

Table B1.17 Existing research program for the Lobster Fishery (tick denotes complete or scheduled for corresponding year).

Research Project	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	Aims & comments
Logbook program and analysis of catch and effort data from the commercial fishery	✓	✓	✓	✓	✓	✓	Provide information about catch, effort and CPUE and their spatial (by latitude & depth) and temporal (by months, seasons, years) variation. This fishery-dependent data provides the "reported annual commercial catch" and the basis for an index of abundance for the biomass dynamic and length-structured models used for stock assessment. It also provides estimates of the numbers of lobsters caught and released (under minimum size, over maximum size, berried females)
Observer-based survey of the size-structure of commercial rock lobster catches	✓	✓	✓			✓	Provide information about the sizes (and maturity) of rock lobsters and their spatial (latitude, depth) and temporal (seasons, years) variation. This fishery-dependent data provides annual estimates of the size-distribution of the commercial catch that are used to fit the length-structured stock assessment model. This survey will be repeated periodically
Observer-based survey of the magnitude and species composition of byproduct and bycatch taken in lobster traps	✓	✓	✓				Provide information about the magnitude and composition of retained and discarded species caught by the commercial fishery (and their spatial & temporal variation). The data-collection component of this survey was completed over 3 years (1999-00 and 2001-02) in conjunction with the observer survey.
Survey of puerulus recruitment to nearshore waters. Investigate relationship between puerulus abundance and subsequent recruitment to the fishery	✓	✓	✓	✓	✓	✓	Provide annual estimates of puerulus recruitment; Determine whether estimates are predictive of the abundance of legal-sized lobsters in future years (medium term); Examine the relationship between recruitment and the size of the mature stock (long term); Commenced in current format in 1995-96 and provides a measure of change in recruitment over time
Development of fishery-independent survey of abundances of mature lobsters	✓	✓	✓	✓	✓	✓	Develop a fishery-independent survey of the abundance of mature lobsters. Initially, experiments were done to determine a trap design that would maximise the catch of mature lobsters (1999-00, 2000-01). Using the standard trap design the survey was repeated in 2001-02, 2002-03 and 2003-04. Repeats of this survey (frequency to be determined) will provide fishery-independent estimates of the relative change in abundance of the mature stock over time and comparison with fishery-dependent indices
Tagging program and analysis of lobster growth and movement	✓	✓	✓	✓	✓	✓	Estimate rates of growth of lobsters (across the size-range); estimate rates of movement of lobsters (south to north migration, inshore-offshore movements). Tagging also occurred prior to 1999-00. Reduced tagging since 2001-02 (opportunistic tagging of large mature lobsters only). Recapture component of program ongoing
Annual stock assessment and ongoing development of biomass dynamics and length-structured models	✓	✓	✓	✓	✓	✓	Develop models of the lobster population and fishery that can be used to assess changes in stock biomass over time and provide a risk assessment of alternative management strategies (alternative TACs in particular). Provide an annual assessment of the stock to the TAC Committee (incorporating the modelling and information from various research programs). Biomass dynamic and length-structured models of the lobster population and fishery have been developed and are updated annually. These models provide estimates of changes in biomass of the population over the history of the fishery and make predictions about likely changes in biomass that would result from alternative harvest strategies (TACs in particular)
Survey of non-commercial harvest of rock lobster	✓	✓					Estimate the annual catch of rock lobsters by recreational fishers (including Indigenous fishers) in NSW. Surveys to be repeated periodically (frequency to be determined)
Survey of unreported component of commercial catch	✓						Estimates the illegal catch for use in the stock assessment models and reports to the TAC Committee. To be repeated at intervals yet to be determined

B1.7 Compliance

Fisheries Compliance Services aim to provide protection and ensure long term sustainability in the Lobster Fishery through an effective and cost efficient advisory and enforcement program consistent with the management arrangements for the fishery.

NSW Department of Primary Industries has approximately 100 fisheries officers responsible for coordinating and implementing compliance strategies in NSW. These strategies include:

- maximising voluntary compliance
- providing effective deterrence for offences
- providing effective support services.

Approximately 75 of these fisheries officers are located in coastal areas of NSW, including ports from which the Lobster Fishery operates. The general duties of these fisheries officers include conducting patrols, inspecting commercial and recreational fishers and fishing gear, and recording rates of compliance.

Effective implementation of any fisheries management regime requires a compliance framework that leads to optimal levels of compliance within that management regime. According to the Strategic Direction for Australian Fisheries Compliance and Framework for Fisheries Agencies developed by fisheries agencies throughout Australia in 1999, an optimal level of compliance is defined as:

'that which holds the level of non-compliance at an acceptable level, which can be maintained at a reasonable cost for enforcement services while not compromising the integrity and sustainability of the resource.'

NSW Department of Primary Industries manages compliance service delivery for each significant fishing or target program through a district compliance planning process administered within the Biosecurity, Compliance and Mine Safety Division. Each district fisheries office is responsible for compliance service delivery within a geographical area, and develops a district plan based on the particular priorities associated with that area. These priorities vary throughout the state, may be determined by a focus of certain fishing activities in that area, and may also be driven by the existence of areas of importance, or sensitive habitat within that area.

The district plan for the location sets out the percentage of available time officers from that office will spend on particular compliance duties. All coastal fisheries offices in NSW focus a set number of resources toward achieving optimal levels of compliance in the Lobster Fishery through their business plans. Other target service areas, including the recreational fishery, related commercial fisheries and the patrolling of fishing closures whilst carrying out routine duties, all provide indirect compliance benefits for the fishery.

The compliance objectives for the rock lobster resource are:

- to advise and educate the commercial, recreational and marketing sectors and the general public on the management rules and promote and encourage the sustainable use of the rock lobster resource
- to maintain the integrity of the Total Allowable Commercial Catch (TACC)

- to maximise compliance with the management rules by all sectors and to apprehend and prosecute fishers involved in the illegal taking and/or selling of rock lobster.

NSW Department of Primary Industries (previously NSW Fisheries) developed and implemented a statewide compliance operational plan for the Lobster Fishery in 1999. This plan is updated annually to implement efficient and effective compliance and advisory services.

Officers regularly inspect fishers endorsed in the Lobster Fishery in relation to size limits, logbook completion and to ensure compliance with the quota management system. In addition, officers regularly inspect the marketing, retail, and recreational sectors. Rewards (funded by industry) of up to \$500 may be paid for information leading to a conviction for rock lobster related offences. Fisheries Officers have broad powers including the authority to board and search vessels and enter and search premises. Officers also have powers to seize various items connected with fisheries offences including fishing equipment, boats and motor vehicles.

The compliance level for commercial fishers in the Lobster Fishery for 2001-2002 was 86.6%, an increase of 5.6% from the previous period (NSW Fisheries, 2003). These statistics are based on a rigorous evaluation of compliance levels including minor administrative matters as well as more serious offences.

B1.7.1 Fisheries Investigation Unit

The Fisheries Investigations Unit (FIU) is an operational unit established in 2000 that consists of 10 officers positioned at various offices along the NSW coast. The FIU integrates intelligence and fish receiver functions with abalone and lobster compliance functions. Industry directly contributes to lobster compliance through funding a Fisheries Officer position.

The annual report for the Lobster Fishery summarises the performance of the fishery (including compliance) against the objectives of the FM (Lobster SMP) Regulation.

Table B1.18 is the Strategic Plan for Lobster Compliance as it appears in the Lobster Share Management Plan.

Table B1.18 Existing strategic plan for lobster compliance contained within the Lobster Share Management Plan.

Objective: Maintain or increase the biomass of mature and legal sized rock lobster (ie. rock lobster that is not a prohibited size fish - as specified in clause 7 of the Fisheries Management (General) Regulation 1995)	
Strategies	Positive input into NSW Fisheries team management approach with regard to the rock lobster fishery
	Attendance at MAC meetings
	Fisheries magazine articles
	Regular liaison with stakeholders to discuss concerns and trends
	Information given to Total Allowable Commercial Catch Committee
Objective: Minimise the number of offences committed by fishers and fish processors	
Strategies	Maintain dedicated officers in the Quota Managed Fisheries Compliance Group identified through program budgeting tasked with rock lobster compliance duties
	Maintenance of equipment needed for response capability
	Overt patrol of coastal waters targeting recreational and commercial and illegal diving activities
	Extended rock lobster compliance patrols targeting organised rock lobster thieving operations
	Covert patrols targeting rock lobster theft and illegal trade
	Prosecution of persons involved in the theft and illegal trade in rock lobster
	Accurate and relevant information provided to Magistrates to assist in sentences which reflect potential damage to the resource
	Increased profile of overt patrols
	Continued public awareness programs through information packages and advisory functions
	Submission of information reports for inclusion on the database
	Supplying specialist equipment and officers to assist other Departmental staff during rock lobster compliance programs
	Continued implementation and management of the Statewide Rock Lobster Compliance Plan

B1.7.2 Penalties

The FM Act provides for maximum penalties for individuals and corporations of 2000 penalty units, or 2 years imprisonment, or both. Currently each penalty unit is worth \$110.

A lobster offence is an offence against the share management plan, the FM Act or the Regulation relating to the taking of rock lobster. The share management plan designates the contravention of provisions of the plan as shareholder offences and or endorsement holder offences.

The Lobster Fishery has designated share forfeiture offences (see Table B1.19). If a shareholder or nominated fisher of a shareholder is convicted of a share forfeiture offence, the number of applicable demerit points is recorded against the name of the concerned shareholder. All shares held by the shareholder may be forfeited to the Minister for Primary Industries if the total number of demerit points accumulated reaches or exceeds six. Demerit points are not cancelled by the expiration of time.

Table B1.19 Share forfeiture offences in the Lobster Fishery.(Source: *Fisheries Management (Lobster Share Management Plan) Regulation 2000*)

Share forfeiture offence	Description	Number of demerit points
Contravention of cl. 16 of Lobster SMP Regulation	Contravention of quota	2
Contravention of cl. 22 of Lobster SMP Regulation	Rock lobster to have tag attached	2
Contravention of cl. 48 of Lobster SMP Regulation	Daily log sheets	2
Contravention of cl. 49 of Lobster SMP Regulation	Monthly reconciliation	2
Contravention of cl. 107 FM (General) Regulation	Interference with set fishing gear	3
Any offence under the FM Act or Regulation that is punishable by imprisonment		3

Note. Clause 133 of the FM (General) Regulation also provides for share forfeiture for failure to pay a community contribution or other amount due under the FM Act.

B1.8 Consultation

There is a range of consultative bodies established in NSW to assist and advise the Minister for Primary Industries and NSW Department of Primary Industries on fisheries issues. There are committees established to provide advice on fishery specific issues as well as consultative bodies to advise on matters which cut across different fisheries or sectors.

In addition, NSW Department of Primary Industries representatives from management, compliance and research undertake annual informal meetings with lobster fishers at a number of locations along the NSW coast. This provides an opportunity for fishers to raise issues and for Fisheries staff to provide up to date information direct to the stakeholders in the fishery.

B1.8.1 The Management Advisory Committee

Share management fisheries in NSW each have a Management Advisory Committee (MAC) that provides advice to the Minister for Primary Industries on:

- the preparation of any management plan, strategy or regulations for the fishery
- monitoring whether the objectives of the management plan, strategy or those regulations are being attained
- reviews in connection with any new management plan, strategy or regulation
- any other matter relating to the fishery.

The actual composition and role of management advisory committees is set by the FM Act and its regulations and may be altered from time to time. Current membership on the Lobster MAC includes a Chairperson who is an experienced lobster fisher, four other industry positions (including representatives from the north and south coast of NSW), a conservation representative, a recreational fishing representative, a NSW Department of Primary Industries representative and an Indigenous position (currently vacant).

The industry members of the MAC comprise representatives that are elected by shareholders in the fishery. The members hold office for a term of three years, however the terms of office are staggered and the terms of half of the industry members expire every 18 months.

The non-industry members on the MAC are appointed by the Minister for Primary Industries and also hold terms of office of up to three years. The number of non-elected members in the MAC must be less than the number of elected members.

At least two meetings are to be held each year, unless otherwise determined by the MAC. The MAC often receives advice from NSW Department of Primary Industries observers on research, compliance and administrative issues relating to the fishery. However, only members of the MAC have voting rights on the decisions of the MAC.

B1.8.2 Ministerial advisory councils

Three Ministerial advisory councils are currently established under the *Fisheries Management Act 1994*. The Councils provide advice on matters referred to them by the Minister for Primary Industries, or on any other matters the Councils consider relevant. They report directly to the Minister.

The Ministerial advisory councils currently established are:

- Advisory Council on Commercial Fishing (ACCF)
- Advisory Council on Recreational Fishing (ACoRF)
- Advisory Council on Aquaculture (ACoA).

The Lobster Fishery and each of the other share management and restricted fisheries have representatives on the ACCF. These representatives are nominated by each of the respective MACs and appointed by the Minister.

The name and composition of Ministerial advisory councils is determined by regulations under the FM Act, and may be altered from time to time.

B1.9 Interactions with other fisheries

The *Fisheries Management Act 1994* establishes a system of advisory councils who advise the Minister for Primary Industries on issues that cross fishery management arrangements in NSW. The same kinds of structures do not always exist where management issues cross jurisdictions (e.g. across state borders). The main interaction in terms of competition for the eastern rock lobster resource in NSW is with the recreational fishery. The Lobster Fishery also interacts with other commercial fisheries where lobster traps are set in the same areas as other commercial fishing gears (such as setlines, tuna long lines, fish traps and trawl nets).

B1.9.1 NSW commercial fisheries

No other commercial fisheries in NSW are permitted to land rock lobster. Fishers, who are not endorsed to operate in the Lobster Fishery but catch lobsters as a bycatch in other commercial fisheries, must return the animals to the water. There are some species, however, that are taken as either byproduct (i.e. not targeted but retained) or bycatch (i.e. discarded) in the Lobster Fishery. These species, such as redfish and wobbegong sharks, may be taken or even targeted, by other NSW commercial fisheries.

Most lobster fishers (around 90%) are also endorsed in other NSW commercial fisheries (NSW Department of Primary Industries fisheries licensing database, 2002). Of the 147 lobster fishers actively participating in the Lobster Fishery in 2001-02, 35% participated in the Lobster Fishery only and the remaining 65% also participated in other NSW commercial fisheries. When they did so, the other fisheries involved were mainly the ocean trap and line, estuary general and ocean hauling fisheries. The percentage of lobster fishers who participated in multiple fisheries are as follows:

- 37% participated in two fisheries
- 21% participated in three fisheries
- 7% participated in four fisheries.

Although there is some conflict between commercial fishing sectors in NSW, the interaction of fishers participating in more than one fishery possibly reduces the level of conflict that may be expected if each fisher participated in one fishery only. The diverse operations of many commercial fishers in NSW means that most fishers have an understanding of the issues affecting each other and the industry as a whole.

Mullet and luderick are commonly used bait species in the Lobster Fishery, with most of these fish supplied by the estuary general and ocean hauling fisheries. A smaller proportion of bait is imported from other states (in particular tuna frames used as bait offshore).

B1.9.1.1 Ocean Trap and Line Fishery

The Ocean Trap and Line Fishery targets finfish species with bottom set fish traps and a variety of lining methods in offshore areas where the Lobster Fishery also operates. The fish trapping component of the Ocean Trap and Line Fishery has a similar operation to lobster trapping.

Approximately 49% of fishers operating in the Lobster Fishery also fished in the Ocean Trap and Line Fishery in 2001-02. These are mainly fishers who have been endorsed in the two fisheries since before the commencement of the lobster share management plan and have lobster trapping and demersal fish trapping history.

B1.9.1.2 Estuary General Fishery

Approximately 25% of fishers operating in the Lobster Fishery also fished in the Estuary General Fishery in 2001-02. The Estuary General Fishery does not directly interact with the Lobster Fishery. However, lobster fishers who are also endorsed to operate estuary hauling or meshing nets may gather species such as mullet and luderick to bait their lobster traps.

B1.9.1.3 Ocean Hauling Fishery

Approximately 17% of fishers operating in the Lobster Fishery also fished in the Ocean Hauling Fishery in 2001-02. Fishers endorsed in both of these fisheries have the ability to take fish, such as mullet and luderick under an ocean hauling endorsement for use in their lobster traps. Direct interaction between ocean hauling activities and lobster trapping are thought to be low.

B1.9.1.4 Other NSW commercial fisheries

Two lobster fishers also participated in the Abalone Fishery in 2001-02. Abalone and rock lobsters share habitat in shallow reef environments. As there is a modest increase in the number of fishers diving to take lobsters commercially, there is an increasing potential for interactions between

these two fisheries to occur. The possibility of interactions between abalone and lobster fisheries is heightened on the south coast where commercial abalone divers and lobster divers are sharing fishing areas.

NSW trawlers sometimes catch lobsters in their trawl nets, entangle and cut off lobster traps, remove lobsters from traps and damage lobster habitat with trawl gear, causing costs to the Lobster Fishery.

B1.9.2 Lobster fisheries in other states

The Queensland east coast lobster fishery consists mostly of one species of tropical spiny rock lobster (*Panulirus ornatus*) taken exclusively by diving (mainly using 'hookah' equipment). This commercial fishery operates from Cape York to 14° south latitude (north of Cape Melville) with over 90% of catch taken for the export market. Eastern rock lobster (*Jasus verreauxi*) is not taken by the Queensland fishery.

Eastern rock lobsters comprise a minor incidental catch in the southern rock lobster fisheries off Tasmania, Victoria and South Australia. The NSW Lobster Fishery takes a small amount of southern rock lobster (*Jasus edwardsii*) from the waters off the south coast of NSW. Southern rock lobster comprises less than 1% of total NSW commercial rock lobster catch.

B1.9.3 Commonwealth fisheries

B1.9.3.1 Offshore Constitutional Settlement (OCS)

The Offshore Constitutional Settlement (OCS) involves an exchange in power between the States and the Commonwealth over marine and seabed resources. These settlements aim to provide a framework for more ecologically rational management of fish populations and simplification of administration and licensing for fishers.

An OCS was reached between NSW and the Commonwealth in 1991 that defines jurisdiction over specific fisheries by area, species and gear type. This OCS is still binding and covers waters outside 3 nautical miles (nm). The Commonwealth retain jurisdiction over tuna and billfish species by the main commercial methods in all offshore waters (outside 3 nm) and over the 16 major trawl species by the methods of fish trawling south of Barrenjoey Point only. The Commonwealth Small Pelagics Fishery also extends outward from 3 nm.

Under the agreement, NSW retains jurisdiction for all species in all coastal waters (inside 3nm). North of Barrenjoey Point, the Commonwealth has ceded jurisdiction for all species from 3 nm to about 80 nm (except tuna and tuna like species and the Small Pelagics Fishery). South of Barrenjoey Point, NSW has jurisdiction for trawling inside 3 nm only, however NSW still retains jurisdiction outside 3 nm to about 80 nm for all other species, except tuna and tuna like species and the Small Pelagics Fishery.

Since the signing of this agreement, negotiations have continued between the Commonwealth and NSW in an attempt to further simplify the agreement and meet fishers' requirements and expectations.

B1.9.3.2 Eastern Billfish and Tuna Fishery

Changes in the management of the Eastern Billfish and Tuna Fishery have led to increased interaction between tuna long-liners and the Lobster Fishery in the north of the state. The season for

tuna long-lining and lobster trapping in deep water coincides. Lobster fishers are concerned about the loss of lobster traps due to float lines being tangled or severed by the long lines (TAC Committee 2002). Meetings have been held between representatives of lobster and tuna long line fishers to discuss gear conflict over recent years. Notices and maps have been distributed indicating main lobster fishing grounds on the mid-north coast and periods when lobster gear is set in the area of interaction.

B1.9.3.3 South East Trawl Fishery

The offshore component of the Lobster Fishery interacts with the South East Trawl Fishery. These fish trawlers sometimes catch lobsters in their trawl nets, entangle and cut off lobster traps and damage habitat with heavy bobbin gear, causing costs to the Lobster Fishery. Meetings occurred on the south coast in 2003 with lobster and trawler operators to discuss gear interaction. The issue has also been raised with the South East Trawl MAC.

B1.9.4 Recreational Fishery

The recreational fishery includes diving and trapping for lobsters. Diving is permitted without the use of underwater breathing apparatus. Recreational fishers are restricted to the use of one marked trap in a depth of 10 m or less.

Recreational fishers were restricted to one trap in 1936 and to a daily limit of five lobsters in 1968. In 1993, recreational fishers were restricted to the existing daily bag limit (and possession limit) of two rock lobsters. Recreational fishers must also adhere to the eastern rock lobster minimum and maximum size limits of 104 mm and 200 mm (respectively) and must return lobsters carrying eggs to the water.

Recreational lobster fishers are required to hold a recreational fishing licence. There are no tagging or tail clipping requirements for lobsters taken for recreational purposes in NSW.

The recreational fishery interacts with the Lobster Fishery because the same stock is harvested by both groups. In particular, competition for rock lobsters occurs in inshore areas where the activities of commercial and recreational lobster fishers overlap. Lobster traps used by commercial and recreational fishers (and any lobsters therein) are prone to theft as they are generally left unattended.

A 12 month survey of recreational fishing in NSW was conducted in 2000-2001 as part of the National Recreational and Indigenous Fishing Survey. An interim report by NSW Fisheries (now DPI) estimates the annual quantity of lobster taken by recreational anglers in NSW to be 7.4 t. The accuracy of this estimate is questionable, given that only nine households were identified as harvesters of lobster in this survey. The TAC Committee assumes a recreational catch of 25.8 t when determining the TACC for the Lobster Fishery, based on an earlier survey of recreational fishers concentrated on the south coast of NSW by Andrew *et al.* (1997). The TAC Committee acknowledges the need for a more detailed analysis of alternative estimates of recreational catch (TAC Committee, 2003).

B1.9.5 Indigenous fishing

Fishing for rock lobster is an element in the culture of coastal communities of the Aboriginal people of south eastern Australia. Schnierer and Faulkner (2002) report that lobster species are targeted by Indigenous communities in all coastal regions of NSW. In 1997, NSW Fisheries (now DPI) conducted a small survey on Aboriginal coastal fishing. The survey showed that Indigenous people fished regularly and that they often fished to feed large or extended families. When certain circumstances exist, the Minister for Primary Industries may issue a permit under the *Fisheries*

Management Act 1994 that authorises Indigenous people to meet specific cultural obligations with respect to traditional fishing. This may include exceeding the recreational daily bag limit of two rock lobsters per person.

The exact number of Aboriginal people directly involved in commercial lobster fishing is not presently known. While there is provision for Indigenous representation on the Lobster MAC, an Indigenous representative has not been nominated.

The NSW Government released the Indigenous Fisheries Strategy and Implementation Plan in December 2002. The strategy provides for the development of a range of initiatives and programs to facilitate Indigenous fishing in NSW. An Indigenous Fisheries Strategy working group has been formed with members from inland and coastal communities to advise NSW Department of Primary Industries on Indigenous issues and on how to consult with Aboriginal communities. The NSW Indigenous Fisheries Strategy will:

- encourage a broad community understanding of Indigenous traditional cultural fishing issues in NSW
- ensure that the importance of traditional cultural fishing is acknowledged in fisheries policy and practices, and during discussions on fisheries resource management issues
- encourage and support the involvement of Indigenous communities in the management of the state's fisheries resources
- encourage and support the involvement of Indigenous communities in commercial fishing, fishing based ecotourism, and the emerging aquaculture industry.

B2 Ecological Issues

Introduction

The aim of this section of the EIS is to describe the potential environmental impacts arising from the current manner in which the rock lobster fishery operates. A risk analysis, considering all components of the ecosystem and large-scale ecological processes, is used to identify those aspects of the existing operation of the fishery (described in Chapter B1) that could impact the environment. Those aspects of the current fishery that are assessed as having a high likelihood of compromising the ecological sustainability of the environment and/or the fishery will be identified and should be significantly modified or changed through the Fishery Management Strategy (FMS), whereas aspects assessed as posing little or negligible risk may receive little, if any, modification in the FMS (Chapter D).

In Chapter E the proposed management strategy will be assessed to determine whether its management measures can effectively reduce the risk to the environment and ensure that the fishery continues to operate in an ecologically sustainable manner. The recommendations arising from this assessment should where possible be incorporated into the management strategy for the fishery to improve the ecological performance of the fishery.

B2.1 Outline of the Risk Analysis Process

B2.1.1 Introduction

A broad range of risk analysis, risk assessment and risk management information and literature was reviewed. This information and literature covered generic environmental risk analysis principles (Standards Australia/Standards New Zealand 2000), a risk analysis and reporting framework for ecologically sustainable development in fisheries (Fletcher et al. 2002), the risk analysis terminology provided by the Food and Agriculture Organisation of the United Nations (FAO) in their online glossary of fisheries terms and definitions (<http://www.fao.org/fi/glossary>), and relevant publications in the aquatic sciences dealing with quantitative and qualitative risk analyses and assessments (Francis, 1992; Francis and Shotton, 1997; Lane and Stephenson, 1998).

A description of this risk analysis framework and the definitions of the terms used are provided below.

B2.1.2 Risk Analysis Framework and Terminology

Risk analysis is an iterative process that has three main steps: risk assessment, risk management and risk communication (see Figure B2.1). The risk analysis process is intended to provide insights about sources of risk and their potential impacts, which then enables managers to take mitigative action against undesirable outcomes.

Risk is the probability or likelihood of an undesirable event happening. This broad definition of risk reflects common usage in fisheries science (Francis and Shotton 1997; FAO, <http://www.fao.org/fi/glossary>). This definition requires that an *a priori* definition of consequence be given for the undesirable event that is being analysed. In this way, the definition of risk combines the consequence and likelihood of an undesirable event happening.