CHAPTER 2: ROOT CAUSES AND SOLUTIONS

SUMMARY

Overall conclusion:
Although the solutions to overfishing are well known, the transition to sustainability is complicated by highly resilient economic and institutional barriers.

Argument 1: Management solutions for every fishery archetype are known and well-documented. Effective fishery management is based on simple principles, such as the reduction of the fishery commons to an economically feasible number of users; the use of relevant information to limit mortality; and the prevention of dangerous negative externalities such as the destruction of habitat, wildlife, or broodstocks. The FAO Code of Conduct for Responsible Fisheries describes a broad consensus for such a responsible, ecosystem-based approach to fisheries management. For industrial fisheries, these principles are commonly implemented through scientifically guided decision-making frameworks (e.g., harvest control rules, rebuilding requirements, and long-term management plans) that set appropriate output controls (e.g., TACs or escapement targets) and are often optimized through the use of catch shares or other forms of rights-based management. For multi-species coastal fisheries, especially in developing countries, this rigorous management approach is exceedingly difficult to enact. Instead, a combination of input controls (e.g., limited access, seasonal closures, gear restrictions) and community-based fishery management approaches have proven to be most effective, especially when they rely on appropriately mandated and scaled spatial management approaches such as integrated territorial use rights and protected area systems fisheries.

Argument 2: However, adoption of these solutions is effectively blocked by a combination of institutional weakness and powerful economic forces. Despite recognition of these principles, progress has been halting. Most nations lack effective fishery management institutions or community-based fishery management traditions and are largely incapable of imposing effective mortality controls. Weak management creates a vicious circle where individual fishermen are concerned about the dissipation of their future incomes, are compelled to rely on short-term yields, and see no economic reward for “good” behavior. With future landings ever more uncertain, today’s catch is ever more important. This dynamic compounds the “race for fish” and inexorably erodes the biological and economic fundamentals of the fishery. In many cases, subsidies are introduced to improve these eroded economics, which further fuels the spiral toward excessive effort and collapse. Except for highly productive and resilient fisheries (e.g., anchoveta, shrimp), we can assume that economically viable fisheries without effective mortality controls are bound for overexploitation and, potentially, collapse. Even highly productive fisheries are likely to be overexploited, though they are less likely to collapse and recover more quickly.

This assessment documents three case studies in which the dynamics described above play out: Atlantic Bluefin Tuna, Gulf of Mexico Red Snapper, and Tropical Grouper. In the case of Eastern Atlantic and Mediterranean bluefin tuna, the inability of ICCAT to impose and enforce meaningful mortality restrictions has led to massive overcapacity throughout the bluefin tuna fishing industry. This overcapacity has created strong incentives for some fishermen to break the law in order to realize profits. In the case of the Gulf of Mexico Red Snapper fishery, a high volume of dead discards and overfishing in the recreational sector, driven in part by inappropriate management measures, have adversely affected all sectors of the fishery. In the case of tropical grouper, the biological characteristics of the stocks are such that even purely artisanal fishing is threatening the survival of the stocks, and large-scale commercial fishing will cause collapse in very short order.

In this report, we will define “catch share” as a fishery management system that allocates a secure privilege to harvest a specified amount of a fishery’s total allowable catch to an individual or group. The term includes a variety of different forms: individual transferable quotas (ITQs), individual fishing quotas (IFQs), cooperatives, community fishing quotas, territorial use right for fishing (TURFs) and more. Their central purpose is to solve the problem of the commons through clearly defined, exclusive property rights – in economic terms, they balance the use value (i.e. the value obtained from harvesting) against the asset value (i.e. the future harvests) of a fish stock, conferring to the participants an assurance that a share of the fishery will be theirs into the future, without the infringement by others.
Argument 3: As a result, the transition to sustainable fishing is very difficult. Although current overfishing produces economic losses believed to be in excess of $50 billion per year,62 these losses are not the results of irrational behavior—quite the opposite. Our inability to correct overfishing is based on three basic root causes: first, fishery restoration usually requires a reduction in fishing effort for some period of time, usually leading to short-term financial losses throughout the value chain. Those players who place a higher value on short-term profit may in fact prefer high short-term yields to the prevention of fishery collapse. Second, the economic costs and benefits of fishery restoration are not evenly distributed among the players; there are winners and losers. In a consensus-based decision-making system such as that used by the RFMOs, potential losers will attempt to block any reforms. Third, both fishery data and active management are usually necessary to achieve sustainable fishing. However, in many places, there are no means to organize and pay for these necessities. Without an indication of the health of the fish stock, even the fishers with the best intentions can overfish. Without effective management, the depletion of the shared resource is the likely outcome. Even assuming a politically feasible solution can be found, effective management can require a substantial up-front investment in a resource strapped environment. The infrastructure and operating costs of effective management (whether government led or community based) are rarely taken into account. The investment required for improved fishery management is greatest where the fishing crisis is most acute—in the coastal fisheries of developing countries. The Malthusian pressure in many developing nations makes coastal fishery management exceedingly difficult, and is further complicated by the challenges of illegal fishing, huge data deficiencies, and the lack of alternative livelihoods for fishermen. Because fishing is a livelihood of last resort in many communities, governments are often reluctant to close fishing opportunities to their citizens for fear of social problems.

### Evolution of Basic Fishery Management Solutions

<table>
<thead>
<tr>
<th>Developed countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No management</strong></td>
<td>• No vessel registration system for commercial fishing</td>
</tr>
<tr>
<td></td>
<td>• Weak or no enforcement of EEZ from DWFs</td>
</tr>
<tr>
<td></td>
<td>• Legally mandated or effective open access for all fishers</td>
</tr>
<tr>
<td></td>
<td>• No effective gear restrictions</td>
</tr>
<tr>
<td><strong>Basic controls</strong></td>
<td>• Industrial fishing: Same as developed countries</td>
</tr>
<tr>
<td>(no real mortality</td>
<td>• Coastal or small scale fishing: Essentially none, except some restrictions on damaging gear types</td>
</tr>
<tr>
<td>limits)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vessel registration and reporting requirements</td>
</tr>
<tr>
<td></td>
<td>• Basic effort reduction measures (some combination of closed areas and/or closed seasons)</td>
</tr>
<tr>
<td></td>
<td>• Gear restrictions on damaging gear types</td>
</tr>
<tr>
<td><strong>Intermediate controls</strong></td>
<td>• Industrial fishing: Same as developed countries</td>
</tr>
<tr>
<td>(some prospects of</td>
<td>• Coastal or small scale fishing communities</td>
</tr>
<tr>
<td>mortality reduction)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• In addition:</td>
</tr>
<tr>
<td></td>
<td>• Limited access (vessel/permit limits)</td>
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<tr>
<td></td>
<td>• Gear restrictions that serve as effort limits (vessel size/horsepower, trawl size, mesh size, trap limits)</td>
</tr>
<tr>
<td></td>
<td>• Effort controls (e.g., days-at-sea systems, fishery closures, tradable effort controls)</td>
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<td></td>
<td>• Basic bycatch reduction measures (TEDs, Nordmore grates)</td>
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<tr>
<td></td>
<td>• In addition:</td>
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<tr>
<td></td>
<td>• Legal basis for community-based marine tenure systems</td>
</tr>
<tr>
<td></td>
<td>• Promotion of area-based CBFM for communities seeking control over fishing effort of sessile and semi-sessile species (TURF-Reserves, LMMAs, permisos, etc.)</td>
</tr>
<tr>
<td><strong>Advanced controls</strong></td>
<td>• Industrial fishing: Large closed areas, harvest control rules, and TACs</td>
</tr>
<tr>
<td>(strong mortality</td>
<td>• Community/coastal fishing:</td>
</tr>
<tr>
<td>control; EBFM)</td>
<td>• Integrated, large-scale TURF-Reserve systems to cover pelagic species and more vulnerable finfish</td>
</tr>
<tr>
<td></td>
<td>• Sophisticated CBFM practices</td>
</tr>
<tr>
<td></td>
<td>• Harvest control rules or long-term management plan to create decision-making guidelines</td>
</tr>
<tr>
<td></td>
<td>• TACs or escapement targets for major fisheries (i.e., output controls), supplemented by TACs for bycatch or weak stock species</td>
</tr>
<tr>
<td></td>
<td>• Adaptive input controls for small-scale, data-deficient, and volatile fisheries</td>
</tr>
<tr>
<td></td>
<td>• Catch share systems to improve economic incentives (e.g., ITQs, IVQs, CDQs, TURFs, quota pooling, etc.)</td>
</tr>
<tr>
<td></td>
<td>• Permanent or rotating closed areas to accommodate spawning habitats and weak stocks (no take reserves and no trawl areas)</td>
</tr>
</tbody>
</table>
CHAPTER 2: ROOT CAUSES AND SOLUTIONS

Argument 1:
Management solutions for every type of fishery are known and well-documented

All effective fishery management systems are based on the same principles. These include the reduction of the fishery commons to an economically viable number of users; the reduction of mortality to a scientifically determined precautionary level; the recognition of ecosystem impacts of fishing; the empowerment of fishermen; and the prevention of dangerous externalities such as habitat, wildlife, and brood-stock destruction. These principles are broadly represented in the FAO’s Code of Conduct for Responsible Fisheries (CCRF), and have been endorsed and expounded upon in many reports, including the Prince’s International Sustainability Unit (PISU). However, the real world imposes constraints to the effective application of these management principles. In particular, the capacity, authority, mandate, and sophistication of the institutions responsible for fishery management diverge hugely among nations. As a recent symposium of ecosystem-based management (EBM) noted, “The greatest risk identified for many of the regions of the world is the lack of effective governance. Rectifying this central problem is a prerequisite for any form of sound fishery management.”

Given this constraint, best practice in fishery management varies as a function of the institutional capacity.

Best practices in fishery management for regions with strong institutional management capacity. There is a basic evolution of fishery management solutions across global fisheries. [Figure 2-1] In the developed world, effective management is typically government mandated and led, with substantial input and co-management support from fishing communities. Even countries with a long tradition of community-based fishery management, such as Japan, rely on national legislation to authorize and guide these groups. At a minimum, almost all developed countries and industrial fisheries feature basic vessel registration, limited access, and monitoring requirements. These are fundamentals of management. In addition, most countries have some method to set catch targets, though these vary in their scientific rigor. More advanced systems set targets that typically limit the TAC to levels below maximum economic yield (MEY) or MSY. Escapement targets, minimum and maximum size limits (for species with low discard mortality rates), and sex selectivity (e.g., berried females) are other examples of useful output controls. Limits based on MEY are preferable, because MEY catch levels can reduce the risk of accidental overfishing, improve ecosystem health, and maximize profits. [MEY is typically more precautionary than MSY]. [Figure 2-2]

A fundamental difference among countries’ management approaches is whether they seek to meet catch targets through input controls or outcome-based standards. A combination of gear restrictions and effort controls, seasonal controls, and in some cases bycatch reduction measures have been widely used. These input controls often do not prevent fishery collapse because fishermen can fully comply and still catch more than the targets. In addition, input controls can trigger a “race for fish” which increases fishermen’s accident rate and decreases the economic value of the product.

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63 The FAO Code of Conduct for Responsible Fisheries calls for “measures which are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing countries.” It also calls for States to “apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.”

64 FAO Code of Conduct for Responsible Fisheries: “Management measures should not only ensure the conservation of target species but also of species belonging to the same ecosystem or associated with or dependent upon the target species.”


66 Although MEY is often difficult to define as it requires details on the cost of fishing, a basic precautionary limit such as 80% of MSY (Hilborn, R. 2009. Pretty Good Yield and exploited fisheries. Marine Policy 34(1): 193-196) can be used.
ITQ systems have consistently succeeded in preventing fishery collapse

Percent of fisheries collapsed with (dotted line) and without (solid line) ITQ

*A Percent of fisheries collapsed with (dotted line) and without (solid line) ITQ management using the Worm et al. (6) collapse threshold (10% of historical maximum). The number of ITQ fisheries increases through time (right y axis and dashed line), and the rate of implementation has been accelerating.

*B Percent of fisheries collapsed with (dotted line) and without (solid line) ITQ management using more conservative collapse thresholds: 1 to 6% of historical maximum catch.

Source: C. Costello et al., 2008; Can Catch Shares Prevent Fisheries Collapse? Science 321:1678-1681
There is still some debate in the scientific community about the preference of output based controls. Dr. Sidney Holt, one of the fathers of the MSY concept, recently espoused that output controls should be secondary to input controls. While that may be true in theory, the final conclusion of this analysis, drawing from interviews from around the world, is that in practice output-controls (e.g., TACs, escapement targets, bycatch limits, etc.) are least likely to be abused and to lead to overfishing. Empirical analyses indicate that fisheries with quota caps are overexploited less frequently than fisheries with input controls. Similarly, the UCSB research of unassessed stocks found that the presence of a TAC is associated with higher biomass levels. Output based controls are generally the preferred form of management for large, relative stable fisheries for which scientific stock assessments are feasible.

In terms of the specific design elements, performance-based control measures that set clear output-based standards and provide accountability and incentives for fishermen to meet those standards have been particularly effective. In the most robust systems, the quotas under these limits are allocated under rights-based systems (catch shares), which are intended to efficiently distribute the economic rents among stock “owners” or communities, and slow the race for fish. As one review summarized, “It is widely believed and supported by anecdotal evidence that once fishers have a financial stake in the returns from sensible investment in sustainable practices, they are more easily convinced to make sacrifices required to rebuild and sustain fisheries at high levels of economic and biological productivity.” The promotion of catch shares has been a common thread within the conservation community, though it is not without controversy. Rights-based systems have consistently succeeded in slowing fishery collapse, because they provide fishermen with direct accountability and a compelling incentive to respect TACs, tend to consolidate and reduce the fleet, and align the economic well-being of the fishermen with the health of their stocks. If designed correctly, rights-based systems can also encourage fishermen to further optimize the health of the stocks by reducing overall effort and voluntarily closing critical habitat. Despite the theory of rights-based management leading to improved health of fish stocks, catch shares are not a silver bullet. The empirical evidence has been mixed in some cases. Catch shares have been shown to reduce the variation in catch from target catch levels, and TAC overruns, though they don’t necessarily result in increased biomass. More importantly, catch share systems require very careful optimization of multiple design parameters such as quota allocation, quota concentration limits, treatment of spatially differentiated fisheries, and trading provisions. These design considerations need to balance the desired economic, biological, and social objectives of the fishery, and there are often inherent tradeoffs between them.

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69 Costello, et al., In Press.
70 Rights-based is used as a general term. These systems may be setup as dedicated access privilege systems and do not have to confer ownership of the public good to resource users.
Simple gear restrictions have demonstrated the potential to improve the health of reef fish populations in developing countries.

![Figure 2-4](image)


Fisheries under co-management systems have higher biomass than those with no local management.

![Figure 2-5](image)

**Source:** Cinner, Joshua, et. al., 2012. Co-management of coral reef social-ecological systems. PNAS, vol 109: 14
Finally, there are many instances where there is not enough capacity (technical, analytical, etc.) to implement and manage performance-based control measures. In such instances, adaptive input control measures may be the best option. These measures adjust the level of fishing effort in response to changes on the water. They are most applicable to fisheries where the costs of output controls are considered too high (e.g., small scale or data deficient fisheries) or the natural resilience and volatility of stocks makes it difficult to set a TAC in advance (e.g., some squid fisheries). Adaptive input controls modify the level of effort in response to new (or real-time) changes on the water, flexibly adjusting fishing effort to the actual state of the stocks according to a pre-determined rule. Adaptive input controls can include limited access, seasonal closures, gear and area restrictions, days at sea restrictions, and vessel limitations or limits on the quantity of gear used by individual vessels. For example, New Zealand lobster fishermen shut down when catch per unit effort (CPUE) falls below a pre-set threshold. While these systems do not necessarily require full stock assessments of fishery independent data, they do require some sort of data to be useful such as CPUE, the size distribution of fish, or bycatch interactions.

Regardless of the decision on whether to use input or output measures, there are two overarching goals. The first is to reduce the fishery to an appropriately sized group of properly incented fishermen. The second is to depoliticize the annual catch or effort setting process through appropriate management guidelines. The two goals are deeply connected, since fishermen are far more likely to accept these management guidelines if they can be assured of their secure, long-term benefits. The creation of harvest control rules, mandatory rebuilding requirements, or long-term management plans, ideally combined with catch shares, are all mechanisms that help separate management decisions from annual allocation fights. These rules ought to be straight-forward and transparent, thus avoiding the black box, politically-charged TAC and effort setting processes.

Advanced fishery management systems also increasingly feature an array of protections for the broader ecosystem. EBFM includes protections for vulnerable marine wildlife populations, restrictions on the bycatch and discarding of non-target species (e.g., weak stocks), and greater protections for marine habitats, such as no-trawl areas, essential fish habitat designations, and marine protected areas. These management measures are essential complements to the management of direct target stocks to meet overall ecosystem objectives. Progress on EBFM has been most advanced in countries that have already addressed overfishing. [See Figure 1-14] [See Appendix 4 – Ecosystem Based Fishery Management]

**Best practice for developing country and small-scale coastal fisheries.** For industrial fisheries, vessel licensing and permit limits, closed seasons, gear restrictions, and large closed areas are feasible in almost all parts of the world. However, in countries with weak management institutions, sophisticated output controls (TACs and catch shares) and responsive input controls rarely work, even when they are mandated by law. Often, there is too little information, capacity, money, and infrastructure to create and enforce the system. The lack of stock assessments and basic biological information frequently compound the challenge.

Small-scale, data-deficient fisheries thus require a very different approach, particularly in coastal areas of the developing world. In tropical regions these fisheries often include a great variety of species, a tremendous number of boats, and a wide variety of gear; are spread over many jurisdictions; lack stock data; and have limited institutional oversight and enforcement.

Creating enduring and effective fishery management systems for these types of fisheries is one of the most persistent challenges in global fisheries management. In the absence of effective centralized management, coastal communities need the legal right to assert tenure over their coastal shelf marine resources. (In many countries, this is not possible due to “open access” laws.) Once the legal right to assert tenure is granted, and proper guidance is given, a variety of co-management and cooperative approaches can be adopted (e.g., municipality limits on access, gear restrictions, creation of closed areas, and seasonal limits), which effectively close the fishery to outsiders, and provide local fishermen with the incentive to manage their stocks for long-term health and allow them to exclude outsiders. There are many examples, such as MPAs in Kenya, where such community-based action has been able to rebuild small-scale fisheries through closed area management and gear restrictions. [Figure 2-4] Similarly, tropical coral reef fisheries with co-management systems have higher biomass levels in target stocks than those with no local management. [Figure 2-5]

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Critical importance of community leaders

Regression tree showing the most important factors determining success of coastal co-management systems

Higher branches off greater explanatory power

The tree explains 69% of total deviance

Average success scores, number of fisheries

Co-management success

Low

Leadership

NO

Social cohesion

NO

Spatial management

NO

1.4 n = 31

1.8 n = 40

3.2 n = 9

0.9

2.2

Protected areas

NO

YES

5.9 n = 19

4.3 n = 33

3.6 n = 21

5.6 n = 12

High

Sedentary

NO

Individual quotas

NO

Yes

TURF

4.9 n = 52

6.4 n = 38

4.4 n = 130

5.5 n = 90

n = 130

n = 33

n = 21

n = 12

There has been a convergence of interest within the non-governmental organization (NGO), academic, and development communities around in effective community-based management. One of the promising proposed approaches for this type of management is the combination of TURFs with no-take reserve systems, or TURF-reserves, which have the potential to capture the ecological and economic benefits of appropriately located and scaled no-take zones, and channel them toward local communities by effectively limiting access to local stakeholders. Properly designed and sized no-take areas generally improve CPUE in fishing areas adjacent to reserves; [Figure 2-7] however, there is not sufficient data on the overall economics of TURF-reserve systems for local communities, given the potential downsides associated with lost fishing grounds and the costs of organizing, monitoring, and enforcement.

These TURF-reserve systems could well be the most important management approach for multi-species coastal fisheries, but we are far short of conclusive quantitative proof and major concerns remain. A recent study found that, among various co-management systems, local compliance with TURF systems was most problematic. Defining who has traditional access rights is often muddied by factors such as marriages, or changes in social groupings. The complications of proper design, enforcement, and operational capacity are challenges that will complicate broader adoption. But, interest in these approaches is growing, and efforts are underway from Mexico to Indonesia to marry the protected area and community-based fishery management approaches.

In considering their potential, it is important to recognize that these approaches have very real limitations:

- **Leadership and homogeneity.** Community-based management systems such as TURF-reserves do not work well in highly heterogeneous, densely populated areas; a Gutierrez and Hilborn study of co-management documented the “critical importance of prominent community leaders and securing the livelihoods of communities depending on them.” [Figures 2-6, 2-8]

- **Scale.** The applicability of TURF-reserves has been documented for sessile and semi-sessile species such as abalone, sea cucumber, lobster, and, potentially, reef fish with localized ranges. The effective application of TURF-reserves to mobile finfish is less clear. Initial estimates developed by Indonesian fishery scientists suggest that one would need a minimum management area of 500 square miles or more in order to cover the ecologically determined range of these species. In densely populated areas, attempts to orchestrate CBFM over multiple communities can easily revert to an open access fishery, with all its attendant problems. While Japan provides an example of widespread CBFM for multiple species, an abiding challenge for philanthropy is how best to develop and scale new systems, given the huge number of coastal areas and individual communities that might each require their own tailored system.

- **Design.** In many cases, TURFs probably work especially well when integrated with properly scaled no-take areas protecting key habitats, such as spawning grounds. These reserves must be carefully designed, placed, and supported by the local fishing community. Without that strong foundation, no-take areas do not survive for long, particularly as the political support for protected areas in each community ebbs and flows over time. It is not clear at this point how a critical mass of properly designed TURF-reserve systems will be launched in the short- and medium-term, or how best to turn a local or regional movement into a global phenomenon.

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77 Confidential Interview.
### Effective fisheries management depends on the application of a wide variety of approaches

<table>
<thead>
<tr>
<th>Region</th>
<th>Gear restrictions</th>
<th>Capacity reduced</th>
<th>Total allowable catch reduced</th>
<th>Total fishing effort reduced</th>
<th>Closed areas</th>
<th>Catch shares</th>
<th>Fisheries certification</th>
<th>Community co-management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bering Sea, Gulf of Alaska</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td></td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
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<tr>
<td>California Current</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td></td>
<td>+++</td>
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<tr>
<td>Northeast U.S. Shelf</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>North Sea, Celtic-Biscay</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Iceland</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
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<td>+++</td>
</tr>
<tr>
<td>Southeast Australian Shelf</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td></td>
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<tr>
<td>Northwest Australian Shelf</td>
<td>++</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>New Zealand</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td></td>
<td>+++</td>
<td>+</td>
<td></td>
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<tr>
<td>Kenya (Artisanal)</td>
<td>++</td>
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<td>+++</td>
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<tr>
<td>Chile and Mexico (Artisanal)</td>
<td>+++</td>
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<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td>+++</td>
</tr>
</tbody>
</table>

**Count** 10 7 6 2 8 5 3 4

**Total score** 14 10 18 5 15 13 3 8

In summary, the basic tool kit required to manage fisheries is quite well known. The principles have been documented by international institutions such as the FAO. Fishery managers today are effectively using a variety of approaches, among which harvest control rules built around output controls, and enshrined in catch share approaches. These approaches are generally the most reliable in regions with strong centralized fishery management capacity. Community-based co-management, and particularly TURF-reserve systems, may have the most promise for small-scale coastal fisheries, particularly in the developing world. [Figure 2-9] Across all systems, basic input controls are an integral component of the system.

Although the basic tool kit is well known, practitioners are still learning what specific combinations of tools are best suited to particular fisheries. Understanding how to best match a specific management system to the characteristics of the fishery will need further attention to help guide future reform efforts, especially for small-scale fisheries. The evolution of fisheries management must proceed in a fashion that recognizes the limitations of management systems (e.g., capital constraints, institutional barriers, technological gaps), and develops the basic foundations before launching into more advanced goals.
Systemic vulnerability of fisheries is driven by three major factors – economics, biology, and institutions and policies

\[
\text{Systemic vulnerability of fishery} = f \left( \text{economic, biological, institutional/policy vulnerability} \right)
\]

<table>
<thead>
<tr>
<th>Economic vulnerability</th>
<th>Biological vulnerability</th>
<th>Institutional/policy vulnerability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic characteristics that make a stock susceptible to overfishing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock effect – harvesting costs are not that sensitive to decrease in stock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High discount rate</td>
<td></td>
<td></td>
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<tr>
<td>Certain input and output price parameters</td>
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<td></td>
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<tr>
<td>Poverty and a lack of alternatives</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Species characteristics that make a stock susceptible to overfishing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longevity/slow growth</td>
<td></td>
<td></td>
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<tr>
<td>High age at first maturity</td>
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<td></td>
</tr>
<tr>
<td>Low fecundity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictable aggregations</td>
<td></td>
<td></td>
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<tr>
<td>Proximity to surface or shore</td>
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<tr>
<td>Faithful to habitat</td>
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<tr>
<td><strong>Lack of capacity for government-led control over fish stock mortality</strong></td>
<td></td>
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<tr>
<td>Little to no management</td>
<td></td>
<td></td>
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<tr>
<td>Complex, overly politicized, consensus-based management</td>
<td></td>
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<tr>
<td>Illegal/amoral management</td>
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<tr>
<td>Lack of opportunity for local control on mortality</td>
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<tr>
<td>No legal basis for co-management solutions</td>
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<td></td>
</tr>
<tr>
<td>Absence of individual influence on mortality (by fishermen or cooperatives)</td>
<td></td>
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</table>
Vulnerable fisheries offer few rewards for individual responsibility

Economically vulnerable fisheries: Fisheries where the economic justification for rebuilding is weak (e.g. choke stocks), and where high discount rates due to uncertainty fuel the race for fish.

Figure 2-11

The greater the uncertainty, the greater the fisherman’s implicit discount rate, and the more rapid deterioration of the fishery

**Revenue**

Discount rate 0% Approaches ∞

MEY

MSY

K

Effort

0

Cost

**Figure 2-12**
Susceptibility to fishing pressure is a better predictor of overfishing than fishery productivity.

Source: W.S. Patrick et. al., 2009. Use of Productivity and Susceptibility Indices to determine Stock Vulnerability. NOAA.
CHAPTER 2: ROOT CAUSES AND SOLUTIONS

Argument 2:
The adoption of effective fishery management has been routinely blocked by a combination of institutional weakness and powerful economic forces.

A combination of economic, biological, and institutional drivers determines any fishery’s vulnerability to overfishing. These factors strongly reinforce one another, and, collectively, they present a formidable set of obstacles to the implementation of best fishery management practices.

- **Fisheries are economically vulnerable** when they offer few rewards for individual responsibility. In an open access system lacking effective effort and/or mortality controls, fishermen are rightly concerned about the security of future landings and have an economic incentive to value short-term yields over potential future landings. This uncertainty and competition often leads to unreasonable increases in capacity and effort (“the race for fish”), and inexorably erodes the economic fundamentals of the fishery. The greater the uncertainty, the greater the fisherman’s implicit discount rate, and the more rapid the deterioration of the fishery.

- If subsidies are introduced to improve the eroded economics, as they often are, they only serve to provide additional momentum in this spiral toward fishery collapse. Apart from highly productive and resilient fisheries (shrimp, anchoveta), most economically viable fisheries lacking effective mortality controls are bound to be overfished or collapse. Even highly productive fisheries will be overfished under these conditions. Fisheries that straddle multiple management jurisdictions have an additional source of management uncertainty, and it is no surprise that fish stocks deteriorate with the number of EEZs.

- **Biologically vulnerable fisheries** (e.g., species that exhibit schooling behavior, slow growth rates, low fecundity, or high age at maturity, as well as fisheries close to coasts) are highly susceptible to fishing pressure and recover slowly. For example, shark populations globally appear to be far more vulnerable to overfishing than anchoveta populations, largely due to the low fecundity and growth rates of many shark species. Surprisingly, high susceptibility to fishing pressure is a better predictor of overfishing than low fishery productivity.
Fisheries that lack governmental or individual mortality control are highly vulnerable

![Diagram](image)

Although legal limits on EA BFT catch have fallen over the past 5 years, tuna ranching capacity continues to be ramped up

**Figure 2-15**

E. Atlantic bluefin tuna, estimated catch, total allowable catch (TAC) quota, recommended TAC, 2002-2010

- **Catch (Thousand metric tonnes)**
  - TAC
  - Estimated total bluefin tuna catch
  - Tuna ranching capacity

The International Commission for Conservation of the Atlantic Tuna (ICCAT) has set its TAC quota in excess of the scientifically recommended quota, and failed to regulate IUU fishing.

Source: ICCAT SCRS, 2008, 2010; team analysis
• **Institutionally vulnerable fisheries** are plagued by the lack of control over fishing mortality rates. Simplistically, control over mortality can be exerted by government-led management regimes or by individuals or communities vested with some degree of control over fisheries (such as traditional use rights or CBFM). Fisheries with weak governmental and individual mortality controls are highly vulnerable to overfishing. [Figure 2-14] The absence of effective institutional control not only permits overfishing, but also effectively encourages overfishing because there is no guarantee that stocks will be there in the future. In other words, the effective discount rate is very high, which further fuels the race to fish.

The linkage is clear: a lack of institutional strength creates a level of uncertainty around future landings that only fuels the hard-wired race for fish. Very few economically relevant fisheries are biologically capable of enduring this level of effort without depletion or collapse. While the systemic drivers of overfishing are common across most fisheries, they play out over a unique set of actors and conditions in each fishery. These fishery-specific idiosyncrasies need to be understood and taken into account in order to overcome the barriers to reform and achieve effective fisheries management. To illustrate the need for greater fishery-specific information, the following three case studies explore the economics and dynamics of rebuilding fisheries: the Atlantic bluefin tuna fishery, the Gulf of Mexico snapper fishery, and the tropical grouper fishery.

**Eastern Atlantic bluefin tuna case study.** The Atlantic bluefin tuna fishery is managed by ICCAT. The stocks are severely stressed, and the Commission members have proven incapable of taking decisive action. Under “business as usual” assumptions, we estimate the Eastern Atlantic bluefin tuna stocks will collapse in the next 4-7 years. This scenario is based on the assumption that IUU fishing continues unabated in the coming years. There are some indications that efforts undertaken by ICCAT (e.g., implementing a vessel monitoring system, requirements to pay back quota overages) may already be slowing IUU fishing. If these efforts continue to be successfully implemented, our business as usual scenario is overly pessimistic and the fishery may avoid collapse, or even achieve ICCAT targets for recovery to $B_{MSY}$ by 2022.

The eastern Atlantic bluefin tuna industry is dominated by purse seiners, who take 60% of the legal catch (the remainder is caught by long-liners, traps, bait boats, and trawlers). Substantial overcapacity exists in the purse seine fleets, with over 250 boats added in the last ten years to a fleet now totaling over 600 vessels. The boats mostly catch young tuna during spawning aggregations, which eliminates most of the stock effect. The full nets are then dragged to grow-out farms, where the tuna are fattened for eventual export to Japan. The farms have been built, at great capital expense, to accommodate five times the volume of current TACs. [Figure 2-15]

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78 These case studies combine the biological modeling (by UCSB/Eco-analytics) and economic modeling of restoration scenarios (led by McKinsey and Company).
79 Collapse here is defined as less than 10% of the sustainable biomass, or the biomass which delivers the maximum sustainable yield. For the East Atlantic Bluefin tuna, this was determined to be approximately 350,000 tons.
82 I.e., the cost of fishing does not increase as the stock levels decrease; there is no economic feedback loop or warning signals
Figure 2-16

Summary of scenarios

Purse seiners: Total yearly net income

Yearly cash flow
$ Millions (each scenario)

Ranchers: Total yearly net income

Yearly cash flow
$ Millions (each scenario)
We combined age-structured biological models and detailed cost models to shape three potential scenarios for the future of this bluefin tuna fishery:

- **“Business as usual”:** This scenario assumes current TACs and levels of IUU fishing remain constant.
- **“No IUU”:** This scenario assumes that ICCAT successfully implements the recently specified reductions in IUU rates and TACs.
- **“Close until recovery”:** This scenario assumes a total closure of the Atlantic bluefin fishery until the stock is fully recovered ($B_{MSY}$), with TACs then set at $F_{MSY}$. It also assumes complete cessation of all IUU fishing.

**Business as usual.** At current levels of fishing mortality, the Eastern Atlantic bluefin tuna fishery will collapse in the next 4-7 years. A recovery plan was put in place in 2006, and recently strengthened due to pressure from the environmental community. On the advice of scientists, ICCAT recently reduced the fishery’s TACs by 4%, and this TAC reduction has some chance of avoiding stock collapse, but only if no IUU fishing occurs. There are some indications that efforts to reduce IUU are beginning to have an effect, but it remains to be seen to what degree they will reduce IUU. As recently as 2009, IUU landings exceeded ICCAT’s TACs by nearly 2.5 times, and a quick tabulation of recent Japanese imports suggests that this trend is continuing. If current harvest levels (approximately 40,000 tonnes per year) are maintained, the stock will reach the point of collapse by 2014. Other assessments of the trajectory of the Atlantic bluefin stock have been more optimistic. This is due to differences in the modeling methodology: the two key differences appear to be the assumptions around IUU and the current biomass level of the Eastern Atlantic bluefin tuna.

The reason this overfishing is so resilient is that ICCAT is faced with the perfect storm: institutional inability to enforce IUU or set aggressive TACs; economic disruption brought on by overcapitalization of fisheries and ranchers, as well as tuna price volatility; and high biological accessibility to high fishing pressure. All this leads to massive uncertainty and a race for fish in a de facto open access fishery which, in the absence of meaningful enforcement, does not stop at the specified TAC. The ease with which tuna are caught in spawning aggregation sites means that purse seiners see a very low stock effect in their catches, which further sets the species on the path to collapse.

**Fishery restoration.** Returning the bluefin tuna stock to B$MSY$ could be achieved by closing the fishery altogether until recovery occurs, or by completely eliminating IUU in order to allow ICCAT’s new TACs time to rebuild the fishery - ICCAT has set a target of rebuilding the fishery by 2022. A complete closure would produce a full recovery within 6-11 years, while the latter proposal carries some risk of fishery collapse, even if perfectly implemented. Either scenario would be beneficial for most of the major economic actors in the industry over the long run, except for those purse seiners benefiting today from IUU, and for the tuna ranchers who also currently rely on IUU. The elimination of IUU would yield purse seiners incremental rents of $20 million over five years, and nearly $400 million over 15 years (in net present value). Closing the fishery until recovery would eliminate purse seiner rents of $144 million in the first five years, but that would be compensated by an incremental rent of $466 million over a 15-year period. [Figure 2-16] Tuna ranchers, who are already losing money, are the biggest losers in any recovery scenario, and they can be expected to oppose further TAC reductions and IUU elimination efforts vigorously.

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83 Three out of 11 of our modeling scenarios resulted in fishery collapse.
85 The Taylor study assumes that Eastern Atlantic bluefin is at $B_0$ in 1950 and uses landings history in an age structured model to estimate current and projected $B/MSY$ levels. Using this methodology they estimate SSB in 2008 to be about .85 BMSY. The most recent stock assessment from ICCAT estimated SSB to be between .19 and .51. A second key difference is that the Taylor study assumed that future catches would be constrained to the TAC (i.e., no IUU will occur).
Greater reform is unlikely without more active pressure from affected sections of the markets. ICCAT has a difficult challenge in allocating quota to individual vessels, enforcing this quota, and excluding “flag of convenience” vessels, making IUU a resilient problem in the fishery. One potential pathway forward would be for the mainly Japanese buyers of bluefin to restrict their purchases to those fish that were verifiably caught by compliant vessels, or to support a six-year shutdown of the fishery, but the feasibility of this buyer-collusion solution is not clear. Ideally, the market should advocate for the establishment of a rights-based management system for bluefin, such as a catch share system, in order to better align the incentive of the fleet with a longer time horizon. This system could potentially eliminate the race to fish and prove to be a powerful deterrent to IUU fishing.

**Gulf of Mexico Red Snapper case study**

The U.S. Gulf of Mexico red snapper fishery is an ideal demonstration of the efficacy of various management schemes for different players accessing a single fishery. Red snapper, which has been heavily exploited, is currently covered under the Magnuson-Stevens Act and is under a rebuilding plan with a TAC set to return snapper to target levels. Fifty-one percent of the TAC is allocated to commercial fishermen, with the remainder of the TAC shared across the recreational segments of the fishery: private anglers, smaller charter boats which take out 4-6 people per trip, and larger “headboats” which can accommodate groups of around 20 to 80 recreational anglers per trip.

The commercial sector operates under an effective, relatively data-rich IFQ system which allows commercial fishers to keep track of their collective impact on the fishery. This actually comes in under the Magnuson-Stevens Act and is under a rebuilding plan with a TAC set to return snapper to target levels. Fifty-one percent of the TAC is allocated to commercial fishermen, with the remainder of the TAC shared across the recreational segments of the fishery: private anglers, smaller charter boats which take out 4-6 people per trip, and larger “headboats” which can accommodate groups of around 20 to 80 recreational anglers per trip.

The recreational sector has a strong desire to preserve the snapper resource, but lacks the tools and management scheme to do so. To meet rebuilding targets, management is currently forced to progressively shorten the recreational fishing season. Uncertainty around future season length, which reached an all-time low of 48 days in 2011, fuels a derby fishing mentality that only exacerbates the management challenge. Discard mortality remains high due to a combination of low bag limits, high minimum size requirements, and inadequate information regarding the proper handling of fish. Additionally, minimum size requirements may not be an appropriate management tool for species of fish such as red snapper that are not particularly resilient to catch and release. Certain fishers who may adhere to the two fish per person limit regardless of size of fish caught may be forced to throw back and kill undersized fish.

In order to reduce “derby fishing,” an ITQ could be established in the for-hire sector, which includes headboats and charter boats. This would help keep the for-hire segment of the recreational fishing industry within the appropriate limits, while improving the overall economics of the for-hire sector substantially. Given their impact in the fishery, private anglers will need improved management as well if we expect to achieve sustainable fishing in the Gulf. There have been some innovative ways to better engage private anglers in contributing real-time data, and there should be increased efforts to enhance the fishing experience for private anglers while preserving the fishery.

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86 For every five fish landed, six fish are killed through the discarding process, according to recent estimates by NOAA scientists and the Southeast Data Assessment and review report.

87 It is important to note that the dead discard rate also includes mortality as a result of regulatory discards (i.e., discarding fish that is below minimum size limits), and it is possible that stricter regulations will increase the discard rate. This relationship should be further explored in order to determine the ideal amount and combination of regulations in the recreational sector.
We modeled five scenarios to suggest how best to reach the SPR targets for this fishery:

- “Business as usual”, with current rates of recreational sector dead discards and quota overruns
- “IFQ in the for-hire sector”, with accountability and adherence to a quota by charter boats and headboats (we assume 30% of recreational TAC goes to charter boats, 20% to headboats, and 50% to private anglers), and business as usual activity by recreational fishers
- “Dead discard reduction”, where dead discards in the recreational fisheries are reduced from 1.2x to 0.5x the weight of harvests
- “Strict quota conformance” by all players – commercial and recreational – but maintaining current discard and discard mortality rates
- “Strict quota conformance and reduced dead discards” by all players, which is the ideal scenario

The following major insights are gained from an exploration of the results [for Figure 2-17, please see next page]:

- A 60% reduction in dead discards from 1.2x harvested weight to 0.5x harvested weight has astonishing results. By 2018, the total harvest increases 2.5x for all sectors. Private angler days-at-sea restrictions become unnecessary almost immediately, while the season for head boats and charter boats increase by 3-4 times its current length. Over the next five years, commercial profits would increase by $9 million, headboats by $90 million, and charter boats by $122 million (putting that whole industry back into profitability). The findings highlight the huge effect that private angler discard mortality has on economic rents across the entire industry.

- A strict quota-compliant ITQ system for charter boats and headboats fails to reach the 26% target spawning potential rate by 2032. This shows that a solution that does not require private anglers to fish to quotas and reduce dead discards is not an adequate solution. Commercial fisher profits remain relatively constant, and they do not see an increase in the amount of fish that they can catch. Headboat profits would increase by $105 million over the next five years, while charter boat profits would increase by $47 million over the same time period.

- The ideal solution to maximize economic rents in the fishery would include establishing an ITQ system for the charter boat and headboat sectors, supplemented by aggressive steps to limit discard mortality. Such actions could include punitive fines for highgrading, the creation of an angler certification and education program, and establishing a system of accountability for recreational fishers such as tagging.

**Tropical Grouper case study**

Grouper is an important fish in Southeast Asia, primarily because of the astronomically high prices certain grouper species can fetch in the Hong Kong and mainland China live reef food fish trade (LRFFT). However, grouper has been widely overfished throughout much of the region, and (in the absence of formal stock estimates) professionals indicate that the biomass of these species is well below B_{MSY}. The overfishing of groupers has continued unabated and has expanded into new regions. In some parts of the Coral Triangle, the ecological damage is exacerbated by the presence of destructive fishing gear such as cyanide. If current overfishing continues unabated, our illustrative model points to the regional collapse, depriving many local fishermen of a lucrative livelihood, and significantly damaging an unparalleled marine ecosystem.
**Preferred snapper scenario: TAC compliance and reduced dead discards**

- **Actual and Projected SPR vs. goal over time**
  - Percent of goal
  - SPR by 2032
  - Projected
  - Goal

- **Harvest by different sectors over time**
  - Harvested snapper (tons)

- **Profits by sector over time**
  - US$ Millions
  - Charter reduced
  - Headboat
  - Charter boat
  - Commercial

- **Net present value for different sectors**
  - US$ Millions
  - 2016
  - 2032

* Profits of the for-hire sector depend on number of days that they are on the water

** Season length for private anglers steadily increases to a full-year season
Reversing the region-wide overfishing trend is difficult given that there are multiple factors that drive overfishing. The strong and growing demand for live reef fish (primarily sold in restaurants in China and Hong Kong) provides a powerful incentive to catch these fish, even when substantial costs are involved in hunting down remaining populations. To link markets with the disparate fisheries in Indonesia, the Philippines, Malaysia, and throughout the region, influential live reef fish traders act as middlemen, further enabling overfishing. Traders are often mobile, establishing outposts throughout the region to collect fish (and leaving when serial overfishing occurs), providing gear in some cases, and establishing markets for undersized fish which can be “grown out” in marine cages. The need to harvest live fish has encouraged the use of highly destructive cyanide fishing in some regions. Most importantly, a vacuum of effective fishery management capacity voids the prospect of limiting mortality to the scientifically appropriate levels. The challenge is made all the more difficult given that grouper complexes are often not well understood, and are slow growing species.

In the absence of specific fishery data, we constructed a hypothetical model that builds on known biological and market characteristics. The outlook is not encouraging. Even if fishing is constricted to coastal communities, we find that the stock collapses—i.e., declines to 10% of carrying capacity—by 2030. If we add in large-scale commercial operations of the type we now see in the field, populations collapse within four years. Any maximum sustainable yield scenario eliminates large-scale commercial operators entirely, and restricts artisanal harvests. Given the profits involved in the LRFFT, this is hard to imagine.

A handful of potential solutions have been suggested:

- There is general consensus that marine reserves are a necessary tool, and at a minimum need to better protect grouper spawning aggregation areas.
- National cyanide bans would help to increase the average harvested fish size, thereby contributing to both the biological and economic situation, but would not be sufficient to solve the problems of overfishing.
- Size limits on live reef fish and national cyanide bans would help to increase the average harvested fish size, thereby contributing to both the biological and economic situation, but would not be sufficient to solve the problems of overfishing.
- Trade-based solutions and other market interventions (export quotas, market campaigns, the Convention on International Trade in Endangered Species (CITES) listings, FIPs, etc), could potentially limit growth in demand, but would be very challenging to successfully implement and would not address overfishing occurring for subsistence and local markets. These efforts are unlikely to be effective in the presence of substantial IUU and illegal trade.
- Ultimately, any viable solution requires limiting overall fishing mortality. Protecting spawning aggregations and undersized fish, reducing the use of destructive gear, and dampening market demand for the end product, while valuable efforts, will not be sufficient to solve the problem. Given the complexity of government-led management for multi-species, near-shore fisheries in the region, considerable attention has been placed on promoting effective community-based management solutions, such as TURFs and reserves. The development of TURF-reserve systems should be promoted and potentially linked to a market-tenure system for major traders, and supplemented by export quotas and better regional import-export controls.

For all scenarios we assume the starting biomass of the fishery is 38.75% of carrying capacity. Regionally, grouper stocks are likely below B_{MSY} (around 50% of carrying capacity). However, individual stocks may range from untouched to fully depleted. The hypothetical stock we model sits somewhere in the middle, or perhaps slightly closer to untouched.
Though sustainable fisheries may be more profitable, attempts to manage them have not always yielded expected results.

Figure 2-18
Lack of sustainable fishery management has resulted in what looks to be significant value loss

<table>
<thead>
<tr>
<th>Source</th>
<th>Estimated yearly value lost $ Billions</th>
</tr>
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<tbody>
<tr>
<td>FAO 1993</td>
<td>54</td>
</tr>
<tr>
<td>Garcia &amp; Newton 1997</td>
<td>46</td>
</tr>
<tr>
<td>Sanchirico &amp; Wilen 2002</td>
<td>90</td>
</tr>
<tr>
<td>Wilen 2005</td>
<td>80</td>
</tr>
<tr>
<td>World Bank 2008</td>
<td>51</td>
</tr>
</tbody>
</table>

Source: World Bank “Sunken Billions”

If players are making rational economic decisions, there must be a reason this value isn’t being captured

Three hypotheses:

1. Winners and losers
   - Value doesn’t accrue equally to all players, some will win and others will lose
   - Losers tend to block attempts at reform
   - Losses will be incurred when less fish are caught during transition — these might be too large for the industry to bear
   - Depending on discount rates recovery could be NPV negative
   - Past studies use social discount rates, which are much lower than industry rates

2. Losses during transition
   - Management costs could exceed additional value captured
   - In many places, there are no means to finance management

3. Management cost not accounted

Figure 2-19
Estimates of annual global fishery management costs range from 4-10% of the value of the capture fisheries

Management costs

U.S.$ Billions

Annual value of capture fisheries = $94 billion

$3.6 billion  WWF (2001)
- Country subsidies were compiled from international organizations
- Subsidies towards management are shown here

$7.5 billion  OECD (2003)*
- Cost of management were submitted by OECD countries
- Global costs were extrapolated based on average cost per metric ton

$8.3 billion  Khan et al. (2006)
- Country subsidies were compiled from numerous sources
- Subsidies towards management are shown here

$9.3 billion  Sumaila et al. (2010)
- Revised analysis by Khan et al. (2006)

* Global costs were extrapolated based on values reported by OECD countries
CHAPTER 2: ROOT CAUSES AND SOLUTIONS

Argument 3: The transition to sustainable fishing is hard

The ocean is a productive system. Global overfishing is reducing the productivity of the system, in both biological and economic terms. Estimates of the economic rents lost to overfishing range from $50 to $90 billion per year.89[Figure 2-18] Since Garrett Hardin defined the tragedy of the commons, we've recognized that the rational economic decisions of individuals in a commons are a recipe for disaster. Efforts to overcome that basic stumbling block are often thwarted by a suite of compounding economic and institutional barriers such as those described here.

**Economic barriers to fishery restoration**

- **Asymmetric allocation of losses and benefits.** Fishery restoration can be costly for those that depend on the fishery. Typically, losses are not spread equally across the fishing industry value chain. The distinct economics of major actors (capital intensity, operating margins, discount rates, etc.) make it possible for some to weather restoration in great shape; others, however, face truly existential threats. For example, a shutdown of the bluefin tuna industry to restoration would impose a total burden of $100 million per year on purse seiners and tuna ranchers. The Spanish bluefin tuna grow-out farms would lose $75 million per year. The inevitable resistance of risk-averse actors jeopardized by the transition is often difficult to overcome in the politically charged decision-making processes.

- **High management costs.** Fishery management itself can be expensive and is typically not financed through cost recovery programs from landings. Globally, management costs in the Organization for Economic Co-operation and Development (OECD) countries range from 4-10% of the value of the capture fisheries.[Figure 2-19] Where fishery management institutions are currently weak, finding new resources for fisheries is a huge obstacle. Public regulatory entities are typically cash-starved, and an already strained industry is understandably unwilling to contribute to the collection box. The costs of developing or reforming management are typically not included in the calculations of the costs and benefits of restoration. In the case of tropical grouper, the need to build a functioning management system in several countries, whether at the national, municipal, or community level, is the fundamental limiting factor in fishery recovery.

- **Data gaps.** Huge data gaps frequently lead to market failure. For example, the true count of Atlantic bluefin tuna caught by purse seiners and transferred to grow-out farms is not known, nor is the precise amount of IUU fishing currently decimating the stocks. Without a semblance of accurate catch data, it is impossible to manage one of the world’s most important fisheries. More generally, of the tens of thousands of fisheries in the world, we have detailed stock assessments for fewer than 1,000. When stock assessments are missing, as they are for minor stocks or most fisheries in the developing world, management decisions must be based on fishery dependent data, such as coarse effort and landings estimates.

- **High industry discount rates.** High discount rates often make fishery restoration economically unattractive. In the most extreme case, a hungry subsistence fisherman has an almost infinite preference for today’s catch over next year’s. In general, fleets in the developing world, working with no guarantees that stocks will be there in the next year, operate under real or implied discount rates that exceed, year by year, the rate of increase in rents created by potential fishery restoration.

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89 e.g., FAO, 1993; Garcia & Newton, 1997; Sanchirico & Wilen, 2002; Wilen, 2005; World Bank, 2008
A minority-protective decision making process in RFMOs prevents ambitious measures from being passed

<table>
<thead>
<tr>
<th>RFMO</th>
<th>Decision making process</th>
<th>Barriers to implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICCAT</td>
<td>• In practice, consensus – in the past 40 years, ICCAT has only had six parties object to three recommendations (according to its Convention, ICCAT only needs majority support)</td>
<td>• ICCAT effectively limits participation of meetings with high fees. The limited transparency leads to decisions being not well understood or well considered. This can decrease accountability</td>
</tr>
<tr>
<td>IOTC</td>
<td>• By 2/3 majority</td>
<td>• Any party may opt out with no justification or consequences</td>
</tr>
<tr>
<td>IATTC</td>
<td>• Consensus</td>
<td>• End up with the “lowest common denominator” or inaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chile and a number of other coastal states are not members. Limited VMS for large fishing vessels</td>
</tr>
<tr>
<td>WCPFC</td>
<td>• Consensus</td>
<td>• End up with the “lowest common denominator” or inaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CCSBT</td>
<td>• Consensus</td>
<td>• Self-assessment of CCSBT states that “management measures associated with capacity reduction are best left to members’ domestic arrangements”</td>
</tr>
<tr>
<td>GFCM</td>
<td>• Majority; consensus for financial decisions (allocation of member contributions, etc.)</td>
<td></td>
</tr>
<tr>
<td>CCAMLR</td>
<td>• Consensus</td>
<td>• End up with the “lowest common denominator” or inaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• There is an opt-out provision</td>
</tr>
</tbody>
</table>

Source: http://www.dfo-mpo.gc.ca/fgc-cgp/documents/mcdorman_e.htm
Institutional and structural barriers to fishery restoration

The institutional and structural barriers to fishery restoration include lacking institutional capacity, weak or non-existent data, and weak, consensus-oriented decision-making systems. These barriers are especially pronounced among the high seas fisheries administered by UN-mandated RFMOs, and among fishery management institutions in the developing world. We will discuss these in turn.

Regional Fishery Management Organizations (RFMOs). With few exceptions, RFMOs operate with a consensus-based decision-making process. In some cases, the need for consensus is a formal operating rule of the RFMO. In other cases, it has emerged informally as the standard practice. [Figure 2-20] The failure to reach decisions would result in open access in the fishery; consequently, the consensus-based rules protect the inevitable economic losers, who routinely block fisheries restoration. Similarly, the system is an inherently difficult forum in which to promote any measures—such as stock management, bycatch limits, and habitat protections—that violate any of the parties’ narrowly defined economic self-interest. For example, in 2010, NGOs recommended a TAC reduction of 50% for bluefin tuna, but the delegates of ICCAT could agree to only a 4% reduction for the following year, which was associated with just a 60% probability of reaching biomass target levels.
Nearly all RFMO delegates represent fishing interests

RFMO Delegates and Affiliated Organizations for IOTC and CCSBT

Composition of IOTC Delegates (88 total)

- Ministry of Foreign Affairs and Trade: 47.7%
- University/Research Institutes/Environmentalists: 18.2%
- Ministry of Agriculture and/or Fisheries: 10.2%
- Fishing Corporation: 9.6%
- Fisheries Organization/Association: 5.7%
- Other: 2.3%

Composition of CCSBT Delegates (70 total)

- Ministry of Foreign Affairs and Trade: 38.6%
- University/Research Institutes/Environmentalists: 28.6%
- Ministry of Agriculture and/or Fisheries: 26.3%
- Fishing Corporation: 9.6%
- Fisheries Organization/Association: 7.1%
- Other: 2.9%

Only ~12-18% of delegates do not represent fishers or the fishing industry

Source: http://www.iotc.org/English/index.php; http://www.ccsbt.org/site/

Figure 2-21

RFMOs are financially dependent on member contributions

CCSBT member contributions by percent (2010)

- Indonesia: 30.8%
- Taiwan: 10.2%
- South Korea: 10.2%
- New Zealand: 9.6%
- Australia: 9.6%
- Japan: 8.4%

Total = $1,112,483


WCPFC member contributions by percent (2010)

- Japan: 22.3%
- Korea: 13.3%
- Chinese Taipei: 12.8%
- EC: 10.0%
- USA: 9.6%
- Other: 36.7%

Total = $3,638,643.21

IOTC member contributions by percent (2010)

- European Union: 30.1%
- Florida (US territories): 6.4%
- China: 6.3%
- Japan: 6.3%
- Australia: 7.0%
- France (IO territories): 7.0%
- Other: 26.3%

Total = $1,112,483

ICCAT member contributions by percent (2009)

- EC: 36.7%
- Other: 17.8%
- Japan: 12.8%
- USA: 10.6%
- China: 6.0%
- Papua New Guinea: 5.5%
- Taiwan: 5.5%
- Japan: 5.5%
- Brazil: 5.5%
- Greece: 6.7%
- Iran: 6.7%
- Ghana: 6.7%
- Vietnam: 3.4%
- China: 3.4%
- Thailand: 1.9%
- France (St. P. & M.): 1.9%
- South Korea: 1.5%
- Korea: 1.5%
- Vanuatu: 1.5%
- South Africa: 1.5%
- Mexico: 1.5%
- Tunisia: 1.5%
- Panama: 1.5%
- Canada: 1.5%
- Other: 1.4%

Total = $3,638,643.21
Conservation interests are not well represented in RFMO decision-making. Nearly all RFMO delegates represent fishing interests. [Figure 2-21] In the Indian Ocean Tuna Commission (IOTC), for example, 50% of delegates represent an agricultural or fishery ministry, 20% fisheries organizations, and 10% fishing corporations. To make things worse, RFMOs are financially dependent on member contributions, and large fishing nations often have disproportionate funding shares (Japan and Australia contribute over 31% of Commission for the Conservation of Southern Bluefin Tuna’s (CCSBT) budget). [Figure 2-22] Implementing and enforcing conservation decisions is often blocked by a lack of funding from members opposed to self-funding enforcement and planning. This tendency is exacerbated by a lack of transparency of RFMO proceedings.

The RFMO mandate and legal platform is weak. The UN Convention on the Law of the Sea (UNCLOS) provides only vague standards, which do not explicitly prohibit over-exploitation. [90] The UN Fish Stocks Agreement (UNFSA) provides a fishery management framework, but not all RFMO members are UNFSA Contracting Parties, and can thus block reform by opposing UNFSA. In violation of UNFSA standards, for example, RFMO members often wait for extensive (and elusive) scientific evidence of stock decline before implementing conservation measures. [92]

RFMOs are only as effective as their members allow them to be. As a result of perverse incentives, and a minority protective decision-making process, RFMOs have become paralyzed by their own contracting parties. [See Appendix 3 – RFMO Review]

**Developing world fishery management agencies.** Effective mortality controls for small-scale coastal fisheries are notoriously difficult to impose. In data-poor, highly decentralized environments, TACs and quotas are very difficult to implement. CBFM involving limited access systems such as TURF-reserves are more suitable, but require significant (and often elusive) scale to work for mobile species like finfish, and can be entirely pre-empted by open access laws.

In many parts of the developing world, the management of industrial-scale fisheries is also beyond the institutional capacity of these countries. In highly decentralized archipelagos such as Indonesia and the Philippines, even straight-forward, effort-based input controls are notoriously tough to implement. The data gaps are huge, stock status is almost entirely unknown, and landings and effort data are not systematically collected. Districts and provinces often have enforcement rights, but those are used unevenly, if at all.

To make matters worse, uncontrollable third parties are often in play. Frequently, well-financed IUU fishing in foreign water is protected by diplomatic pressure. International distant water fleets operate under a variety of arrangements, some of them legal under foreign access agreements and overseas development aid agreements, others protected by inside deals and flags of convenience. Improving the status of these fisheries cannot rely on CBFM. Instead, it will require a longer-term change of government capacity and improvements in the rule of law.

Within the developing world, many of the core ingredients for effective fisheries management are much broader than the scope of this study. Fisheries management challenges may not be adequately addressed without progress on overarching problems such as, economic development, corruption, alternative livelihoods, and infrastructure development, to name a few.

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90 The United States and European Union contribute roughly 30% and 40% of IATTC’s annual budget respectively.

91 Article 61(2) of UNCLOS states that “coastal state[s]...shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation.” This clause does not explicitly prohibit over-exploitation, and does not clarify whether resources should be defined by specific stocks, species or biomass.

92 In March, 2010, the Foreign Minister of France stated that, “France wants to wait for a scientific report on Bluefin tuna due next year before the world community bans trade in the fish”. In June 2008, measures to protect juvenile bigeye tuna and yellowfin tuna were rejected by IATTC because of the inherent uncertainty in scientific stock assessments.