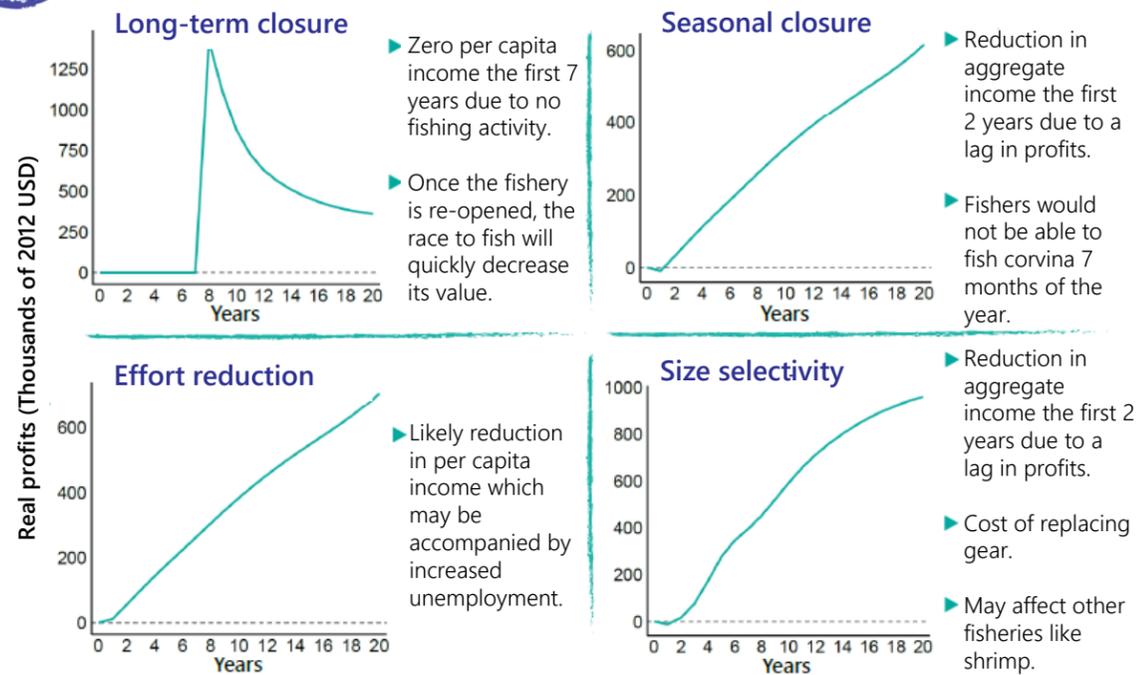


# 3

## Social and economic tradeoffs of optimal economic management over time



The optimal strategy that combines the different management approaches, follows a path almost identical to size selectivity and would involve all tradeoffs described for effort reduction and size selectivity. Including a long-term closure may increase profit levels but adds all the tradeoffs described above.

### Conclusions

If current management in the Gulf of Nicoya remains unchanged, the Corvina Reina fishery will continue underperforming. The economic benefits of fisheries compliance from our analysis, reinforce the need to fully implement the National Marine Strategy of Control and Surveillance and the new Interinstitutional Surveillance Station in the upper part (Zone 201) of the Gulf of Nicoya.

Under the current policies, compliance with effort restrictions should be a priority. Implementation requires significant improvements in monitoring and enforcement. We recommend a full census of fishing effort as there is currently no reliable estimate of the number of fishing boats active in the Gulf of Nicoya. The introduction of minimum sizes can further improve economic performance. Currently Costa Rica has no size limit legislation for any of its fisheries and our results support this type of legislation. Similar size limit regulations may favor other 13 fisheries that also demonstrate price premiums for larger individuals.

### Acknowledgments

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## Quantifying the economic potential of small-scale fisheries in the Gulf of Nicoya, Costa Rica

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**Client:** Lindsey Larson, from Rare-Fish Forever  
**Advisors:** Andrew Plantinga and Laura Urbisci



ON THE WEB AT [HTTP://NICOYAFISHERIES.WEBLY.COM/](http://NICOYAFISHERIES.WEBLY.COM/)

SPRING 2017

### Overfishing in the Gulf of Nicoya



Declining catch rates and persistently low socio-economic development in coastal fishing communities in the Gulf of Nicoya, Costa Rica, suggest current fisheries management is not generating optimal benefits for resource users. There is compelling evidence that the current management approaches - effort control, closed fishing season, and gear restrictions - have not been working as expected over the last three decades (1).

Low levels of compliance have been observed for all management approaches, suggesting that the fishery is in a de facto open access (2). This is an undesirable stage, as all benefits for the fishery eventually dissipate, generating no net economic gains. Furthermore, the lack of scientific or economic rationale to support the design of regulations has been recognized by the government itself (3). Thus, lack of compliance and poor scientific and/or economic criteria in the design of current regulations have been identified as the principal sources of ineffective management.

### Significance

The Gulf of Nicoya is one of the largest in Central America and is home to dozens of communities that are highly dependent on fishing as their main economic activity, with few alternative livelihoods available in the area. Decline of fisheries resources would result in increased risks of poverty for Gulf of Nicoya's coastal inhabitants.

This situation has concerned local authorities and the national government. The Ambassador of Costa Rica to the United States approached our client, Rare and its Fish Forever program, to learn more about the potential for small-scale fisheries improvement in the Gulf.

### Our goal

Guide the allocation of efforts to increase compliance and inform the improvement of policy design by quantifying the economic potential of Nicoya's small-scale fisheries under different management approaches.



**Figure 1.** Map of the Gulf of Nicoya in Costa Rica. Source: Adapted from José Francisco Nuñez.

## Case study: Corvina reina fishery in the upper gulf

We focused our analysis in the upper Gulf of Nicoya, which has historically been a priority target for management interventions. This area serves as the main fishing ground for over 20 fishers associations and as a nursery area for several commercially important species. To pilot our analysis, we selected an economically and culturally important fishery as a case study for the area, the corvina reina (*Cynoscion albus*). This fishery is the most important single-species finfish fishery in the upper Gulf, accounting for 51% of the catch in this region. It is caught with gillnet, handline and bottom longline.



Sold in three main size categories, with a higher price per gram for larger fish



**Figure 3.** Corvina reina (*Cynoscion albus*)  
Source: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Mexico.

## Research questions and general approaches

### 1 What is the status of the corvina reina fishery in the region?

We implemented static data poor length-based analyses to first characterize the status of the corvina reina fishery. Using length-frequency data, we estimated the fishing mortality ratio, Froese sustainability indicators, and spawning potential ratio to evaluate the size composition of the catch, the fishing pressure on the stock and its performance.

### 2 What is the economic potential of the corvina reina fishery for current management approaches, under perfect compliance and improved design?

To measure the economic potential of the corvina reina fishery for current management approaches under perfect compliance and improved design, we constructed an age-structured model. This approach is applied to determine the theoretical economic optimum of the fishery, taking into consideration age-specific vulnerability of fish to gear type and individual reproductive potential. It also allowed us to incorporate the price premium for larger corvina, which is relevant for management aimed at maximizing economic outcomes. Profits were projected over 20 years with a discount rate of 9% for two different scenarios for each approach: perfect compliance with current regulations and perfect compliance with the regulation that maximizes net present value. We consider a continuation of zero profit open access equilibrium as the status quo.

### 3 What are the economic and social tradeoffs involved with optimal outcomes of different management approaches over time?

We projected the profits generated over 20 years for each optimal management approach and inferred the associated socio-economic impacts in the context of the gulf based on the time path and policy implications.

## 1

### Status of the corvina reina fishery on the upper Gulf

All of the estimated data-poor indicators suggest that the corvina reina fishery in the upper part of the Gulf of Nicoya is in an overexploited state, as shown below. All indicators are below the target for a healthy fish stock population.

	Mature fish in the catch	Fish of optimal length in the catch	Mega-Spawners in the catch	Fishing mortality ratio	Spawning potential ratio
Target	100 %	100 %	30-40 %	1	40 %
Actual	41 %	16 %	29 %	1.23	23 %

## 2

### Economic potential of the fishery under perfect compliance and improved design

We identified four management approaches described below which are currently applied or being considered by the Gulf's managers. A fifth scenario (combined) explores the interaction between the existing policies. Since current regulations are not being followed, all of them display a status quo level (▲) that is different from what is stipulated by the law (▲). Using our model we identified the regulations for each management approach that would maximize profits (▲) over 20 years.

#### Long-term closure

Currently being considered to allow the recovery of biomass.



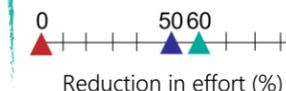
#### Seasonal closure

A three to four-month closure is carried out every year since 1985 in the upper gulf.



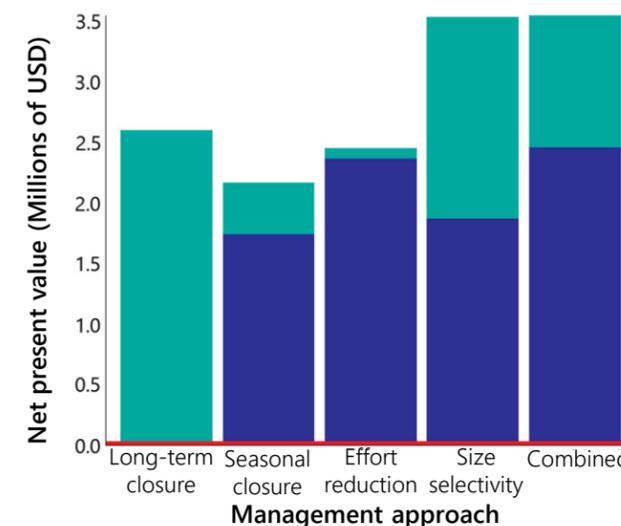
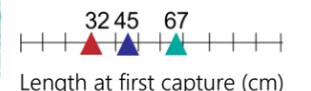
#### Effort reduction

Implemented through the allocation of fishing licenses.



#### Size selectivity

Implemented through minimum mesh sizes for gillnets to ensure reproduction.



Profits increased under both scenarios across all management approaches. Perfect compliance with existing management project increases ranging from 1.6 to 2.4 million USD in NPV. With no changes to existing policies, compliance with effort control would generate the highest benefits. Increasing size selectivity showed the highest positive effect under regulation adjustment. The maximum gains to the fishery were model through a combined policy of an 8 % reduction in effort and minimum size of 75 cm.

**Figure 2.** Net Present Value (NPV) of the different management approaches, under perfect compliance with current regulation (blue) and perfect compliance with optimal design (green). The status quo is represented by the red line.