veyed through other channels. It is generally known that people are more inclined to over-estimate risks if information is held back during the risk assessment process and, with few exceptions, an early release of information is generally a positive step.

Appropriate risk communication requires not only good knowledge of the subject but also the proper use of language. While scientific terminology may be confusing to laypeople, it may also lead to misinterpretation and subsequent misunderstanding.

5.6.2 Communication with the public at large and the media

There are many ways of communicating with the public, and each of them requires specific skills. Dealing with newspapers requires careful choice of words and, since journalists mainly use their own language, it might be appropriate to request that text provided to the journalists should be cited as verbal quotation. Radio communication is often done through interviews, with questions and answers and, as in television, time constraints require quick responses.

In choosing the medium to use, one should first decide on the target audience to be addressed. The medium selected as the first platform for disseminating information will influence the spectrum of the public being addressed or informed. The consequences of starting by using a specific type of communication system can be significant. In the case of coastal aquaculture, one may wish to act through local, target-group oriented fixed (landline) telecommunications or through mobile communications (cellular radio) or even satellite communications, which might be initially accessible to fishermen and sailors first rather than the public at large. Amateur radio or specific Internet links or networks contact different audiences. In each case, it is important to realise which audience needs to be informed first. The final decision on any of these considerations is context dependent and certainly needs a case by case approach. Therefore, we are only able to point to these scenarios without giving any preference for any of the case studies outlined in this report.

5.7 Engagement and communication tools

5.7.1 General guidance

There is a need to recognise that building stakeholder relations is very different from public relations activities. As pointed out previously, in public relations, the communicator usually attempts to find the best method to 'sell' an idea. In stakeholder relations, the communicator will have to stay neutral, facilitating communication and trying to bring participants to consensus. There are a number of common rules that are well known, but have not often been followed by science experts involved in risk assessment exercises. These are briefly addressed here. :

(a) Build trust among stakeholders and the public

One has to expect that as communications to the public use quite different strategies to stakeholder communications, there is no need to attract their attention. They are already highly motivated, often sceptical and even worried and sometimes impatient to address their particular concerns. Skills are needed by the facilitator to recognise immediately these sensitivities, scepticism or hostility. A method often used to achieve an acceptable working climate in stakeholder relations and at communication meetings is to acknowledge the expressed problems, apologising for any mistakes made and sharing control. It is important to address people's doubts. Ignoring or downplaying their doubts may reduce trust among stakeholders and with the public.

(b) Simplify language and presentation

It is not advisable to omit information because it seems to be overly technical, even though risk issues may be extremely complex. Participants in communication meetings usually do understand scientific and technical issues easily, if they are properly prepared and presented, mainly through visual aids such as diagrams and graphics. Verbal presentations and printed informational material (*for example*, flyers, posters) should avoid acronyms as well as scientific jargon.

(c) Assure objectivity

It can be difficult to respond in a credible format when opinions are expressed very strongly or even in an intentionally offending manner. It should often be easy to differentiate between opinions and facts. In order to maintain credibility, the facilitator should respond to both opinions and facts in the same manner.

(d) Use proper language

Messages containing negative connotations receive more attention and are remembered longer. This is a well-known fact on which media build their business. However, risk communication is most effective when reporting what has been done rather than what has not been done!

(e) Communicate clearly

Information must be presented at the audience's level of understanding, otherwise people may feel left out or misinformed and may refuse to accept the information provided. It is important 'to know the audience' to be able to convey messages effectively. It is often helpful to use examples that the audience is familiar with. Back these with solid information to help to put the risk in perspective.

(f) Identify and discuss areas of uncertainty

Discuss sources of uncertainty, such as how the data were gathered, how they were analyzed, and how the results were interpreted. Uncertainty should be clearly indicated in logic models or influence diagrams. This demonstrates that the uncertainties are recognized, which can lead to an increase in trust and credibility.

(g) Be cautious when comparing risks

Comparing a risk with another with which the stakeholder is familiar can be helpful. But caution is required, as people's perception of different types of risk depends on a wide range of factors, as discussed above.

(h) Broad participation

Ensure that all key stakeholders and relevant organisations are involved. This will enhance credibility and ownership of the results.

(i) Know your clients

Research the interests and needs of your target audience in relation to the issues being addressed, in order to improve the focus of the risk analysis and the quality of the risk communication process.

(j) Involvement of the media in risk communications

While stakeholder communication meetings normally are designed to deal with relatively small groups, the media play an important role in amplifying risk communication to (a) reach a larger audience and/or (b) emphasise specific issues that are of wide interest. The media are not necessarily interested in solving problems but in selling news, and the best products to sell include (among others) catastrophes, controversies, conflict and fears. The operational modes to be potentially considered in risk communications are outlined below.

5.7.2 Specific tools

The core principle of effective communication is to supply what people feel that they need to know. It is surprising how often this simple concept is neglected in risk communications. Rather than conduct an objective analysis of what the public believes and what information they need to make the decisions comfortably, risk communicators typically ask technical experts what they think are the critical issues people should be told about. Communicators will also often have their own staff or expert advisors to advise on these critical issues. Such advisers may know relatively little about the needs of the stakeholders or interest groups that are the audience at discussion fora, workshops or group meetings as well as recipients of brochures, flyers and communication letters. A useful technique is to have draft communications evaluated by individuals with background knowledge and experiences similar to those who will use them.

Bridging from the public's knowledge and beliefs to an understanding of what information they need to make their decisions is one of the most important considerations in effective risk communication. However, the public's state of knowledge, beliefs and needs are not usually those that are determined by the technical experts. Earlier, we discussed that some of the general and specific knowledge individuals require to make decisions is often the product of social, psychological and economic considerations. Further, risk communications are distributed to larger groups or entire populations and each of these populations has a mix of individuals with different educational and social backgrounds, so the needs of populations will greatly vary.

A further key to effective and credible risk analysis is to clarify known relationships, agree on which are the most important, and identify areas of particular ignorance or uncertainty. A variety of tools can be used to engage stakeholders or other experts in problem formulation, exploring relationships and presenting results. Some of these can feed directly into the risk analysis process.

5.7.2.1 Influence diagrams

An important early requirement in effective risk communication is to develop a conceptual model that can be used as a framework for problem formulation and the exchange of ideas, knowledge, priorities and values. Influence diagrams were developed by decision analysts as a way to summarise information about uncertain situations, allowing effective communication between experts and decision makers in relation to an analysis (Howard and Matheson 1981; Shachter 1988).

At minimum, any communications strategy should include the development of a simple influence model based on the identified chain of events and processes linking a potential hazard to an adverse effect or endpoint. It should be developed in collaboration with expert stakeholders and using simple language. An example is presented in Figure 5.3 and 5.4, where Figure 5.3 explains the symbols used for Figure 5.4. Once the basic chain has been established, the various factors affecting the strength of the links in the chain can be explored. This process will not only provide the analyst with a much better understanding of concerns, issues and user knowledge, it will also assist in giving a sense of 'ownership' of the process to stakeholders and/or other experts. The influence diagram can then be used as a starting point for developing the more rigorous 'logic model' (Figure 5.5) and associated severity, probability and uncertainty ratings used in the risk analysis. It may also be used, modified as required by the logic model, to present the findings of the risk analysis towards the end of the risk analysis process (Figure 5.6). This will ensure that the language and concepts are those understood by the target groups.

Other examples of influence diagrams and logic models can be found in the individual case studies in Chapter 6.

5.7.2.2 Decision trees and decision analysis

Decision trees may be useful where the risks associated with alternative actions or strategies are being explored, where these may result in different endpoints or effects of concern, and where uncontrollable factors may affect the expression of a particular endpoint. The basic approach is very similar to that described above, for example, stakeholders are asked to map out the chain of events which may follow from an activity, but the chain will branch in response to specific events, actions, or choices. The probabilities associated with each branch can then be discussed and explored in more detail later by the risk analyst.

Figure 5.3 : Symbols used in the influence diagram representing different functions such as data input, scenario building, issue identification and degree of certainty

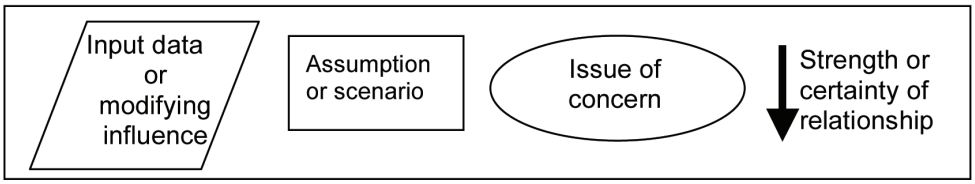


Figure 5.4 : Example of an influence diagram based on a case study presented in this report (See chapter 6.3)

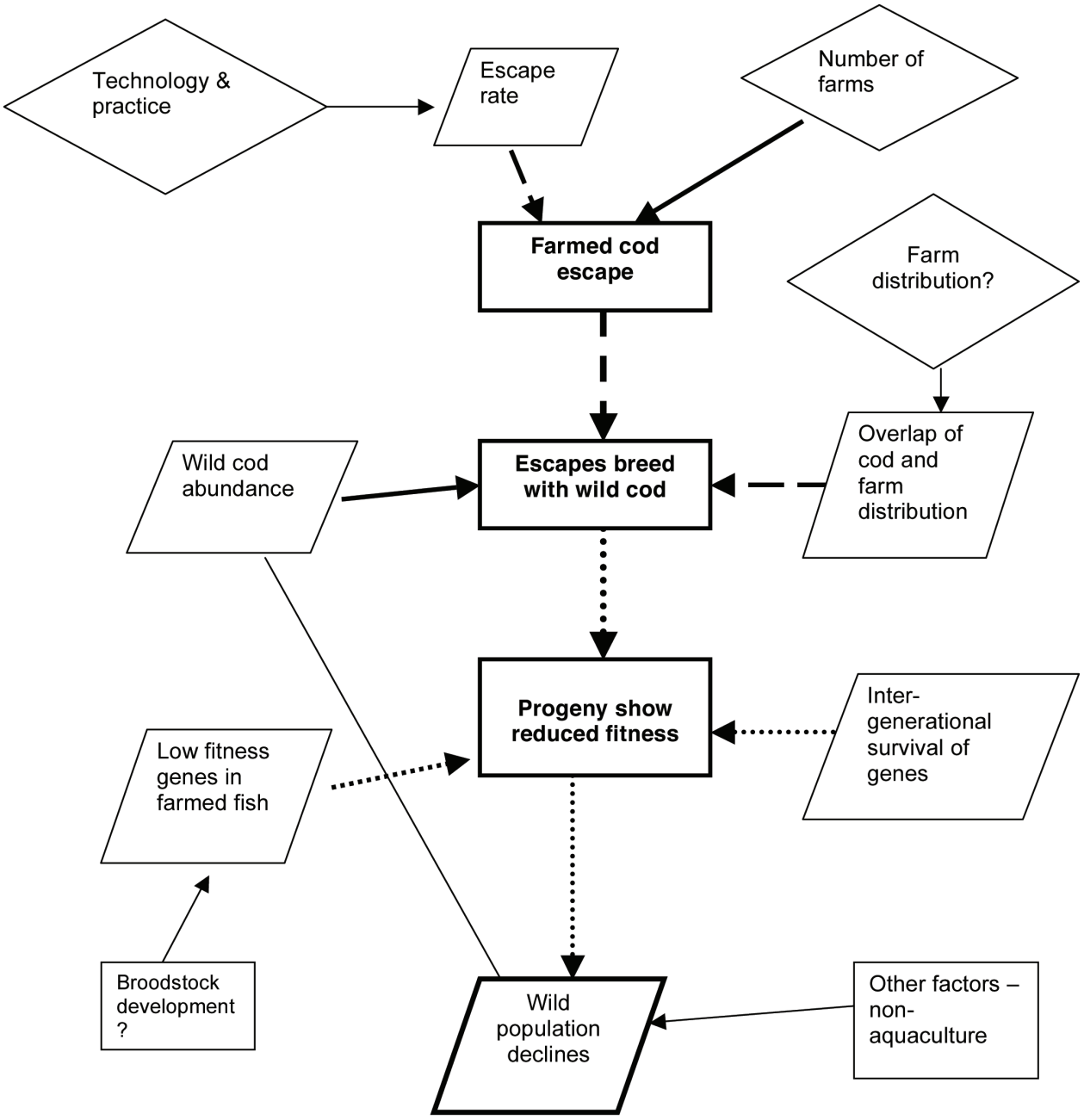


Figure 5.5 : Principle logic model which can be further developed by expert groups and used as a basis for detailed risk analysis (Standard flow chart symbols from http://www.patton-patton.com/basic_flow_chart_symbols.htm).

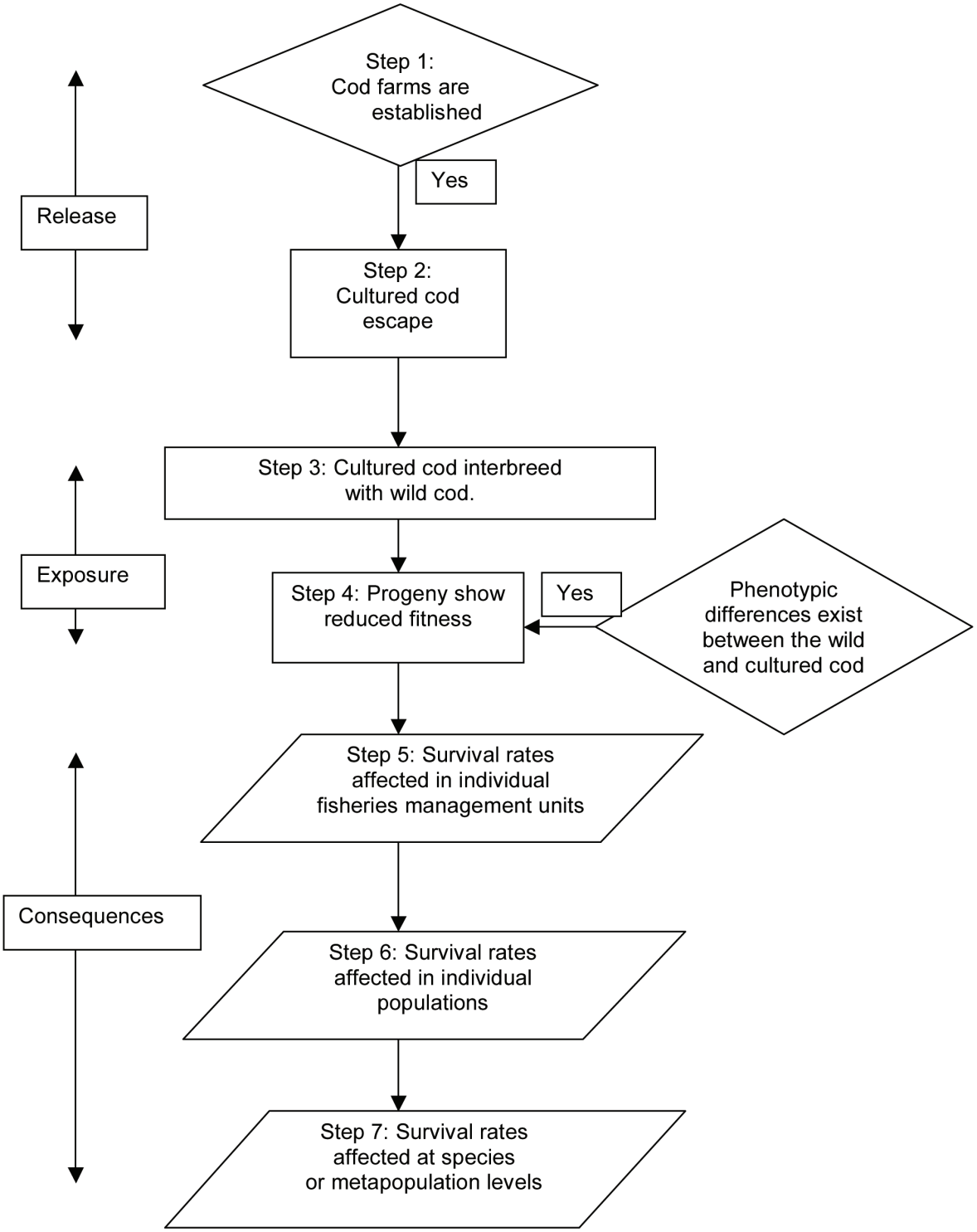
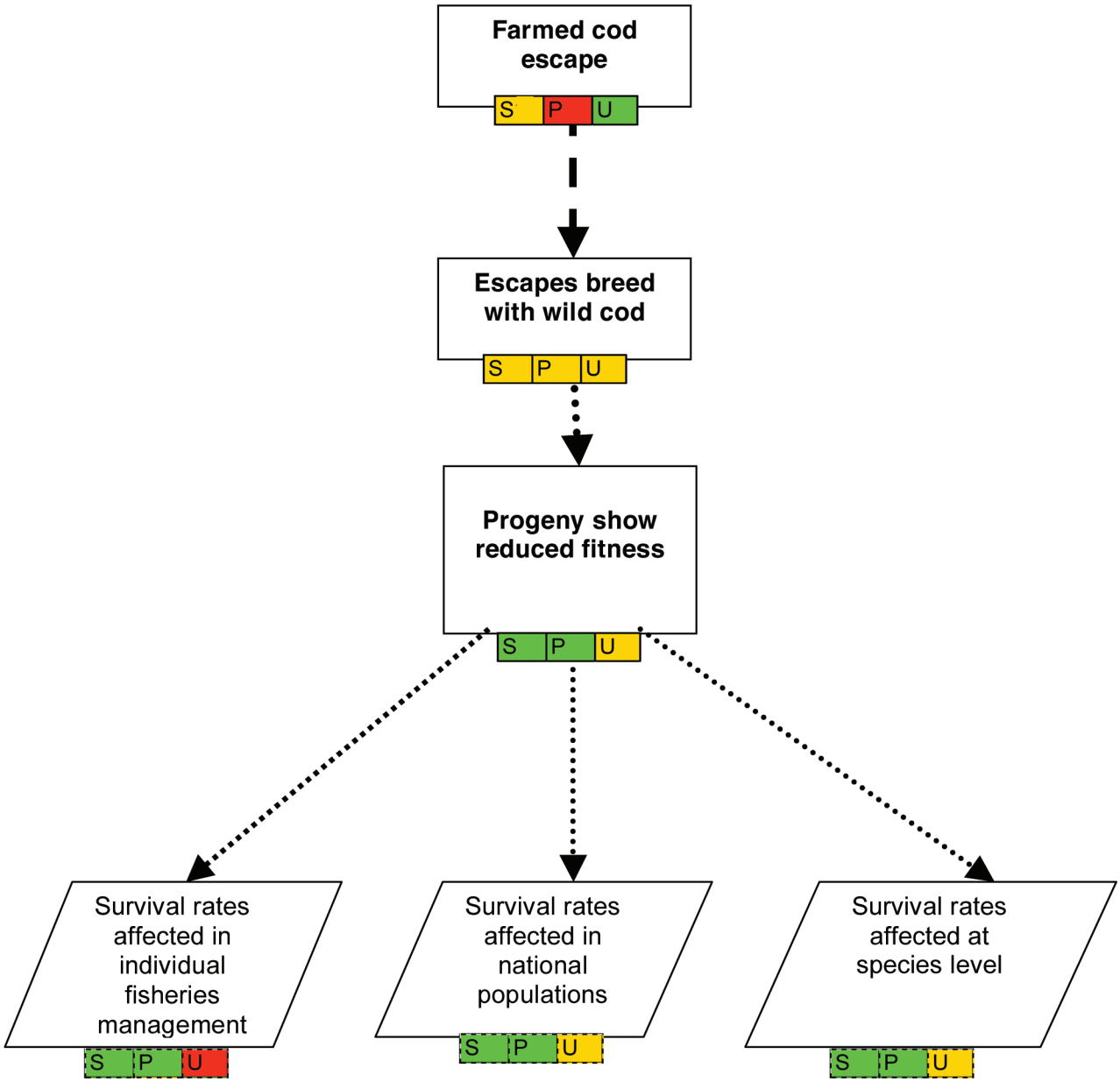


Figure 5.6 : Summary of risk analysis - used as a tool in validating and communicating results.
Colour bars reflect low (green), medium (orange) and high (red) ratings for severity (S), probability (P) and uncertainty (U) and are for illustrative purposes only



5.7.2.3 *Mental modelling*

A more sophisticated development of the above approaches is a technique called mental modelling (Morgan *et al.* 2002) which may be useful when dealing with more complex issues or sets of issues, where human perceptions are complex and varied, and where significant resources are available. It uses expert knowledge to form a framework which is developed using information from interviews with the target population. Those interviews are not questionnaire based. Such interviews run a real risk of bias by inadvertently communicating the experts' knowledge or providing clues in cases where respondents are unsure or their answer. Instead open-ended interviews are used. These interviews typically begin with very general questions like, 'What makes you choose to buy sea food rather than other types of food?' The intent is to get an immediate expression of whatever comes into the respondent's mind on the topic. Each topic that they raise is subsequently explored in more detail. In the final stage, the interview is more directed to make sure that no major factors have been overlooked. That stage may have respondents sort pictures and indicate which is relevant to the topic and their sorting process. They may be asked to solve problems using their beliefs (rather than just reporting their beliefs) and they may be asked for explicit definitions of terms commonly used.

Mental modelling: the process

1. Develop knowledge framework (detailed influence diagram)
2. Open ended interviews with target population:
   - Framed initially by user perspective (general)
   - Elaborated in response to specific questions
   - Elements of expert framework tested against user (specific)
3. Develop detailed influence diagram
4. Compare expert influence diagram with population defined influence diagram and amend focus of technical risk assessment as appropriate

The complex series of factors and interactions are mapped out in an influence diagram. Unlike the simple influence diagram generated above, corresponding to a single chain of causality, this diagram is likely to have many connections and pathways, representing the range of understanding and perceptions of the stakeholders.

The complexities typical of mental models in such circumstances can be illustrated by the example of an analysis (Figures 5.7a and 5.8a) of Canadians' mental model of the factors influencing their choice to purchase aquaculture seafood products from among the array of food stuffs available (DFO 2006).

Examining Figure 5.7a (for example, the model derived from interviews with experts) the first impression is that this is a daunting, perhaps an incomprehensible representation. This is not an uncommon problem when dealing with such a complex decision process, but patterns and relationships can be identified. To understand the diagram easily, first establish what are the major factors and influences affecting the decision. The larger ovals are factors of major influence. In the experts' model (Figure 5.7b), there are groups of major nodes that have an underlying theme. (These have been outlined in boxes drawn with dashed lines.) For example, Box A concerns risk control, regulations and industry practices. While these factors do not directly affect the choice to buy seafood, they do affect the consumer's access to seafood, which in turn influences the choice to buy seafood. Similarly the quality of communications (Box B) does not, other than point of sale communication, have a major direct influence on the choice. In contrast, Social and Cultural factors (Box D) are major direct influences, as are Perceptions of Environmental Effects (Box E).

In Figure 5.8a, we can see the process as it was revealed to interviewers by members of the Canadian public. This diagram is built as an overlay on the expert model of Figure 5.7a. In this diagram, the degree of influence is indicated by colour rather than the size of the node. Red indicates major influences and uncoloured nodes and the dashed circles and influence lines were not mentioned in any of the interviews with experts. To examine the major factors in the public decision making process, ignore the size of the circles and focus only on the colour of the node as in Figure 5.8b.

As noted earlier in Chapter 2, there are significant differences between the perceptions of the experts and those of the public. One of the first things to note is that the components of Box A were of secondary influence on the decision to purchase (Figure 5.8b), and not a major influence as anticipated by the experts (Figure 5.7b). Interestingly, while a person's social milieu was a major influence on the choice to buy, the perceptions of the socio-cultural impacts of aquaculture activities was not. Further, some factors that experts thought might be of lesser influence on the decision to purchase were actually major factors, among these were cost, access, convenience, and knowledge of appropriate preparation techniques. These are significant differences that should influence the content and delivery of any communications. It is also clear that a large number of factors influence the decision to buy, and a decision to address only one of them would limit the effectiveness of any communication strategy.

5.7.3 *Workshop and meeting facilitation*

Engaging people effectively in a communications strategy requires expert facilitation. It is vital that the facilitator is seen as neutral, and knowledge and understanding of stakeholders and issues of concern is at least as important as technical expertise, which in any case can also be provided by participants.

How many workshops and / or meetings are required in the decision making process will depend on the number of stakeholders involved, the diversity of subject areas to be covered, and the priorities by which issues have to be addressed. The latter may vary from case to case. In complex situations, it may be advisable to call for an initial meeting at which a simple agenda is set up, providing the opportunity for all stakeholders to get

Figure 5.7a : An experts' mental model of factors influencing consumers decision to buy seafood as seen by a survey of experts (DFO 2006). The size of the oval is proportional to the importance of the factor's influence on the factor (oval) or decision (box). The arrows indicate what decision or factor is influenced. Dashed arrows or ovals indicate influences not identified by the experts as important. Dashed boxes represent logical groupings of factors.