Marine aquaculture is a technology driven industry which relies heavily on research to develop new species and the appropriate technology for commercial production. At present, marine aquaculture in South Africa is dominated by molluscan shellfish farming (abalone, mussels and oysters) and exciting new industry initiatives are presently underway that are exploring the culture of indigenous marine finfish. However, despite these enterprises there is considerable scope for the sector to diversify further. In fact, expanding the species base can be regarded as a prerequisite for the development of a globally competitive industry as well as for bringing appropriate technology to the small-scale, community-based operation. In most cases, all that is needed to develop species for new industries is an investment in technology. The Fisheries branch of the Department of Agriculture, Forestry and Fisheries (DAFF), together with support from local industries and universities, plays a significant role in this regard and is presently involved with a number of research projects that are investigating the feasibility of various candidate species for aquaculture, promoting environmentally sustainable aquaculture practices, and improving the biosecurity of aquaculture activities in South Africa. The research activities of the Fisheries branch are divided into 5 key areas:

1) Marine Finfish Research

Support is required for the development and/or adaptation of marine culture technologies to establish reliable breeding and rearing techniques for a number of marine finfish species. There is a need to focus on a limited number of species, while maintaining the flexibility to act on viable emerging projects. Present research addresses the culture of economically important species, such as the dusky kob (Argyrosomus japonicus), white stumpnose (Rhabdosargus globiceps) and Cape hake (Merluccius capensis). Key areas of research include brood-stock conditioning and spawning, gonad enhancement, larval rearing, grow-out, nutritional studies and growth trials.

Current Projects:

i. The effects of various environmental parameters on growth heterogeneity of larval and juvenile dusky kob – Kevin Christison, Mark Goodman, Joseph Ginindza, Brett Macey, Alistair Busby [DAFF]

ii. Effect of lipid levels on production performance, fillet quality and quality changes during storage – Joseph Ginindza, Trevor Probyn [DAFF], Peter Britz [Rhodes University]

iii. Fishmeal replacement studies: soya and sunflower extracts – Mark Goodman, Joseph Ginindza [DAFF], [CSIR]

iv. Optimizing live feed production for finfish larvae – Mark Goodman, Faith Swanepoel-Madubula, Kevin Christison [DAFF]

v. First-feeding and weaning of finfish larvae – Mark Goodman, Joseph Ginindza, Kevin Christison, Alistair Busby [DAFF]

vi. Bioenergetics of cultured fish, specifically nitrogenous excretion – Mark Goodman, Trevor Probyn [DAFF]

vii. Population genetics of Argyrosomus japonicus and the potential genetic impacts of farmed fish on associated wild fish populations – Brett Macey, Sven Kerwath [DAFF], Paulette Bloomer [UP], Rouvay Roodt-Wilding [SU]

2) Marine Invertebrate Research

Research and development of culture technologies for marine invertebrates is presently focussed on two economically important species, the South African scallop (Pecten sulcicostatus) and sea urchin (Tripneustes gratilla). Key areas of research include brood-stock conditioning and spawning, gonad enhancement, larval rearing, grow-out, nutritional studies and growth trials.
**Current Projects:**

i. The effect of algal concentration on gonad maturation in the scallop *Pecten sulcicostatus* – Dale Arendse, Grant Pitcher, Brett Macey [DAFF], Sissel Andersen [IMR].

ii. The effects of temperature on ontogenesis of *Pecten sulcicostatus* from fertilization to the veliger stage – Dale Arendse, Grant Pitcher, Brett Macey [DAFF]

iii. An assessment of cultivation potential of *Pecten sulcicostatus* in relation to selected environmental factors during grow-out e.g. temperature, algae concentration, etc. – Dale Arendse, Grant Pitcher, Trevor Probyn, Brett Macey [DAFF]

iv. Reproduction cycle and spawning activity of wild populations of *Pecten sulcicostatus* in relation to their environment – Dale Arendse, Grant Pitcher, Brett Macey [DAFF]

v. The development of an artificial diet for the production of export quality Roe from the sea urchin, *Tripneustes gratilis* – Mark Cyrus, John Bolton [UCT], Brett Macey, Deon Horstman (DAFF)

vi. Growth and development of larvae of the echinoid *Tripneustes gratilla* under laboratory conditions – Rheinhardt Scholtz, John Bolton [UCT], Brett Macey, Deon Horstman [DAFF]

3) Marine Aquaculture Disease Research

Research involving the diagnosis, biology and containment of pathogenic organisms associated with marine aquaculture candidate species is important in sustaining the marine aquaculture sector. Some of the key areas of research include morphological and molecular diagnosis, integrated pest management strategies, treatment trials and impacts and epidemiology of pathogens on farmed and wild caught animals.

**Current Projects:**

i. Development of molecular markers for rapid and sensitive identification of the fungus responsible for Abalone tubercle mycosis - Kevin Christison, Brett Macey [DAFF], Mariska Greef [UWC]

ii. Development of an Oligonucleotide probe for *Halioticida noduliformans* based on the small-subunit rRNA gene: An assessment of the prevalence of this fungus amongst live abalone holding facilities in South Africa since 2006 – Brett Macey [DAFF], Anna Mouton [Amanzi Biotechnology]

iii. Further investigations into the biology and epidemiology of *Halioticida noduliformans* – Kevin Christison [DAFF]

iv. Taxonomy and systematic of parasites and pathogens of aquatic organisms. – Kevin Christison [DAFF]

v. Epidemiology, pathology and characterisation of scuticociliates on farmed finfish. – Kevin Christison [DAFF]

vi. Disease surveillance for pathogens of farmed oysters in South Africa. – Kevin Christison [DAFF], Tertius Gouws, John Grewar [Stellenbosch Veterinary Laboratory]

vii. Targeted surveillance of farmed Abalone (*Halotis midae*) for the virus responsible for Abalone viral mortality. – Kevin Christison [DAFF], Anna Mouton [Amanzi Biosecurity]

viii. Targeted surveillance for Pilchard Herpes Virus – Kevin Christison, Brett Macey, Carl Van der Lingen [DAFF]

ix. Evaluation of dietary live yeast *Debaryomyces hansenii* on the immune system of *Argyrosomus japonicus* and its susceptibility to a protozoan parasite – Brett Macey, Kevin Christison [DAFF], Vernon Coyne [UCT]

x. Effects of temperature on the immune response of *Halotis midae* and its susceptibility to *Halioticida noduliformans* infection – Brett Macey [DAFF]

xi. Role of probiotic bacteria in abalone larval settlement and the growth and disease resistance of spat – Brett Macey [DAFF], Karusha Moonsamy, Vernon Coyne [UCT]

xii. Development of vaccines for aquacultured fish - Brett Macey, Kevin Christison [DAFF], Vernon Coyne, Ed Rybicki, Inga Hitzeroth, Ann Meyers [UCT].
4) Environmental Impacts

Marine aquaculture practices, particularly intensive feed-supplemented systems, have the potential to cause serious negative environmental impacts; affecting not only the sustainability of farm operations themselves but also other users of the coastal resource. The initial expansion of the global prawn and finfish farming sectors provide numerous examples of poor planning and implementation and to a large extent provide the basis for the current negative perception of aquaculture.

Competitive pressures, technology development and more efficient regulation is directing aquaculture towards best management or sustainable practices. Marine aquaculture in SA is poised for a rapid expansion phase as farming practices diversify and extend into new realms. It is important that past mistakes made elsewhere are not repeated and that our industry develops along eco-friendly lines through the adoption of smart design and good farm management practices.

Current Projects:

i. Re-assessment of the impact of suspended shellfish culture on sediments in Saldanha Bay - Fatima Samodien, Trevor Probyn, Andre du Randt, Alistair Busby and M. Potgieter [DAFF].
ii. Monitoring of abalone farm effluents – M. Potgieter, Fatima Samodien and Trevor Probyn [DAFF]
iii. Monitoring of aquaculture development zones – Grant Pitcher, Trevor Probyn, Andre du Randt [DAFF]

5) Harmful Algal Bloom Research

Harmful algal blooms (HABs) cause harm by producing toxins that accumulate in shellfish or fish, or through the accumulation of biomass that may impact marine life, food webs and the environment in negative ways. The number of harmful blooms, the economic losses from them, the resources affected, and the number of toxins and toxic species are all considered to have increased dramatically in recent years. HABs have particularly adverse effects on aquaculture ranging from reduced growth and reproduction to mass mortalities, which lead to significant losses in harvestable resources, and to spoiled or contaminated products.

The needs for research and monitoring are many. New tools and approaches are required to detect, analyze, predict, and manage HAB outbreaks and the associated problems they may cause. The major priorities and needs for additional capability and understanding fall into three thematic areas: Blooms, Toxins and their Impacts; Bloom Ecology, Dynamics and Prediction; and Seafood Safety, Monitoring and Public Health.

Current Projects:

a) Blooms, Toxins and their Impacts

i. Identification of toxins, their source, transfer and pervasiveness in food webs [e.g. domoic acid, yessotoxins, gymnodimine] – Grant Pitcher, Joyce Ntuli (DAFF), Bernadette Hubbart [UCT], Allan Cembella, Berndt Krock [Alfred Wegener Institute for Polar and Marine Research], Claudio Marangoni, Stuart Sym [University of Witwatersrand], Jacob Larsen [Botanical Institute of Denmark], Stacey Etheridge, Jonathan Deeds [US Food and Drug Administration]
ii. Kinetics of toxin uptake, accumulation, retention and depuration in culture animals [e.g. mussels, oysters] – Joyce Ntuli, Grant Pitcher [DAFF], Bernadette Hubbart [University of Cape Town], Allan Cembella, Berndt Krock (Alfred Wegener Institute for Polar and Marine Research, Germany)

b) Bloom ecology, dynamics and prediction

iii. Nitrogen nutrition of HABs – Trevor Probyn [DAFF], Sophie Seeyave [Southampton University]
iv. Physical oceanography and HAB dynamics – Grant Pitcher, Andre du Randt [DAFF], Drew Lucas [University of California Santa Cruz]

v. HABs and low oxygen conditions – Grant Pitcher, Trevor Probyn, Andre du Randt [DAFF]

vi. Ecology and Oceanography of HABs in upwelling systems [as a participant of GEOHAB in comparing HABs in the California, Iberia and Benguela upwelling systems] – Grant Pitcher, Trevor Probyn, Andre du Randt [DAFF], Linda Joyce, Stewart Bernard [CSIR], Raphe Kudela [University of California Santa Cruz], Ted Smayda [University of Rhode Island], Vera Trainer [NOAA, Northwest Fisheries Science Center], Paco Figueiras [Instituto de Investigaciones Marinas], Barbara Hickey [University of Washington], Teresa Moita [Instituto de Investigacao das Pescas e do Mar]

c) Seafood safety, monitoring and public health

vii. Establish instrument analysis and biological assays to detect and measure toxins – Grant Pitcher [DAFF], Bernadette Hubbart (UCT)

viii. Bio-optical detection of HABs – Trevor Probyn [DAFF], Stewart Bernard [CSIR]

ix. Bloom detection and monitoring – Grant Pitcher, Trevor Probyn, Andre du Randt [DAFF], Stewart Bernard [CSIR]