

# 5 MANAGEMENT OF THE TRADE

The major issues concerning the LRFF trade, as noted in Chapter 1, are overfishing including fishing on spawning aggregations,<sup>115</sup> destructive fishing,<sup>116</sup> wastage of both target and nontarget fish, capture of threatened species, and various social issues. Development of a sustainable LRFF fishery requires management measures to be targeted at the fishers, traders, and/or consumers. Correspondingly, there are three approaches to regulating the trade:

- fisheries management per se, i.e., managing fisheries by limiting their size (quantities of fish taken) and scope (areal and/or seasonal fishing closures);
- demand-side and trade controls using national, regional, and international mechanisms; and
- influencing consumer behavior, through codes of practice, industry standards, and consumer outreach programs.

The role that aquaculture of LRFF plays in the trade is discussed in Chapter 6. This subsector requires careful management because, although the volume of production through aquaculture is large (more than 20,000 t per year), the majority of small fish that are grown-out consists of wild-caught fish. There are clearly roles for regional/international organizations in broader aspects of managing the trade. These are discussed in Chapter 7. Finally, social issues, which have an impact on the success of managing the LRFF fisheries, are described in Chapter 4.

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<sup>115</sup> Sadovy and Vincent 2002.

<sup>116</sup> Johannes and Riepen 1995; Barber and Pratt 1997; Pet-Soede and Erdmann 1998.

## FISHERIES MANAGEMENT: METHODS AND IMPLEMENTATION

In most countries where LRFF fisheries have become established, they coexist alongside or in close proximity to traditional subsistence fisheries. This overlap implies that the impact of fishing activity for LRFF trade cannot be viewed in isolation. Managing the LRFF fishery and any coexistent non-live fisheries that target the same populations will require monitoring the activities of all resource users including fishers, buyers and/or brokers, wholesalers and retailers, government agencies, and trade associations.

Tropical reef fish fisheries tend to target many diverse species, use multiple fishing methods, involve many fishers, and be spatially dispersed, with many landing points. This complexity and a general absence of biological data make the assessment and determination of sustainable levels of harvest for all fishery sectors especially difficult, as described in Chapter 3. A characteristic feature of tropical small-scale fisheries, such as those where the LRFF trade occurs, is their “physical” (geographic, socioeconomic, and political) remoteness from decision makers.<sup>117</sup> This remoteness makes the effective implementation of management tools to control the degree of exploitation of target and nontarget species extremely difficult.

In fact, most LRFF-producing countries do not have a management strategy specifically for these fisheries<sup>118</sup> and few countries have specific legislation to preclude LRFF fisheries commencing or to close a LRFF fishery down once established. In many countries where the trade in LRFF is well established, the fishery is managed on an ad hoc basis or there may be no management of reef resources at all.

There is a range of conventional management options available for managing LRFF fisheries as well as regulatory tools that may be unique to LRFF fisheries. Basically, they can be grouped into controls over inputs and controls over outputs. This section examines some of the relevant management options. The advantages and limitations of the various tools in the context of the

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<sup>117</sup> Pauly 1998.

<sup>118</sup> Exceptions are PNG and the Solomon Islands, which are in the process of finalizing management plans explicitly for their LRFF fisheries.

LRFF trade are described in Appendix 1 and a summary of the current situation is given in Appendix 2.

## Input Controls

### *Licensing*

Licensing of fishers and/or foreign operators is one of the strongest mechanisms available to manage LRFF fisheries, in that it can recognize traditional reef ownership, create resource rents, and limit entry so as to control the intensity and location of LRFF fishing activities. The effectiveness of licensing programs however, is hindered by a lack of cohesion between and enforcement capacity of various tiers of authority. The requirement to negotiate access agreements with traditional owners, in conjunction with provincial or national government approval, while complex, can safeguard the resource and serve as a means for communities to extract payments from industry in exchange for access to the resources.<sup>119</sup> In reality, the high value of the resource, along with weak enforcement capacity and official corruption, has tended to erode the effectiveness of customary marine tenure in controlling LRFF trade activities. Disputes, whereby some traditional owners have welcomed the trade and others have not, have seen communities and governments close down LRFF fisheries.

The prospect of issuing licenses and maintaining a license program for many hundreds or thousands of subsistence fishers is limited. In many countries, licensing will likely be more effective when targeted at buyers or exporters. In Indonesia, for example, foreign companies that hold a license to export LRFF are permitted to fish only outside the 12-nautical-mile zone and license fees are based on the ships' fish holding capacity. Unfortunately such companies do not need a license to collect and export fish caught by local fishers, although such a requirement would allow better monitoring of export volumes.<sup>120</sup> In the Philippines, the export and transport of fish and fisheries products require permits from the Bureau of Fisheries and Aquatic Resources. License conditions require that the exporters maintain and submit records on the

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<sup>119</sup> In general, fishing licenses granted by national or provincial governments will be contingent on access agreements negotiated at a local level.

<sup>120</sup> Bentley 1999.

number and species of fish exported.<sup>121</sup> The fishery on the Great Barrier Reef, Australia, is a limited-license regime, requiring operators to be endorsed to catch and market coral reef finfish in either frozen or live form. Fishing effort is regulated via a cap on the total number of commercial licenses. Recently, a total allowable catch was allocated amongst license holders based on catch history. Licenses are fully transferable and can be freely bought or sold.<sup>122</sup>

A high degree of caution in some producer countries that have recently entered the trade is reflected in their use of “trial fishing” periods. Trial fishing allows limited fishing under strict and closely monitored conditions,<sup>123</sup> and can be used to collate data for further assessment.<sup>124</sup> Trial fishing represents a special form of licensing, used to grant permission to foreign vessels to fish commercially or to export fish for the specified trial period. The success or otherwise of this approach will hinge on a country’s ability to implement and enforce a licensing program. PNG, Fiji Islands, Marshall Islands, Seychelles, and Vanuatu<sup>125</sup> have all previously established trial fisheries.

### *Moratoriums*

The use of destructive fishing practices (e.g., cyanide), disputes over payments to fishers, concerns over impact of fishing on fish populations, and conflict between fishing communities over access to fishing grounds have all led to decisions to impose moratoriums on LRFF fisheries.<sup>126</sup> Access disputes tend to predominate in Pacific Island countries where coastal communities hold customary tenure rights over marine resources,<sup>127</sup> and are the result of increases in value of nearshore

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<sup>121</sup> A. Alvarez, personal communication.

<sup>122</sup> G. Muldoon 2003 (unpublished report).

<sup>123</sup> Management measures include, total allowable catch limits, use of hand-lines only to capture fish, restrictions on holding cage size and placement, size limits on target species, exclusion from known aggregation sites, fishing to take place in designated fishing areas and monitoring and reporting controls.

<sup>124</sup> Gisawa and Lokani 2001.

<sup>125</sup> For the Seychelles, see Bentley and Aumeeruddy 1999; the Marshall Islands, Smith 1997; the Fiji Islands, Yeeting 1999b; Vanuatu, Naviti and Hickey 2001.

<sup>126</sup> Johannes and Lam 1999; Donnelly et al. 2000; Padilla et al. 2003.

<sup>127</sup> See Hviding (1996) for a more detailed description of customary marine tenure practices in Melanesia.

resources. There has been a history of ad hoc moratoriums in response to biological, economic, or social concerns, but governments have also used moratoriums in a planned way to limit access to resources by foreign operators.

PNG, Marshall Islands, Solomon Islands, Seychelles, and Vanuatu<sup>128</sup> have all imposed moratoriums on fishing following trial fishing activities, although PNG still has an ongoing trial operation. In the northern Calamianes Islands of the Philippines, a moratorium on the export of LRFF was put in place during 1993–1998 in response to biological concerns. The reinstatement of this moratorium has continued to be promoted by some community members.<sup>129</sup> Similar biological concerns resulted in moratoriums in several parts of PNG since the trade began there in 1991<sup>130</sup> and in parts of the Fiji Islands.<sup>131</sup> In some countries, moratoriums have since lapsed (e.g., the Marshall Islands and Fiji Islands) and LRFF fishing activities have recommenced despite ongoing sustainability concerns. The moratorium in the Solomon Islands was lifted in December 2000, and the fishery is considered “open,” but no LRFF fishing activity has since commenced.

### *Gear Restrictions*

Fishing practices can be regulated through gear restrictions that permit specific fishing techniques, such as handlining, and prohibit others, such as dynamite and cyanide fishing. In a few countries, such as Australia, the Maldives, and PNG, handlines are the only prescribed means by which fish can be captured, although in most Pacific countries cyanide is not an issue. In all countries engaged in the trade, hook-and-line techniques are widely practiced, but usually, alongside destructive fishing techniques, predominantly traps weighted using pieces of live coral (some in which cyanide-fed bait fish are used to anesthetize the target species) and hand nets. The use of compressor diving should be discouraged, given its association with cyanide, overfishing, and diving injuries and deaths.

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<sup>128</sup> For PNG see Gisawa and Lokani 2001; Marshall Islands, Smith 1997; Solomon Islands, Donnelly et al. 2000; the Seychelles, Bentley and Aumeeruddy 1999; and Vanuatu, Naviti and Hickey 2001.

<sup>129</sup> N. Brucal, personal communication.

<sup>130</sup> Richards 1993; Johannes and Riepen 1995.

<sup>131</sup> I. Tuwai, personal communication.

The focus in many countries where a LRFF fishery is well established has been on curbing destructive fishing practices by prohibiting the use of poisons, such as cyanide. Indonesia, Malaysia, and Philippines have such regulations at the national and provincial levels.<sup>132</sup> In the Philippines, a network of cyanide detection laboratories was established in 1994 by IMA, with the assistance of the Philippine Bureau of Fisheries and Aquatic Resources, to facilitate enforcement.

Outreach and training efforts have been made in many areas to induce fishers to switch from destructive to nondestructive gear.<sup>133</sup> There has been little follow-up work, however, to gauge the long-term success or sustainability of these initiatives.

### *Zoning*

Zoning can control the distribution of fishing effort. Areas can be closed seasonally (e.g., to protect spawning aggregations) or permanently as protected areas to act as harvest refugia that provide havens for a portion of the fish populations. Zoning can also be used to address potential user conflicts so as to separate or protect user groups (e.g., subsistence fishery or ecotourism).

The vulnerability of groupers and humphead wrasse while aggregating to spawn has been widely recognized.<sup>134</sup> Some countries—Palau, Pohnpei, PNG, and in Indonesia (Komodo National Park)—have sought to protect aggregation sites from overfishing through seasonal and spatial closures. On the Great Barrier Reef in Australia, seasonal closures have recently been included as part of a new management plan, while legislation to protect known aggregation sites is also being considered. Elsewhere, such as in the Komodo National Park, the Great Barrier Reef, Ha Long in northern Viet Nam, Coron in the Philippines, and parts of the Pacific, marine protected areas have been established, the extent of which varies widely.<sup>135</sup> Such closures are not necessarily in direct response to LRFF fisheries, but as a means of

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<sup>132</sup> Bentley 1998.

<sup>133</sup> Barber and Pratt 1997; Barber and Cruz 1998; Erdmann and Pet-Soede 1998; Pet and Djohani 1998; Barber 1999.

<sup>134</sup> Sadovy et al. 1994; Domeier and Colin 1997; Johannes et al. 1999.

<sup>135</sup> On the Great Barrier Reef, it is estimated that approximately 30% of all reefal areas will be permanently closed to fishing for reef fish under new conservation management measures, but the proportion, if any, is much less in other countries.

conserving coral reef ecosystems and enhancing fishery catches through spillover effects.<sup>136</sup>

## Output Controls

### *Catch Quotas*

Catch quotas can help to maintain catches within sustainable limits. However, they have limited application in tropical, inshore multispecies fisheries that support LRFF fisheries because of the limited biological and ecological knowledge of the target fish. Catch quotas are not enforced in any of the countries currently engaged in the LRFF trade, except Australia, under proposed new management measures; the Seychelles when the fishery was active there; and PNG.

### *Export Control*

Some countries have sought to protect the more vulnerable LRFF target species by prohibiting their export for the trade, although the effectiveness of such measures varies, usually according to enforcement capacity. In Indonesia, commercial export of certain sizes of humphead wrasse is nominally prohibited. However, under specific conditions, local fishers are able to sell these wrasse to collecting companies that have obtained a business permit. Catch and export of humphead wrasse is also banned in northern Palawan, Philippines, while a memorandum of understanding between fishers and dealers in Australia has reduced “live only” exports of humphead wrasse to zero,<sup>137</sup> while the prohibited export of humphead wrasse from Palau is well enforced.<sup>138</sup>

### *Fish Size Limits*

Limits on the size of fish that can be caught help to ensure adequate spawning population. Presently, minimum and/or

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<sup>136</sup> Russ and Alcala 1996; McClanahan and Mangi 2001.

<sup>137</sup> Under new fisheries legislation, the capture of humphead wrasse and humpback grouper for both live and frozen markets will be prohibited.

<sup>138</sup> Author's (TG) observation.

maximum size limits across a wide range of species apply only in Australia and PNG, while Palau has a minimum size limit on one species, the humphead wrasse. In Indonesia, size limits have been decreed on humphead wrasse for export but these limits (above 1 kg and below 3 kg) are market, not biological, based and not enforceable. Application of size limits on grouper species has been recommended in other exporting countries including the Maldives, Philippines, and the Pacific.<sup>139</sup> With the exception of the Philippines, an absence of biological data has meant size limit recommendations are based on combination of known biology of specific species and market requirements. In Indonesia and in the province of Palawan, Philippines, there is an exemption to the minimum size if the undersize wrasses are used for aquaculture. In effect, this offers no protection to the fish because they are exported when they reach market size. They certainly have not had the opportunity to reproduce, which is the biological reason for the minimum size limit.

### *Mode of Transport*

A number of countries engaged in the LRFF trade regulate the conditions under which the fish are transshipped, requiring loading of catches to take place from designated ports, thereby strengthening the ability to monitor exports. In Australia and parts of Palawan, the use of live-fish transport vessels is banned, although the restrictions are circumvented in Palawan by transferring fish to other parts of the province.<sup>140</sup> In both Indonesia and the Philippines, permits are notionally required to transport or export LRFF, while fishing by live-fish transport vessels inside local or national waters is prohibited. In both countries, these regulations have proven ineffective.<sup>141</sup>

Generally, the mode of transport employed depends on distance to markets in Hong Kong, China and mainland PRC and the viability of shipping LRFF by air. In some of the main exporting countries—Indonesia, the Philippines, and Australia—shipments

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<sup>139</sup> Shakeel and Ahmed 1997; Smith 1997; Yeeting et al. 2001; Padilla et al. 2003.

<sup>140</sup> N. Brucal, personal communication

<sup>141</sup> For example, in the Philippines, a ban on foreign-owned live-fish transport vessels in southern Palawan is circumvented by transshipping LRFF to northern Palawan via locally-owned vessels and loading them onto foreign transport boats for export. Author's (YS) observation.

by air are approximately 50%, 90%, and 100%, respectively of total exports. Limited infrastructure in many countries precludes shipping of fish by air. In the Indian Ocean—the Seychelles and Maldives—and parts of the western Pacific, all transshipments are, or were, by sea. In these regions, a combination of distance to market, historically lower prices since 1999 (see Chapter 2) and the absence of air transport options may have contributed to the infrequent and irregular exports of LRFF on financial grounds—effectively a proxy output control.

## Traditional Controls

In the absence of management capacity, traditional ownership may be a way to control fishing activity, for example by licensing or area closures and local surveillance or enforcement. Customary marine tenure prevails throughout many Pacific countries of the region, such as the Fiji Islands, Kiribati, Palau, PNG, Solomon Islands, Tonga, Vanuatu, and Marshall Islands, and is recognized by provincial and national governments. It grants communities and clans ownership of their nearshore fishing grounds and the right to decide who can access these resources.<sup>142</sup> Similar customary laws, *Sasi*, prohibiting outsiders from fishing commercially in village fishing grounds, also exist in Indonesia,<sup>143</sup> although these traditional laws are not acknowledged by the State.<sup>144</sup>

In the Philippines, the province of Palawan has been granted control over managing its LRFF fishery resources; through the Palawan Council of Sustainable Development, and the provincial laws have sovereignty over national laws.<sup>145</sup> The decentralization of marine resource management in Indonesia has resulted in local and provincial control over LRFF fisheries. However, the lack of coordination between various levels of government effectively cripples any effort to control the trade.<sup>146</sup> In parts of the Pacific—Solomon Islands and PNG—customary marine tenure has been used to establish no-take zones.<sup>147</sup>

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<sup>142</sup> Hviding 1996.

<sup>143</sup> Adhuri 1998.

<sup>144</sup> Ministry of Marine Affairs and Fisheries 2002.

<sup>145</sup> Padilla et al. 2003.

<sup>146</sup> Ministry of Marine Affairs and Fisheries 2002.

<sup>147</sup> Donnelly et al. 2000; NFA 2002.

## Monitoring

Effective management requires active fisheries to be carefully monitored in terms of the resource and fishing effort and fish mortality. There are two general types of data that may be collected: fishery-independent data, which assess the resource independently from the commercial fishery (for example by underwater visual census or experimental fishing<sup>148</sup>); and fishery-dependent data that evaluate the resource taken by the fishery itself (for example catch per unit effort and biological data on size, age, and sex). Data should be collected at regular intervals over the long term and according to established protocols specified for each fishery. Sustained monitoring of target species and by-catch allows for effective regulation of resources, adaptive management, and the prevention of overfishing and depletion. To be meaningful, data must be species-specific and not aggregated by group (i.e., a single data set for each species of grouper versus lumping all species under the term “groupers”).

Monitoring and reporting of export volumes are undertaken in most countries engaged in the trade, although the reliability of these records is generally questionable and trade volume is almost certainly underestimated. With the exception of Australia and PNG, LRFF exports are not disaggregated to a species level. Moreover, misreporting of species and inclusion of non-live reef fish in export data is commonplace. At an aggregate level, “official” data tend to underreport exports because of the physical remoteness of fishing areas and the use of live-fish transport vessels, which results in fish movements being unrecorded both leaving the source country and upon arrival in Hong Kong, China (see Chapter 2).

## PRIORITIES FOR MANAGEMENT

An outstanding question with regard to managing LRFF fisheries is whether it is even possible to prosecute a sustained, beneficial fishery. At issue is both whether the enterprise of LRFF

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<sup>148</sup> Samoily 1997; Connell et al. 1998.

fishing can be profitable when kept on a scale consistent with the limited productivity of the resource, and whether the public management costs needed to keep the fishery within those bounds would be prohibitive. The main problem plaguing LRFF fisheries in many areas is overfishing, whether associated with destructive fishing or not. Overfishing is particularly difficult to address in reef fish fisheries and successful management of LRFF fisheries can only occur where there is strong and resolute enforcement.

The industry's frequent pattern of developing boom-and-bust fisheries, progressively farther from the market; its apparent reliance on destructive fishing methods; and the regular use of sea transport to collect fish from remote landing sites are all poor indicators of economic and biological viability. Even in countries whose experiences with the LRFF trade have not resulted in serious environmental impact, LRFF operations have generally been short-lived, often lasting no more than two or three years. Reasons include declines in catch rates, local concerns about competition with other uses of the resource, and local participants being dissatisfied with their returns.

Even the LRFF fishery on the Great Barrier Reef (GBR) with its extensive fishing grounds, supported by strong management capacity and good understanding of biological resources, is considered to be threatened from overfishing. Although a limited-license fishery, the GBR fishery was characterized by a large amount of unused capacity or *latent effort*.<sup>149</sup> Value adding of the main target species in this fishery (see Chapter 2) has provided an economic incentive for mobilization of this latent effort and led to concerns that levels of fishing effort are becoming unsustainable.<sup>150</sup>

## Enforcement

Whether the aim is to develop a sustained, beneficial LRFF fishery, keep the fishery closed, or merely mitigate its adverse effects, the management response will be costly, requiring administration, enforcement, outreach and training, and

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<sup>149</sup> Latent effort is the difference between actual fishing effort applied and the potential effort, if all license holders were to fish to their capacity.

<sup>150</sup> Mapstone et al. 2001.

monitoring, along with building capacity. Without the political will to establish and enforce policies for a LRFF fishery, investment in capacity enhancement will not pay off. Conflicts of interest and corruption from both community authorities and all levels of government are common across countries engaged in the trade.<sup>151</sup> Overcoming these weaknesses, or working around them, is often the single most important management challenge. In order to compensate the public and help rationalize the behavior of the industry, it is generally good practice to try to recover these costs from the industry, such as through license fees.

Tropical reef fish fisheries usually comprise many types of fish and fishing methods, are spatially dispersed, and have many landing points. For these reasons, effective management should not be dependent on detailed data and analysis nor intensive surveillance.<sup>152</sup> But characteristics of LRFF fisheries are quite different than the broader reef fish fisheries of which they are a part, which can both assist and hinder their regulation.

On the one hand, enforcement of management regulations and monitoring of catch and effort should be relatively easy because the fisheries target few species, fishing activity is often spatially concentrated, and exports from some countries are funneled through few points. Bottlenecks on the demand side suggest that enforcement on such issues as listed species could be exercised at major import markets. On the other hand, the remoteness of many fisheries, their long distance from centers of power, and the large number of subsistence-level participants are difficult obstacles to overcome. Lack of institutional and enforcement capacity and a limited willingness on behalf of responsible authorities to impose management restrictions remain a key impediment to successfully managing LRFF fisheries. The prospect of bilateral agreements between export and import countries appears remote given the central role played by Hong Kong, China buyers in source countries and the reluctance of these buyers to reject undersize or cyanide-caught fish upon arrival. Efforts to strengthen enforcement in source countries through using local onboard observers on foreign fishing vessels have been mostly unsuccessful, again as a result of corruption.

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<sup>151</sup> Adhuri 1998; Lowe 2002.

<sup>152</sup> e.g., Johannes 1998.

Curbing the destructive effects of the trade, both in established and developing LRFF fisheries including practices such as cyanide fishing, is often prevented by governments complicit in the trade, usually upon the receipt of small royalties that highly undervalue the resource final value.<sup>153</sup> Moreover, the lack of institutional capacity in a fishery where catches are landed over a substantial coastal area exacerbates the problem of collecting catch statistics and management reliant on that data.

Clearly, high priority should be put on curbing the use of destructive fishing methods. In encouraging the use of handline technology, the main obstacle is that most parts of the region are already overfished as evidenced by declining catch rates in the Philippines<sup>154</sup> and Australia.<sup>155</sup> Moreover, cyanide has been shown to be a more efficient capture technique purely in terms of numbers of fish caught and also average size of fish.<sup>156</sup> Ironically, the use of cyanide tends to exacerbate levels of mortality before the catch reaches the consumer, although traders have already factored in the costs of this and other types of mortality to their costs. Poor handling husbandry, holding, and transportation practices will exacerbate this mortality, which ranges up to 80%.<sup>157</sup>

One important strategy for preventing fish population depletion is keeping especially vulnerable species and large portions of the reef off-limits to the LRFF fishery. The permanent closure of particular areas, in this case obviously including those where spawning takes place, is increasingly being held by scientists as an important way to avoid depletion of fisheries resources worldwide. To be effective, these closed areas have to be big—at least 20% of the total area of an ecosystem is the consensus at present.<sup>158</sup>

Wild harvest of juveniles and fingerlings for grow-out has also been identified as posing a significant biological threat (Chapter 3).<sup>159</sup> Given capacity limitations in many source countries, the use of closed areas to protect these juvenile and immature fish may be easier to enforce than size limits or gear restrictions.

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<sup>153</sup> Pet and Pet-Soede 1999.

<sup>154</sup> Padilla et al. 2003.

<sup>155</sup> Queensland Fisheries Service, unpublished data.

<sup>156</sup> Bentley 1999.

<sup>157</sup> Sadovy 2002.

<sup>158</sup> Pauly and Maclean 2003.

<sup>159</sup> Sadovy 2000; Sadovy and Vincent 2002.

Certain characteristics of the LRFF fisheries identified earlier in this section suggest that enforcement and monitoring efforts will be more effective if targeted further along the market chain (i.e., relatively fewer participants and holding facilities). Moreover, increased use of air transport from source countries in Southeast Asia (Chapter 2) has meant controls requiring high-coverage surveillance or regular quantitative monitoring, such as fish size restrictions or limits on amounts of fish caught or exported, have become more cost effective.

While most attention focuses on destructive fishing practices, the widespread use of specialized live-fish carrier vessels in areas where shipping fish by air remains unfeasible is also a primary cause for concern. Their requirement for a minimum profitable payload of 10–15 t of fish<sup>160</sup> poses a danger to the sustainable exploitation of fish populations, because it sometimes encourages the targeting of spawning aggregations to maximize catches over short periods (Chapter 3 addresses this issue).

## Improving Fish Survival

Keeping the catch alive and healthy is obviously an important objective in a live-product fishery. Fish handling techniques can be improved through outreach to fishers<sup>161</sup> and in many cases there is room for improvement in holding and transport technology. Progress in the former has been made in several countries, leading to improved survival, although the long-term success of such initiatives will depend upon the capacity and willingness of countries to support the programs in the absence of external assistance. Poor holding and husbandry practices, which persist in many source countries using cage facilities, is an aspect of the trade requiring concerted attention. Air transport can, when done properly, reduce mortality of the fish, but is often cost prohibitive and unavailable in many areas.

Fish survival is partly a function of the time it takes to get the fish from the point of capture to the point of export. An important constraint for operations that ship by sea is that large amounts of fish (10 t or more, depending on the distance<sup>162</sup>) must be shipped

<sup>160</sup> P.Chan, personal communication

<sup>161</sup> Pratt 1998; Johannes et al. 1999; Anderson et al. 2003.

in order to make the trip cost effective. Evidence suggests that the long collection times required to catch the minimum carrier-vessel shipment size can result in high losses of fish in holding pens.<sup>163</sup> The economic and biological costs of holding the catch for long periods— feeding costs, the volume of feed fish needed, and mortality—are much higher where sea transport is used (see Chapter 2).

If there is ample frequency of flights, satisfactorily brief routes, and reasonable shipping rates, small shipments can be made by air, in which case the costs of holding the fish are less important and harvest rates can better “afford” to be trimmed to within the limits of the resource. Governments can require live fish to be shipped by air—Australia does just that—but their ability to create a transportation system that would make by-air transport economically feasible is, of course, limited.

If air transport is not feasible and if the overall harvest rate is to stay within the limits of the population, two strategies used to minimize holding costs could be:

- coordinating transport operations across multiple fishing areas to spread effort and catch for a given shipment across a broader area; or
- fishing a given area in brief but intensive pulses, producing, for example, the entire year’s harvest and an entire vessel shipment in just a few weeks.

Either of these alternatives could be achieved through seasonal closures/openings to make sure spawning aggregations are untouched. They should take into account seasonal variations in price and the cultural or economic patterns of fishing communities. Pulse fishing may have the advantage of reducing enforcement and management costs because of the concentration of effort over a specified time.<sup>164</sup>

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<sup>162</sup> Note that shipments from Indonesia and the Philippines can be as low as 3–5 t.

<sup>163</sup> Johannes and Lam 1999.

<sup>164</sup> Graham 2001a.

## National Coordination and Regional Cooperation

Export fisheries call for strong national-level control, but with the exception of Australia, national policy and control over LRFF fisheries have largely proven ineffective. Likewise, as shown earlier, coordination between national, provincial, and local government in most countries involved in the LRFF trade has been limited to date.<sup>165</sup> Where customary marine tenure over nearshore resources is strong, effective national–provincial–local cooperation is essential. National-level controls should require that permission to access LRFF be obtained from customary reef owners and the relevant provincial government(s), so as to prevent localized depletion, protect spawning grounds and threatened species, and minimize conflict and competition between resource users.

There has been little formal cooperation among producer countries in dealing with the LRFF trade. One regional approach that has been considered is maintaining a registry of companies and vessels involved in the trade, for the purpose of sharing information about “good” and “bad” players and possibly for blacklisting bad players. A more costly option would be to develop a centralized vessel monitoring system, in which transport and supply boats are required to carry and continually operate position transmitters.<sup>166</sup> In order to cope with the possibility of poaching in remote areas, the cooperative agreement underpinning the system would have to include key parties on the market side, namely the foreign companies that partner domestic operations in source countries. Only then would there be the possibility of ensuring that all vessels involved in the industry are subject to the monitoring requirements.

## DEMAND-SIDE AND TRADE CONTROLS

While the focus so far has been on supply side management to improve fishery practices and mitigate negative impacts of the LRFF trade, demand countries, most notably Hong Kong, China and

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<sup>165</sup> See also Ministry of Marine Affairs and Fisheries 2002, p.30–34.

<sup>166</sup> Richards 1999

mainland PRC—the largest consumers of live reef fish—need to take more responsibility for the biological and socioeconomic consequences of the LRFF trade on supply countries.

Low prices paid by consumers since 1999 have highlighted the important role of consumers of LRFF in dictating the extent of the trade's influence. Lower prices have meant the viability of transporting fish across large distance to consumer markets from countries, where transport by sea remains the only option, are no longer as attractive to traders (e.g., South Pacific).

The small number of exporters and importers suggests that opportunities for market transformation exist through partnerships between demand and supply countries, either informally through stakeholder agreements or formally through government channels. The prospect of either seems distant because traders show reluctance to accept an active role in promoting responsible fishery practices.<sup>167</sup>

### National, Regional, and International Mechanisms

The Hong Kong, China Government has taken a positive step in regulating the trade by revision of the harmonized code to facilitate monitoring of imports (see Chapter 2).<sup>168</sup> The AFCD has begun to address destructive fishing practices in Hong Kong, China via a program of education, monitoring, and enforcement,<sup>169</sup> but the success of this program appears limited. Development of a regional LRFF trade agreement through Asia-Pacific Economic Cooperation (APEC) would likely be of limited success because APEC is not a negotiating body and although a regional agreement may be of value, bilateral agreements between APEC economies are more appropriate for addressing issues of mutual concern. A multilateral approach by affected APEC supply economies, however, could encourage the Hong Kong, China Government to strengthen its enforcement activities against perpetrators of illegal and/or irresponsible fishing practices there, when such activities are brought to their notice by affected source countries.

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<sup>167</sup> Cesar et al. 2000:150–153

<sup>168</sup> McGilvray and Chan 2001.

<sup>169</sup> Sham 1997.

Several different models have been proposed for achieving collaborative resource management including certification and eco-labeling, voluntary codes of conduct, and industry standards. Of these models, certification and eco-labeling are considered less appropriate because of the large volumes and number of species traded, the diffuse nature of the industry and the uniquely “live” aspect of the product. Industry standards, while difficult to institute for the same reasons, may, when promoted as a voluntary code, be a more suitable model for the LRFF trade.

## Codes of Practice and Industry Standards

The need for a voluntary code of practice for the LRFF trade has been recognized at the highest levels.<sup>170</sup> Effective standardization<sup>171</sup> can help international trade by removing differences or practices that constitute barriers, ensure a consistent quality of product, improve the health and safety of industry participants, and protect the environment. Standardization results from consensus agreements reached between all economic players in an industrial sector—suppliers, users, and often governments.

Currently a standardization project is underway, led by The Nature Conservancy and the Marine Aquarium Council, to develop industry standards for the LRFF trade. The goal of the project is to bring together stakeholders and build a consensus on what “best practices” are needed to improve the conduct of the industry and move toward industry sustainability, encompassing reefs, fish populations, and fishing communities. The project focuses on both wild-caught and cultured fish and covers standards and practices relating to assessment of fish populations, capture and culture methods, holding, transportation, and human health and safety concerns.

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<sup>170</sup> The development of standards and protocols under a code of practice was a key recommendation of the APEC Workshop on Destructive Fishing Practices on the Marine Environment, held in Hong Kong, China in 1997.

<sup>171</sup> Standards in this sense are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that products, processes are fit for their purpose.

## INFLUENCING CONSUMER BEHAVIOR

In many countries, consumer environmental awareness is high, and their collective purchasing power can force industry and stakeholders to change their practices for environmental good. This, however, cannot yet be said for Hong Kong, China and mainland PRC where environmental awareness is as yet underdeveloped. Three research projects have been carried out in recent years on consumer attitudes and preferences in relation to LRFF. The major findings from these studies are:

- Taste, texture, and freshness of the fish are the key factors for choosing to eat LRFF. More people prefer wild-caught fish than cultured fish. In one study, more than a quarter of consumers stated that they would not find cultured fish an acceptable alternative due to the perceived inferior taste.<sup>172</sup> In contrast, a “blind” taste-test study found that consumers of a particular low-value grouper species favored cage-reared over wild-caught fish, but for a high-value grouper favored wild-caught fish.<sup>173</sup> Lastly, most consumers saw the reduced risk of ciguatera poisoning as the main reason for switching to cultured species.<sup>174</sup>
- Awareness of environmental and conservation concerns relating to the LRFF trade was found to be very low; almost half of the interviewees had never heard of fishing using sodium cyanide, and over 80% knew nothing of its destructive effects on coral reefs. Awareness of the vulnerability of key species of the trade was likewise low.
- At least one LRFF currently found on the market, the orange-spotted grouper, is now rarely sourced from the wild as adult individuals. Large numbers of orange-spotted grouper are available from aquaculture operations and the market will not meet the prices demanded for this fish from the wild. Restaurateurs and importers can influence consumers’ preference without the consumers being aware of it.

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<sup>172</sup> Omnitrak 1997. Note that it is not known whether the cultured fish were wild-caught and grown-out or from full-cycle aquaculture.

<sup>173</sup> Chan 2000.

<sup>174</sup> Chau 2001.

As environmental awareness increases in Hong Kong, China and mainland PRC, and indeed throughout the region, consumer choice will become more common, making early consumer awareness programs and campaigns important, particularly among the young, who will be the consumers of tomorrow.

Such programs could also include a form of eco-labeling, labeling products that conform to certain environmental standards. In the case of fisheries, the Marine Stewardship Council certifies fisheries as well-managed and sustainable according to a set of principles.<sup>175</sup> The Audubon Society and the Monterey Aquarium provide listings of common seafoods in the United States for consumers using a simple color code, from green (plentiful) to red (overfished). Labeling of LRFF could be done on menus or display tanks, but would require much more knowledge about the individual species than is currently available, and agreement on standards by respected international bodies.

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<sup>175</sup> The Marine Stewardship Council is an independent NGO representing a partnership between the World Wide Fund for Nature and Unilever. The objective is to provide a system of certification of seafoods based on a broad set of standards for sustainable fishing. See [www.msc.org](http://www.msc.org)