste contamination, fish escapes and predator interactions. However, the industry has developed new closed wall cages in which nets are replaced by an impermeable membrane and water is pumped into (rather than flowing through) the cage. The new equipment reduces the environmental risks associated with salmon production (Environmental Assessment Office 1997).

This limitation to capability planning is important for the Australian industry because aquaculture technology is changing rapidly. Tuna farming is a simple example. This industry was practically nonexistent six years ago, but was valued at $40 million in 1996-97 (ABARE 1997) and the majority of Australian tuna caught goes to tuna farms for ongrowth. The implication is that the benefits from the use of scientific based capability plans in Australia could be significantly improved if economic data could be incorporated.

Further, with the second largest coastline in the world, a detailed nationwide application of capability plans for Australian aquaculture (such as that undertaken in Norway) is likely to be highly expensive and it is unlikely that such a management approach would be cost effective. Currently, regional zoning is applied for aquaculture in some parts of Australia. However, it is essential that all these plans are made consistent and considered as part of a coherent national plan so the development of aquaculture can be balanced and
sustainable. Regional capability plans (such as the CRIS used in Canada) may be useful in areas in which aquaculture has a high potential.

Compared with the Norwegian and Canadian resource capability plans, New Zealand’s approach to resource planning (in principle) could be used to accommodate dynamic issues such as technological changes. If aquaculture operators (or other users) were able to prove that their activities will not adversely affect existing environmental amenities, they should be free to apply to use all coastal regions, in theory at least. However, there are questions about the degree to which the system clearly defines rights to the more abstract economic values such as visual amenity. It is likely to be difficult to assess and enforce the rights of those who enjoy the scenery of an area — how many farm pens, for instance, destroy the visual amenity of an area? One? Fifty? A hundred? Accommodating the value of environmental amenities remains a difficult and largely subjective issue.

Recreational and environmental uses of Australia’s coastal zone are part of the national culture and their amenity values can be correspondingly high. If this approach was to be adopted in Australia, it ideally should be developed further to ensure that all economic values could be incorporated.

A further problem of outcome based approaches to resource use planning is that they require information on the cumulative environmental impact of farming. This is a major issue in Canada where, despite the assessment of individual site applications, no mechanism exists for assessing the cumulative impact of multiple developments on a variety of values in a region or subregion.

There is a final issue to consider in relation to the application of broadscale planning or zoning systems for aquaculture in Australia. At its inception, any planning system will necessarily accommodate only existing or likely uses of land. This means that emerging uses of land such as aquaculture may become ‘locked out’ of potentially useful areas, while established uses become locked in. This is a major criticism of the New Zealand resource management system at present. For Australians to gain the greatest value from the use of their natural resources, any broadscale planning mechanisms must be developed so that it is flexible enough to accommodate new beneficial uses of land.

Overseas experiences – a closer examination

Planning guides the large scale decisions of whether aquaculture is potentially acceptable in areas. However, more localised decisions are also required to settle individual questions of the behavior of operators. How are licences operated, for example? And what is their effect on the distribution of farms? Some methods used overseas to decide the proportion of a resource that aquaculture and other users can access are discussed in this section.
Sector versus sector issues

Allocation of sites in New Zealand is determined using a resource consent system. Resource consents are granted under the Resource Management Act 1991 and determine what kind of activity (for example, what sector) can occur in an area, subject to consistency with the regional plans (discussed above).

Consents specify the exact conditions of individual activities and the environmental and social constraints under which they operate, and they are required before sectors conduct any activity that involves the use of public natural resources. In effect, the permits are used to finely specify individual use rights.

A key feature of consents is that they are fully transferable. Thus, once a recreational fishing group acquires a consent for access to a specific coastal area, the group could sell that consent to another user, say an aquaculture operator. The theory is that the sector that eventually acquires the consent (and the individual user who holds it) will be the most profitable user of the site.

This is not necessarily the case in practice. The activities permitted and the constraints applying are detailed on each consent, so new consent holders are restricted to conducting the same activities of the original holder, or even fewer activities. Thus, new holders need to apply for a new consent if they want to vary their activities. Further, permits are granted on a ‘first come, first served’ basis, so incoming users to a coastal area, say aquaculturists, cannot be assured of the right to buy consents even if they would be more profitable to the community.

Coastal permits in some Canadian provinces, in contrast, are allocated among coastal users according to a variety of ‘preference’ criteria. In New Brunswick, large scale job losses occurred in the local commercial fishing industry during the 1980s and 1990s due to the collapse of the North Atlantic groundfish fishery. In response, the provincial government sought to redistribute rights and wealth in the region by focusing on the needs of ex-commercial fishing operators. The allocation of new marine sites for finfish aquaculture purposes is thus currently conducted so that commercial fishermen have first refusal on the use of the sites.

This means that if aquaculture operators compete with wild harvesters to use a coastal site for, say, salmon farming, commercial fishermen still have preference on site access, even if their enterprise is less valuable to the region.

As a matter of interest, if two or more wild harvest commercial fishing applicants are eligible to be approved for the same site, access is granted in terms of who lives closest to the site.
The New Brunswick approach of emphasising commercial fishing over aquaculture does not seem to be particularly efficient for sites where aquaculture could be a relatively more profitable activity. Similarly, where permits are allocated on a ‘first come first served’ basis, as in New Zealand, this is an inefficient means of deciding whether aquaculture should take preference for a site and which aquaculture application is preferable.

An alternative selection approach might be to allow a bidding system whereby access to coastal areas goes to the highest bidder, regardless of sector (providing that certain environmental constraints are met). This approach means that the most profitable user group could acquire the site. An advantage of this approach is that governments can still accommodate the need to look after particular user groups, provided resource use rights are tradable.

If the local government in British Columbia was committed to supporting wild harvest operators, for example, it could ensure an allocation of user rights to that group in the first instance. Aquaculture operators could then seek to trade with wild harvest operators if aquaculture was profitable enough.

Bid options are used in British Columbia for the acquisition of some shellfish sites. Occasionally held public offerings allow competitors for a site to submit sealed bids to the relevant government agency for use rights. Proposals may also include a preliminary development plan. Usually, the highest bidder is given the opportunity to have their development plan approved.

A similar approach has also been proposed in New Zealand for allocating sites among competing aquaculture operators in the Marlborough Sounds. Indigenous groups are disputing this proposal because it implies that the New Zealand government has the right (ownership) to sell the coast as it pleases. Maori communities dispute the notion that the ownership of the coastal region was ever relinquished, so the issue remains unresolved.

In Australia, bidding systems have been applied (in a limited sense) in the past to allocate access rights to natural resources — for example, to allocate petroleum exploration permits in the Timor Sea region in 1986 (Hinchy, Fisher and Wallace 1989). A market based system, introduced in 1985, was used in oil and gas areas that were considered highly prospective. Permits allocated under the cash bidding system had a much more limited tenure than did other permits, which restricted the flexibility of oil and gas companies to determine their exploration program in Australia (Hogan et al. 1996).

Currently, bidding systems are not widely used to allocate natural resources in Australia. Some aquaculture sites are allocated with the use of a bidding system (in Tasmania, for instance). However, this does not occur on a wide scale, despite the promise that bidding
systems offer an explicit means of ensuring equity and efficiency in any resource allocation (Department of Primary Industries and Energy 1988) and of determining use rights.

Regulation or restriction?
The use of planning approaches to direct resource access appears to be a popular recent innovation in resource use planning for some of the major western aquaculture countries. Certainly, the absence of an explicit planning strategy has been a major criticism of the expansion in fish farming in development appeals in the past (Rosenthal 1994). However, in contrast, aquaculture in some countries is perceived to be subject to excessive regulation and control (Rosenthal 1994).

Similarly, it has been suggested that many governments have been preoccupied with limiting aquaculture development (OECD 1996). Increasing demand for the coastal zone has resulted in an emphasis on spatial allocation issues, and authorities dealing with fish farming are generally more stringent when issuing licences for new fish farms than for other uses.

This is already affecting the number of new farms being established in Europe and could also influence the production and installation costs. Denmark has enforced a moratorium on new installations, while Norway has implemented a hearing procedure for local communities affected by installation (OECD 1996).

The future for Australia
Australia will need to develop strategies to efficiently allocate space among aquaculture and other users so conflicts over space and environmental degradation can be reduced. Broad planning strategies such as those used in New Zealand, Canada and Norway may be useful for determining whether aquaculture is appropriate for particular areas. However, there may be problems with such strategies in incorporating technical change or in identifying losses in environmental amenity.

Technical change associated with Australian aquaculture, such as the development of commercial tuna farming, has been rapid in recent years, and the environmental and recreational amenity of many areas affected by aquaculture may be significant. Thus, any consideration of broad planning schemes in Australia would require policy makers to devise a means of incorporating technical change and amenity values. Bidding systems have potential as a response to this issue. However, the use of bidding options in aquaculture is relatively new in other countries and their effect has yet to be seen.
References


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