

# **Yellowtail Kingfish Aquaculture**

## **Strategic Research and Development Plan**

**2003-2008.**

**Prepared for**

Fisheries Research and Development Corporation &  
South Australian Marine Finfish Farmers Association Inc.

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*South Australian Marine Finfish Farmers Association Inc*



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## **VISION**

**“A profitable, sustainable and valued industry with annual production in excess of 10,000 tonnes by 2008, recognised as producing the world’s best quality Yellowtail Kingfish”.**

## **INTRODUCTION**

This five-year (2003 –2008) Yellowtail Kingfish strategic research and development (R&D) plan has been developed as the principal source of information on this industry sector’s policies, programs and operations as they relate to R&D. The plan has been developed to ensure that the Yellowtail Kingfish industry is developed based on the best available information and is consistent with community and government expectations.

### ***The Plan***

- Provides a brief history of the development of Yellowtail Kingfish farming in Australia;
- describes the industry and it’s business environment;
- highlights the industry sector’s planned outcomes for R&D and the immediate needs; and
- outlines the operational, communications and management objectives and the strategies that the South Australian Marine Finfish Farmers Association Inc, through the Yellowtail Kingfish R&D Steering Committee, intends to adopt to achieve these objectives.

### ***Our Audience***

The plan is focussed on informing all stakeholders of the R&D needs of this industry, including:

- Yellowtail Kingfish farmers;
- various government agencies and industry corporations that fund R&D activities;
- community organisations interested in the activities of this industry sector;
- researchers and research organisations that provide, or are potential providers, of R&D services;
- industries that provide goods and services to the Yellowtail Kingfish aquaculture industry;
- Australian, State and local governments and their agencies associated with management of resources utilised by Yellowtail Kingfish farmers; and,
- the media.

## **YELLOWTAIL KINGFISH AQUACULTURE R&D STEERING COMMITTEE**

The Yellowtail Kingfish Aquaculture R&D Steering Committee (YTKARDSC) was initiated in February 2003 to enhance and promote the orderly and strategic planning and management of R&D to benefit this emerging industry. This committee includes;

- Independent Chairperson
- Chair of the South Australian Finfish Farmers Association Inc (SAMFFA)
- Three other industry representatives
- Executive officer of SAMFFA
- A representative of Primary Industries and Resources SA (PIRSA -South Australian Government)
- Three Scientific representatives (South Australian Research and Development Institute (SARDI, University of Adelaide)
- Fisheries Research and Development Corporation (FRDC) representative (Australian Government)

Observer:

- Aquafin Cooperative Research Centre representative

The role of the R&D Steering Committee is to;

- develop an R& D plan for the Yellowtail Kingfish aquaculture industry that provides strategic direction for research and is responsive to change through a review process;
- set R&D priorities to maximise investment in areas of need;
- monitor national and international research to avoid duplication, and identify approaches that may achieve the greatest potential return;
- plan and assist R&D application development;
- manage existing R&D projects to ensure progress meets milestones and advise on changes where needed to ensure projects maintain relevance;
- manage intellectual property;
- promote collaboration between all industry stakeholders;
- communicate regularly with potential beneficiaries; and
- facilitate the adoption of R&D results.
- attract R&D funding and influence how funding entities apply their investments in this industry sector.

The Yellowtail Kingfish Aquaculture R&D Steering Committee meets every two months, or as needed.

## **STAKEHOLDERS**

Yellowtail Kingfish farmers are the principal stakeholders for the R&D activities aligned to this plan. Interests of all farmers are represented by the peak industry body, the South Australian Marine Finfish Farmers Association Inc. The Association has been operational since 1998 and meets regularly to formulate actions on a range of issues that affect development of the Yellowtail Kingfish aquaculture industry sector.

There is a diverse range of other stakeholders that have some connection to the Yellowtail Kingfish aquaculture industry. These include;

- the commercial fishing industry and fish processors;
- domestic and overseas consumers;
- research providers;
- aquaculture and fisheries managers;
- aquaculture support industries including feed companies;
- recreational and indigenous fishers and fishing charter operators;

- federal, state, and local governments and their agencies;
- training and education providers;
- business, including freight handlers, transport providers and business that provide goods and services to the industry; and
- the community.

## INDUSTRY OVERVIEW AND BUSINESS ENVIRONMENT

### Overview

Yellowtail Kingfish (*Seriola lalandi*) is a native Australian species, which is regularly caught by recreational and commercial fishers in temperate waters.

Commercial culture of Yellowtail Kingfish commenced in South Australia in 1998 when broodstock were collected, conditioned and spawned at a Port Augusta by Spencer Gulf Aquaculture Pty Ltd. This was the first successful spawning of the species in the world.

Funding for a project to investigate the aquaculture potential of Yellowtail Kingfish was provided through the Rail Reform Transition Program initiated by the Australian Department of Transport and Regional Services, with the long term aim of stimulating new employment opportunities in the region. Regional South Australia had suffered job losses following the sale of Australian National Railways in 1997, and needed to develop a new industry with export potential, which could build on the strengths of the region.

Early larval rearing trials produced in the order of 6,000 fingerling that were on-grown in sea cages and demonstrated the extraordinary growth capability and market potential of this species.

The industry has since undergone rapid expansion. It now boasts two commercial hatcheries, located at Port Augusta and Arno Bay. Grow-out to market size of 3 – 5+ kg is conducted in sea cage farms at Port Lincoln, Arno Bay, Franklin Harbour and Fitzgerald Bay. Many other sites are also suitable for Yellowtail Kingfish aquaculture in South Australian waters.

An “Aquaculture Industry Market Assessment” report prepared by Marc Makrid and Associates dated May 2002 stated that “the potential for Yellowtail Kingfish is substantial based on either its prominence as part of the Japanese cuisine or its marketing as a more general (but high end) use in the international market.

A report prepared by Econsearch Pty Ltd for the Seafood Industry Development Board September 2002, reported the following estimated projections for farmed marine finfish in South Australia :

Year	Whole Weight (tonnes)	Value (\$million
2000/01	45	0.9
2001/02	1,100	8
2002/03	2,650	20
2003/04	3,200	24
2004/05	4,000	32
2005/06	5,000	40

In June 2000, Invest Australia (Australian Government) produced a report entitled “Making a Case: Investment Potential in the Upper Spencer Gulf”. This report stated that marine finfish was seen as a rapidly emerging industry in the Spencer Gulf.

The Yellowtail Kingfish industry is now the largest marine finfish industry in South Australia after the Southern Bluefin Tuna aquaculture industry and is the largest sector of SAMFFA.

The Kingfish sector has been a significant investor in the State’s regional economies, so far having invested some \$30 million.

Over the next decade, production is expected to increase further as quality seafood shortages emerge in world markets.

“Investing for Tomorrow’s Fish” (The Fisheries Research and Development Corporation R&D Plan 2000 to 2005), states that “By 2020, Australia is expected to have a population of between 22 million and 23 million, and seafood demand is expected to have risen about one-third (by about 80,000 tonnes per year, to 300,000 tonnes) from that of 1999.”

Currently, some 140 direct jobs have already been created on the Eyre Peninsula, with further casual staff being recruited to assist with production peaks. It is estimated that an additional 300 jobs will have been created from the multiplier effect on ancillary industries, such as engineering, transport, boat manufacture, cage manufacture, retail, building, tourism and business services. Tonnages may well increase to a level where employment levels can be expected to mirror the levels experienced by the Southern Bluefin Tuna industry, which grew from some 350 persons to over 1,000 persons in seven years.

Internationally, the culture of Yellowtail (*Seriola quinqueradiat*.) commenced in Japan (where it is known as Hamachi), through the collection of wild fingerlings in the 1920’s and rapid industry expansion occurred through the 1970’s when production rose from 50,000 tonnes pa to 160,000 tonnes pa, which remains the current level of production. The Japanese industry is still mostly reliant on collection of wild fingerlings and juveniles. Feeding remains largely based on wet diets using a combination of baitfish, binders and vitamin and mineral pre-mixes. In addition to Hamachi, Yellowtail Kingfish (Hiramasa) or gold striped amberjack is also cultured in Japan but production is less than 5,000 tonnes. Other countries embarking upon Yellowtail culture now include New Zealand, Spain (*Seriola dumerili*), Ecuador (*Seriola mazatlana*) and USA (*S. dumerili*)

## **BUSINESS ENVIRONMENT**

In its report “Agriculture: Towards 2015 / 30” published in July 2000, the United Nations Food and Agricultural Organisation (FAO) estimated that by 2030, annual global fish consumption would rise by 25%, consuming 150-160 million metric tonnes. However, the sustainable yield of marine wildcatch fish was estimated at approximately 100 million metric tonnes.

Therefore, aquacultural output, growing at 11 percent a year over the past decade, is the fastest growing sector of the world food economy. In 1950, aquaculture provided less than 1 percent of the fish supply, now it accounts for some 30% of the world fish market.

Climbing from 13 million tons of fish produced in 1990 to 31 million tons in 1998, fish farming is poised to overtake many forms of land based animal farming as a food source.

There will therefore be a worldwide demand for quality seafood and customers will be concerned that any food consumed will be at an acceptable standard. The Yellowtail Kingfish aquaculture industry is poised to tap into this world market.

Worldwide, customers are prepared to pay premium prices for healthy food, grown in a healthy environment and overseas buyers increasingly require environmentally certified products.

Therefore a major goal of the Yellowtail Kingfish industry is to be seen as internationally “clean and green”. This will require the product and the industry to be appropriately certified at world’s best practice standards.

### **Products and Processing**

Yellowtail Kingfish is positioned as a premium quality product, aimed predominantly at the sashimi and “white tablecloth” seafood markets.

In these markets, customers prefer the fish to be grown to approximately 5 kgs.

The fish can be sold whole fresh, whole frozen, filleted, skinned and boned as required, in cutlets or portion packs.

### **Marketing**

#### **Key points:**

- World demand for seafood is increasing, whilst supply (particularly of quality seafood) cannot keep pace with demand.
- Kingfish needs to be positioned as a high quality seafood product.
- The main selling points of Yellowtail Kingfish are that it is very healthy to eat and is grown sustainably in a pristine marine environment.
- Efficient farming technologies ensure that the cost of production will meet market expectations and allow the industry to be competitive in world markets.
- The fish is well known in Asia, and USA, but is not as well known in Europe.
- Markets requiring high quality sashimi and white tablecloth hotels and restaurants are being targeted, predominantly overseas, in Asia and USA. However, European and Australian markets are being developed.
- Therefore, targeted market research, marketing and branding of the product is required, particularly in Europe and Australia. Customers will only pay a premium for the product if they know the features and benefits of the fish.
- International quality assurance is critical to sales. Rigorous environmental monitoring and recording standards are required.
- As a result of product trials, potential customers appear to like the product. Appropriate pricing is the key to sales. The quality and versatility of the fish is attracting the attention of international supermarkets.
- Present economies of scale, production and logistics costs tend to make the product expensive for the frozen market.
- Overseas representatives are required in the markets to develop the brand image and establish “pull – through” orders.

- Long lead times are required to produce a marketable product (18 months – 3 years).
- Overseas markets such as Asia and Europe are potentially huge. Therefore production must be planned well in advance in order to meet future demand.
- Farms may need to specialise to produce products with characteristics to suit particular markets, such as size, fat content etc.
- Therefore farms may need to cooperate in order to service the range of potential customers.
- Fluctuating exchange rate may be a risk.

### **Features and benefits - Drivers**

The main selling points of the product are that:

- It tastes great
- It is safe to eat
- It is a quality product
- The product and the industry are “clean and green”, and have integrity. It is healthy eating. High in protein, vitamin B, Omega 3, Omega 6 and iodine, low in cholesterol.
- It is good looking –presents well.
- It is convenient and easy to cook.

Yellowtail Kingfish has already cemented itself in a number of world markets as a high quality and extremely healthy food. The industry is confident that its product has great export potential over the next decade. In Japan, for example, *Seriola lalandi*, known as Hiramasa, is ranked second only to Southern Bluefin Tuna as a sashimi product.

In relation to sustainability, a number of companies within the industry have already been accredited to the world environmental management standard, ISO 14001. Kingfish aquaculture companies wishing to establish a quality brand are planning to meet the ISO 14001 standard this year. This commitment appears to be unique amongst Australian industries.

The January 2003 Qantas Magazine sings the praises of this quality product. An article by Neil Perry states that:

“Their (South Australian farmed) Kingfish is a handsome creature, weighing in at around 4 kilos, firm fleshed and bright eyed. The flesh itself has an incredibly high fat content, somewhere around 24%, which makes it higher in fat even than salmon. The taste is simply awesome and the texture is rich and creamy. It is simply the best farmed fish product I have ever tasted. It can be cooked, and is delicious, but has to be eaten raw for the sweet flavour to truly stand out”.

### **International competition**

The product will not compete on price in the international commodity market, but rather on its, and Australia’s, clean and green reputation, plus its safety, quality and convenience.

In addition to its great taste and looks, customers will pay a premium to feel confident that they know where it grows, how it is grown, what’s in it and what’s on it.

Competition can be expected from other countries catching or farming the same or related species or from other high quality seafood. However, the industry expects



that international competition will not be able to supply the expected international demand.

Therefore, the main characteristics of the business environment are:

- A large up front capital investment is required in fish farm facilities.
- Other major costs are labour, feed and transport.
- Long lead times to produce marketable product (18 months – 3 years).
- There are various potential markets for various product types.
- Returns will vary according to target market, and varying cost of production.
- Farms will need to cooperate to be able to service the potential range of customers,
- Market research and marketing are required, to identify best market opportunities.
- Markets predominantly export, but Australian market may be developed.
- However, the supply chain is undeveloped and requires significant development.
- Potential demand may outstrip supply, therefore industry must be able to ensure continuity of supply.
- Seasonal harvesting can match supply demand in northern hemisphere countries and needs development to match customer needs.
- Fluctuating exchange rate may be a risk.
- Quality assurance is critical to sales.
- Improved quality assurance will require higher competency levels in workforce.
- The amount of and type of processing has yet to be determined.
- There are limited specialist export certified processing facilities in South Australia.
- The distance between fish farms and processing facilities is critical.
- Refrigerated transport is required.

## **RESEARCH AND DEVELOPMENT**

Research and Development must:

- be developed across the whole of the supply chain –from hatchery to plate,
- take account of stakeholder needs.
- take account of industry's need for a competitive advantage.
- be focussed on implementation of outcomes.
- be regularly reviewed.
- strive to achieve world's best practice.

This R&D plan identifies the strategic areas, which need to be addressed in order to accelerate the sustainable growth of the industry in an economic, social and environmental sense.

Research and development is cyclical. An area of investigation is identified and research undertaken. The results of the research cause policies and practices to be reviewed, revised and implemented, constantly aiming for world's best practice. Any industry "standing still" will be overtaken, so constant monitoring of these practices raises the need for further research and development.

The following quote from the wine industry is also relevant to the Yellowtail Kingfish aquaculture industry (reference "The Australian Wine Industry – Success

Through Industry Leadership, Planning And Innovation” Prime Minister's Science, Engineering And Innovation Council 1999):

“Without appropriate research funding, new knowledge is not generated and, without continual industry input, the right research will not be performed. Second, without communication, even the most useful R&D outcomes remain meaningless. Finally, without an educated work force, even the best research and communication strategy is inconsequential.”

“Equally important, however, has been the transformation of grapes and wine into a value-added knowledge-based product with inputs from education, research, production and marketing, supplemented by continuous benchmarking and technology transfer. Research and education with an industry focus have been indispensable for the establishment of a ‘learning culture in pursuit of excellence’.

Over the period of this Yellowtail Kingfish R&D Strategic Plan, a range of issues will be addressed. These issues are all inter linked and outcomes in one area will affect other areas e.g quality certification affects farm management practices, processing and marketing.

However, research and development takes time, and not all issues can be addressed at once.

This plan proposes that the following objectives be addressed in relation to the Yellowtail Kingfish Aquaculture Industry:

### **Objective 1: SUSTAINABLE FARMING ENVIRONMENT / INDUSTRY GROWTH**

#### **Planned Outcome:**

To develop an ecologically sustainable Yellowtail Kingfish industry that meets and exceeds consumer and community expectation.

#### **Strategies:**

- 1.1: To increase the knowledge of the environmental effects of Yellowtail Kingfish aquaculture.
- 1.2: To develop knowledge, processes and technologies that result in environmental certification of Yellowtail Kingfish aquaculture.
- 1.3: To understand the assimilative capacity of the environment in response to Yellowtail Kingfish aquaculture and apply this knowledge in farming practices.
- 1.4: to increase and apply knowledge on site selection factors and to develop decision tools to improve the planning certainty for Yellowtail Kingfish aquaculture.

### **Objective 2: FISH HEALTH**

#### **Planned Outcome:**

To ensure the highest level of fish health based on appropriate risk planning and management

#### **Strategies:**

- 2.1: To improve knowledge of diseases and pests of Yellowtail Kingfish.

2.2: To develop environmentally sustainable methods of preventing fish diseases and develop sustainable treatments.

2.3: To establish and maintain a health emergency response plan for Yellowtail Kingfish aquaculture.

### **Objective 3: FISH QUALITY/ FOOD SAFETY**

#### **Planned outcome:**

To ensure the product is recognised at the highest international standard for its quality and safety.

#### **Strategies:**

3.1: To understand the factors which determine the intrinsic quality of the product.

3.2: To determine what evidence is required by markets and consumers, in order to prove quality and safety.

3.3: Obtain appropriate international certification.

International markets increasingly require traceability assurance that food products are free of contaminants. The industry supports research to determine levels of heavy metals, PCB's, dioxins etc in farmed Yellowtail Kingfish. This information will potentially facilitate access to the large export markets required to allow expansion of production.

### **Objective 4: PROCESSING / VALUE ADDING**

#### **Planned Outcome:**

To ensure that sufficient appropriate internationally certified processing facilities are available in South Australia which are able to meet customer requirements and obtain the highest value for the product.

#### **Strategies:**

4.1: To accurately determine the present and future processing and value adding requirements of customers.

4.2: To establish or improve technology in South Australia to meet customer requirements in the areas of processing, packaging, improved product quality and shelf life.

Research and development issues that need to be addressed are:

- South Australia presently needs to increase its processing capacity for finfish.
- Some overseas markets prefer to process product overseas (as they have under utilised capacity). Strategies need to be developed to ensure that value adding occurs in Australia.
- Processed products attract higher tariff rates.
- Fresh, healthy product attracts a premium. Therefore projects need to be considered which can extend the shelf life of the product.
- Suitable packaging methods need to be developed and adopted to meet overseas requirements (eg. USFDA limitations on vacuum packed or gas water fired products)

## **Objective 5: MARKET DEVELOPMENT / SUPPLY CHAIN DEVELOPMENT**

### **Planned Outcomes:**

To undertake market research in order to obtain customer requirements in each of the target world markets, USA, China, Hong Kong, Singapore, Europe including Germany, Italy and the UK.

Using this information, develop, implement and review an industry marketing plan which positions South Australian Yellowtail Kingfish as a premium product.

### **Strategies:**

5.1: To determine customer product requirements, packaging requirements, traceability etc.

5.2: To develop an appropriate brand which reflects the fact that the product achieves all customer requirements.

5.3: To define and improve distribution channels and logistics for the product.

## **Objective 6: PEOPLE DEVELOPMENT TRAINING AND SUPPORT**

### **Planned Outcome:**

To ensure that all staff engaged in the Yellowtail Kingfish Aquaculture industry are competent to undertake their function. That is, they have appropriate knowledge and skill and can apply that knowledge and skill on the job.

### **Strategies:**

6.1: To determine the particular knowledge and skills required by people working in the industry.

6.2: To determine how this knowledge and these skills are applied and assessed on the job.

6.3: To convert codes of practice or protocols into training programs which can assess competence.

6.4: To determine and deliver the most appropriate forms of training and assessment.

All of the R&D projects will require associated industry training programs in some form.

Focus areas will be animal husbandry, fish health, product quality, environmental standards, emergency protocols and occupational health safety and welfare (OHS&W)

## **Objective 7: COMMUNICATION**

### **Planned outcome:**

To ensure that the industry is perceived to have integrity and is a good corporate citizen by all stakeholders.

### **Strategies:**

7.1: To improve the participation, consultation and communication processes between the industry, other stakeholders and customers.

7.2: To assist government, stakeholders and communities to understand the industry, and its value to South Australia.

7.2 To actively communicate the industry's sustainable development strategies to the public via a range of media.

7.3: To communicate policies and programs that have provided generic benefits to a wide range of stakeholder interests.

7.4: To communicate appropriate results of R&D projects to other stakeholders, where this does not affect the maintenance of the industry's international commercial advantage.

7.5: To Communicate the detailed, orderly and strongly regulated nature of State Government resource allocation procedures and environmental assessment and monitoring procedures to those in the community.

A range of different perceptions are held about aquaculture, by the various stakeholders. Unfortunately, because this industry is in its infancy, little data is presently available upon which to make informed decisions. Consequently, most of these perceptions are not based on scientific research in Australia.

The industry is keen to liaise with all stakeholders in the identification of R&D projects and to establish transparent world's best practice standards.

## **RESEARCH AND DEVELOPMENT PRIORITY AREAS for 2003/4**

1. On 7 February 2003 an FRDC funded industry R&D planning workshop was convened by SARDI in Whyalla. All stakeholders presented their issues relevant to the activities of the industry, research in progress, potential linkages related research and options for funding. Discussions were held to finalise research needs and priorities. Prior to this workshop SAMFFA had met to work out their collective R&D needs and priorities and these have been adopted within the this R&D plan. These priorities are encompassed under the following headings:

### **1. Fish Health.**

<b>Research Issue</b>	<b>Priority</b>	<b>Cost and Time Needed</b>	<b>Complexity of Research</b>
<b>1. FISH HEALTH</b>			
1.1 Risk identification and analysis <ul style="list-style-type: none"> <li>• Unprepared for fluke impacts</li> <li>• Numerous potential pathogens – Japan &amp; China</li> </ul>	Highest	Medium	Medium
1.2 Emergency response protocols <ul style="list-style-type: none"> <li>• Cage level, farm level, State level</li> <li>• Pathology, skills, resources</li> <li>• Emergency sites</li> </ul>	Highest	Medium	Medium
1.3 Developing “next generation” techniques <ul style="list-style-type: none"> <li>• Lights, electrocharging, filter feeders, attractants, organic in-feed agents</li> </ul>	Highest	High	High
1.4 Stress measurement & management <ul style="list-style-type: none"> <li>• Husbandry effects on disease susceptibility</li> <li>• Key impacts &amp; strategies</li> </ul>	High	Medium	Medium

To date the parasite infestations have been the most significant production problem confronting the Yellowtail Kingfish aquaculture industry and this is the field of research awarded the highest priority by industry at this time.

Since 2000, when the first significant stocking of sea-cages with hatchery reared fingerlings commenced, losses worth hundreds of thousands of dollars have been experienced attributed to infestations of the skin fluke *Benedenia seriola* and the gill fluke *Zeuxapta seriola*.

The industry has quickly adopted methods available for bath treatment of fish and has instigated rigorous parasite monitoring regimes to identify onset of infestations so these can be managed to minimise losses. These treatment and management procedures represent a considerable production cost. Collaborative Australian Research Council (ARC) funded research is being undertaken led by Dr Ingo Ernst (University of Adelaide) to develop an integrated parasite management strategy for the industry.

This involves developing an understanding of the life cycle of each parasite type and the infection dynamics between fish, parasite and the environment. Assessment of available and emerging treatments is also included in this research.

It is known that Yellowtail Kingfish are susceptible to range of potential disease causing organisms. The industry recognise the importance of risk assessment and regard preparation for the possible exposure to introduced diseases as a significant threat.

Three highest priority fish health related projects have been identified. These are:

#### 1.1 Risk identification and analysis.

Both parasites that currently afflict the industry are also major problems in the Japanese kingfish industry. Given the range of pathogens to which Yellowtail Kingfish are known to be susceptible in Japan and China there is a need to undertake a risk assessment to determine likely implications from any introduction.

#### 1.2 Emergency response protocols.

The industry believes that it should be prepared for the threat posed by introduced diseases. Strategies need to be developed that will allow immediate action in the event of their detection in Australia. These strategies need to encompass all procedures to be followed at the cage, farm, State and national level. All issues that may inhibit the ability of industry to respond immediately with remedial actions need to be identified and agreed processes established in advance.

#### 1.3 Development of “next generation” technologies.

Novel methods to combat parasites and diseases (eg. organic anti-parasitic feed agents, lights, electrocharging, filter feeders, attractants etc.) need to be assessed. Information required to gain approval for use for effective agents identified needs to be acquired through research. It is recognised that this approval process may require significant funding. Expanding the number of options available for treatment will be beneficial to the industry particularly if these reduce the cost of treatment and have marketing advantages.

#### 1.4 Stress monitoring and management.

Other fish health related research conferred a lower priority include studies to determine the relationship existing between, husbandry practices (eg. feeding strategies, net changing), levels of stress and susceptibility to disease.

## 2. Industry Sustainability

Research Issue	Priority	Cost and Time Needed	Complexity of Research
<b>2. INDUSTRY SUSTAINABILITY</b> <b>2.1 Food Safety</b> <ul style="list-style-type: none"> <li>• Levels of heavy metals, PCB's etc in cultured fish.</li> <li>• Determine potential fish diseases, which may be contracted by humans. (Such as Coccidia)</li> </ul>	High	Low – Medium	Low
<b>2.2 Processing &amp; packaging technologies</b> <ul style="list-style-type: none"> <li>• USFDA requirements for imports</li> </ul>	High		
<b>2.3 Nutrient Impacts &amp; Carrying Capacity</b> <ul style="list-style-type: none"> <li>• Industry monitoring methodologies</li> <li>• Modeling tidal flows</li> <li>• Seasonal Algal Patterns &amp; indicator species</li> </ul>	Medium	High	High
<b>2.4 Sea Floor Impact Analysis</b> <ul style="list-style-type: none"> <li>• Ecology of different benthic systems</li> <li>• Environmental certification</li> <li>• Impact of Seafloor on Disease Management</li> </ul>	Medium	Medium	Medium
<b>2.5 Broodstock Bloodline Development</b> <ul style="list-style-type: none"> <li>• Stock growth, disease resistance &amp; quality</li> <li>• Tracing desirable traits through markers</li> </ul>	Low	High	High

### 2.4 Seafloor Impact Analysis

- Ecology of different benthic systems beneath and surrounding farms.
- Interaction between parasite life cycle (eg. fluke eggs on sea floor) and benthic systems; and implications to parasite management.
- Farm management across tide rather than with tide (to avoid spread of disease).

### 2.5 Broodstock bloodline development.

- Stock growth, disease resistance, meat quality, tracing desirable traits for the market.

### 3. Stock Security

Research Issue	Priority	Cost and Time Needed	Complexity of Research
<b><i>STOCK SECURITY</i></b> Containment Technology <ul style="list-style-type: none"> <li>• Use of antifoulants to reduce net changes</li> <li>• Steel cages?</li> <li>• Wire trace predator resistant nets</li> <li>• Electronic predator repellants</li> </ul>	High	High	High
<b><i>Predator Ecology</i></b> <ul style="list-style-type: none"> <li>• Shark ecology &amp; relationships to farming</li> </ul>	High	High	High
Recapture methods <ul style="list-style-type: none"> <li>• Escapee behaviour and capture strategy</li> <li>• Fish trap technology – size variation, specificity</li> </ul>	High	Medium – Low	Medium
Study Tour for Farm Management <ul style="list-style-type: none"> <li>• Containment technology</li> <li>• Predator control</li> <li>• Fouling control</li> <li>• Escapee management</li> </ul>	High	Medium	Low

#### 3.1 Containment Technology

- Use of anti - foulants to reduce net changes.
- Development of steel cages, predator resistant nets.

#### 3.2 Understanding of predator ecology

- Shark ecology and relationship to farming, danger periods etc.

#### 3.3 Recapture methods

- Escapee behaviour and capture strategy.
- Fish trap technology, size, variation, specificity.

#### 3.4 Technology Transfer (need to ascertain overseas best practice)

- Containment technology
- Predator control
- Fouling control
- Escape management

Over time direction will shift from short term “tactical” research addressing immediate needs, to longer term “strategic” research as industry consolidates. At this time it is expected that production efficiencies and cost reduction methods will become increasingly important.



## **LINKAGES TO OTHER R&D PLANS AND RESEARCH PROGRAMS**

This strategic R&D plan interfaces and supports action plans prepared by Aquaculture Industry representative bodies at the State and national level. This plan identifies areas of research specifically required for the Yellowtail Kingfish industry sector, but it supports overarching aquaculture industry directions for development as outlined in various plans.

Examples are:

**1. The Australian Aquaculture Industry Action Agenda (Dec. 2002) based upon recommendation from the National Aquaculture Development Committee.**

- Implementing an industry driven action agenda, ensuring that research and innovation is industry driven.
- Growing the industry within an ecologically sustainable framework.
- Investing for growth
- Promoting aquaculture products in Australia and globally
- Maximise the benefits of research and innovation

**2. The State Action Plan - South Australian Aquaculture Council (November 2002)**

- Ensure that the future of South Australia's aquaculture industry is optimised.
- Improve industry / government interaction while minimising impacts on the environment.
- Improve access to resources, streamline the current licensing and approvals system.
- Minimise the risks of disease.
- Optimise investment and enhance marketing capabilities.
- Develop a culture within the industry which that ensures a common focus.

**South Australia's Fisheries and Aquaculture Research and Development Strategy 2002-2007**

**Key Goals are:**

**1. Natural resources are utilised in a way that can be maintained indefinitely**

**Priorities:**

Define resources and create objective measures of the health of resources.  
Define threats to resources  
Develop ways to manage threats  
Predict how changing a threat affects the health of the resource  
Enhance governance arrangements

**2. Ensure that the seafood industry is efficient, profitable and environmentally responsible.**

**Priorities:**

Eliminate technical barriers to improved social, economic and environmental efficiency.  
Evaluate the non biological implications of regulation.  
Identify the best use and highest economic value for seafood production.  
Promote the true value of fisheries and aquaculture to the community at large.

### **3. Increase the professionalism and effectiveness of people in the industry and those providing support services to the industry.**

#### **Priorities:**

Increase communication among and between industry participants and service providers.

Develop leadership and communication skills in industry participants.

Enable participatory co management of resources at the decision making level.

## **REVIEW PROCESS**

### **The Future**

The success of this Strategic R&D Plan will depend on the ability of the industry, stakeholders and research providers to undertake projects that address the priorities identified. Any research pertaining to the Yellowtail Kingfish aquaculture industry must be completed in close collaboration with the industry who will primarily be responsible for implementation of outcomes.

Research management, monitoring and review will be important to the success of this Strategic R&D Plan and will be a core role of the industry R&D Steering Committee. The industry is constantly evolving and it is recognised that the plan will need to be adjusted to accommodate changes in R&D priorities as these arise.

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