

Developing Sustainability Principles and Criteria for Management and Eco-labelling in the Sian Ka'an and Banco Chinchorro Biosphere Reserves, Mexico

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ABSTRACT

An assessment of the biological and economical aspects of lobster fisheries (*Panulirus argus*) within two Biosphere Reserves in Mexico, the Banco Chinchorro and Sian Ka'an, was conducted with the aim of proposing alternatives for improvement in the management at these Protected Areas. A local eco-labelling scheme, "Chakay" representing all cooperatives that fish in these two areas, is discussed. The eco-labelling scheme is an innovative way used to increase compliance with management arrangements, which may in turn lead to more sustainable fisheries. This article reviews the eco-label implementation scheme as a commercial and legal strategy intended for generating an added value to sustainable practices, and discusses how it can be used as an instrument to help scientific monitoring and stock assessment of the lobster population.

The *P. argus*-spiny lobster fisheries are the most highly valued single species captured in the Mexican Caribbean, and the Banco Chinchorro & Sian Ka'an cooperatives represent more than 50% of the State of Quintana Roo's total catch of lobsters. Whilst recognizing that sustainability has environmental, ecologic, economic and social dimensions, addressing it in relation to these fisheries requires an extended analysis of the dynamics of the lobster population, which is an ongoing process. Ecological aspects, survey techniques, and stock assessment are overviewed. The relationship between the socio-economic status of the cooperatives, whose livelihood depends mainly on these fisheries, and the possible impact on the lobster population is analysed.

KEY WORDS: Lobster, *Panulirus argus*, eco-labelling, sustainability, fisheries management, protected areas

Principios para la Evaluación, Manejo Sustentable y Eco-Etiquetado en las Reservas de la Biosfera de Banco Chinchorro y Sian Kaan

Se realizó una evaluación sobre algunos aspectos biológicos y económicos de las pesquerías de langosta (*Panulirus argus*) dentro de dos reservas de la Biosfera en México, Banco Chinchorro y Sian Kaán, con la finalidad de proponer algunas alternativas para mejorar el manejo en dichas Áreas Protegidas. Se analiza el esquema de etiquetado "Chakay" que representa a las cooperativas concesionadas para la pesca, como un medio que puede fortalecer la regulación y el manejo en las diversas instancias, para dirigir a la pesca hacia una mayor sustentabilidad. Este artículo revisa la implementación de dicho esquema como un medio comercial y jurídico que agrega valor a las buenas prácticas de pesca, y así mismo lo ve como un apalancamiento útil para el monitoreo y análisis del stock permanente de la población de langosta.

La pesquería de langosta de *P. argus* es la más valiosa en términos económicos en el Caribe Mexicano, y la captura de Banco Chinchorro y Sian Ka'an representa más del 50% de la producción del estado. Al reconocer que la sustentabilidad pesquera contiene dimensiones ecológicas, económicas, ambientales y sociales, el análisis de estas pesquerías requiere de un análisis extenso de las dinámicas poblacionales de langosta, el cual comprende un proceso continuo. Aspectos ecológicos técnicos de evaluación y análisis del stock son revisadas. La relación entre el estatus socioeconómico de las cooperativas, cuya economía depende principalmente de de estas pesquerías y el posible impacto sobre la población de langosta es analizado.

PALABRAS CLAVE: Langosta, *Panulirus argus*, eco-etiquetado, manejo sustentable, reservas marinas

Élaboration des Principes de Durabilité pour la Gestion et l'Éco-étiquetage dans les Réserves de Biosphère du Sian Ka'an et Banco Chinchorro, Mexique

MOTS CLÉS: Langouste, *Panulirus argus*, eco-etiquetado, principes de durabilité, réserves de biosphère

INTRODUCTION

Areas of Study

Biosphere Reserves of Banco Chinchorro and Sian Ka'an Mexico. Towards the central area of the State of Quintana Roo, in the Yucatan Peninsula of the Mexican Caribbean, 528,000 ha are part of the Sian Ka'an Biosphere Reserve (SKBR), comprised of tropical forests, marshes and coastal lagoons. Further south the Banco Chinchorro Reserve (BCBR) is found comprising 144,360

ha including reefs, lagoons, some keys and adjacent oceanic waters, both considered areas of high bio-diversity and recognized as a main part of the Mesoamerican Barrier Reef System. This is the second largest reef system in the world stretching 380 km from Mexico to Honduras, and holds more than 50 species of corals, 400 species of fish and 30 species of sea fans.

Management Scheme

Both the Sian Ka'an (SKBR) and Banco Chinchorro (BCBR) Biosphere Reserves are part of the Meso-

American Reef System, characterized as some of the areas with highest levels of biodiversity in the Caribbean, and contain some of the largest and most preserved reef extensions (Chávez et al. 1985, INE-SEMARNAP 2000, CONANP 2007). Also home to community based cooperatives which have been recognized worldwide for their unique harvesting techniques (Lozano-Álvarez et al. 1989, Lozano-Álvarez et al. 1993, FAO 2001, Sosa-Cordero et al. 2008), these were declared as protected areas in 1986 (SKBR) and 1996 (BCBR). Unlike national parks, and protected areas in other countries, these Biosphere Reserves (BR) allow for scientific research, human habitation and regulated use of natural resources/fishing (López and Consejo 1986, INE-SEMARNAP 2000, CONANP 2007). Founded mainly for conservation purposes, the overarching goal of an ecosystem management approach has been promoting sustainable development, so the needs of the local stakeholders and inhabitants have necessarily been included in the BR management and strategic planning.

Eco-labels

The pressure to develop tourism at a national scale is strongly related to a desire to generate foreign currency exchange in the economy. At the State regional scale, the desire to meet economic needs leads in many cases to unsustainable use for natural resources including urban development, illegal extraction of resources and fishing. As major threats to marine ecosystems are coupled with the growing human population, encouraging commercial fisheries towards sustainable practices and bettering management for lobster harvesting is a clue action within these reserves. Dealing with these main threats, while meeting the local livelihood needs, is an issue revised throughout this paper, in the search for understanding the role of an eco-label initiative (Figure 1).

Due to evidence in catch rates and total landings, many scientists have published concerning the current international declining spiny lobster harvest scenarios throughout the whole Caribbean, including the Mesoamerican Barrier Reef (Chavez and Ley-Cooper 2007, Chavez 2007). Mexico is not exempt of this trend, yet cooperatives at BCBR & SKBR have managed to keep landing levels relatively stable, and are continuously assessed to better their practices by scientists from Universities like UNAM, ECOSUR and NGO's like RAZONATURA, along with government agencies like fishing CONAPESCA Biodiversity CONABIO and Protected Areas CONANP commissions. Considering these two fisheries as exceptional examples and also an opportunity for improving conservation locally and regionally, stakeholders suggested the creation of "CHAKAY" as an innovative legal tool for commercial representation. Through the netting of industrial property rights, that strengthen governance and better application of existing fishery and protected areas legislation, "CHAKAY" eco-label's rules of use

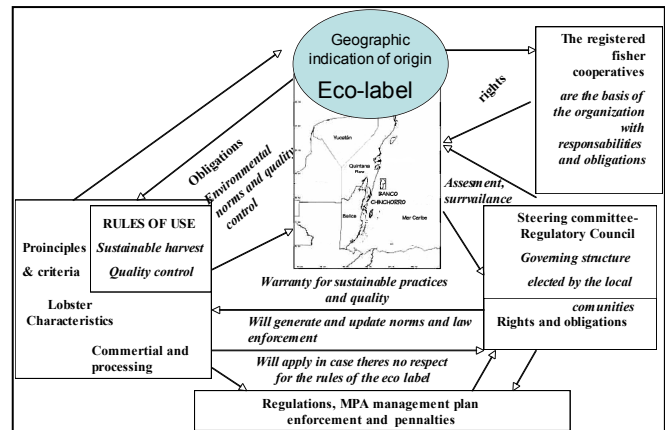


Figure 1. Building a Sustainable Seafood Brand - CHAKAY eco-labelling scheme "CHAKAY" (means lobster in Mayan language), (Ley-Cooper 2009; Ward and Phillips 2010) which is seen as an alternative to satisfy commercial demand while promoting the application of sustainability principles for *P. argus* lobster fisheries within these reserves.

(IntegradoraPesc. Q. Roo 2009) potentiate better management in local practices for artisanal lobster fisher communities, which are already organized into cooperatives with governmental exclusive concessions (Ley-Cooper 2006, Sosa-Cordero et al. 2008), by generating economic incentives, but also promoting consumer responsibility for respecting law enforcement of fishing seasons and minimum size which may allow more sustainable harvests (Ley-Cooper 2009).

The new arrangement has created both an opportunity and a challenge for artisanal fishers. While they were previously granted exclusive fishing rights to these waters and wanting to protect their resources and lobster stocks, the existing tight margins they were facing on the sales of lobster meant that any loss of volume threatened their business viability and livelihoods. Several initiatives had been working closely with these fishers to develop new sustainable fishing practices. In anticipation of the economic challenges the new legislation would present to fishers, the cooperatives involved, founded a for-profit Company Integradora de Pescadores of Quintana Roo SA de CV (Integradora) – which includes six of the states main fishing cooperatives in the partnership. The aim of the Company, Integradora, was to promote the fair trade and responsible commercialization of local sustainable seafood, primarily lobster. Integradora set out to build a sustainable seafood brand called "CHAKAY" and address the economic challenges the fishermen and partner cooperatives faced, taking advantage of a growing demand in the region for their sustainably produced, high quality, seafood products.

Lobster Fishery Component

The lobster (*P. argus*) has historically been the main

economic activity for the communities that inhabit within the BR, and is still the most important. Unlike other parts of the state, fishery catches in both areas of the BCBR & SKBR have stabilized during the last couple of decades (Sosa-Cordero 2003, Ley-Cooper 2006, Chavez and Ley-Cooper 2007). Total tail weight catches have varied around 20 t for BCBR, 70 t total catch for Northern SKBR (Punta Allen), and 30 t total catch for Southern Sian Ka'an (Punta Herrero), respectively (CONAPESCA-SAGARPA 2009). These catches have been achieved without an increase in effort, technology or efficiency in recent years, contrary to patterns observed in other Caribbean fisheries (FAO 2001, de León et al. 2005).

The community-based fishers are organized into cooperatives that follow strict regulations related to their artisanal fishing practices. Skin diving, without alternative air equipment, and the use of "casitas" - artificial shelters in a system of individually owned marine plots called "campos" (see Figure 2) are their only means of technology for capture, along with 60 HP motorized 7m long boats and some GPS (López and Consejo 1986, Lozano-Alvarez et al. 1989, Lozano-Álvarez et al. 1993, Sosa-Cordero et al. 1998). Skin diving limits the exploitation to depths above the 15 - 20 m, which mainly depends on lung capacity of each fisher (Lozano-Alvarez et al. 1991, Sosa-Cordero 2003, Ley-Cooper 2006). Licences are renewed annually and cooperatives must comply with the current legislation that includes a closed season from March to July, a minimum capture size of 135 mm tail length (80 mm CI) capture of egg bearing females is prohibited and other specific park management rules apply such as no take zones. Historically the semi-ownership of the fishing plots has allowed self surveillance and has been thought of as an efficient management strategy for regulating the fishery, which operates in areas that are closed to public use.

The campo plots administered by the cooperatives constitute a harvest technique which is quite unique regarding the property arrangement, since it virtually divides the sea floor as a series of concession blocks given out as territorial ownership to individuals for a better management of the resources within them. With fixed fishing areas, the individual fishing property rights over the "Campos" allow for bettering park ranger and cooperative vigilance.

Banco Chinchorro on the other hand is a false atoll, which is geographically isolated from the coast by a 30 km wide and a 1,000 m deep channel, for which only the three registered cooperatives have a right of entry and restrictively use its resources. Although not identical, this is a similar setting of property ownership as Sian Ka'an, since only the licensed fishers are allowed in the Reserve during the open season, work under close surveillance of park authorities and are assessed periodically by the same steering committee of academics and experts. In both areas these fishing restrictions and potential capacity of adaptation contrasts to open access fisheries, which occur in other

areas of the Caribbean that are progressively leading to a potential tragedy of the commons (Hardin 1968).

The "casitas" are shelters for adult and young recruits (Lozano-Álvarez et al. 1991, (Briones-Fourzan et al. 2000), Sosa-Cordero et al. 2008), which are also used in Cuba ((Baisre 2000), Cruz and Phillips 2000), Bahamas (Deleveaux 2002). These artificial refuges have shown cohabitation of small juveniles, which are more vulnerable to predation, with bigger co-specifics who have greater individual and collective defensive skills. This allows the juveniles to exploit the available food resources in a more efficient way and their time exposed to predators is reduced (Briones-Fourzán et al. 2007), which partially explains the high levels of juvenile recruitment to the fishery in these southern bays of Ascensión and Espiritu Santo (SKBR)(Briones-Fourzan et al. 2000). When lobsters are fished live from the "casitas", divers can do so without affecting the coral reef and allows for selectivity in size and sexual maturity, a main principle now being promoted by academics and the "Chakay" eco-label steering committee for both areas.

As an alternative for improving both the health of the lobster population and the socioeconomic condition of the fishers, the design and implementation of a national eco-label now called: "Chakay", was promoted by all stakeholders, governmental institutions and NGOs, like Razonatura, that were somehow involved with the assessment and management of these fisheries. The thought of gaining added value to the product as: "an immediate and future reward that can compensate for all previous and future efforts focused on bettering fishing practices and management"; was stated as the main objective in the document that legislates the eco-labels "Rules of use". These have been registered under the name "Chakay", which means lobster in native Mayan language (IntegradoraPesc. Q.Roo 2009), at the Mexican Institute for the Industrial Property (IMPI), which is the institution in charge of legislating all industrial property rights.

The "Integradora de Pescadores de Q. Roo" (IPQRoo) enterprise was created as the commercial face of the eco-labelling scheme which represents all six cooperatives that work in these two protected areas. This new socioeconomic arrangement is an innovative way for commercialising only the sustainably fished cooperative products under the one structure: the Administrative Council. Whilst coupled to the "Chakay" eco-label initiative, the General Assembly represented by the Administrative Council, decides upon the enterprise and it allows for a better governmental and stakeholder intervention through the Steering Committee, which in turn is integrated by Governmental authorities (CONANP, CONABIO, SAGARPA), academic research centres and Universities, as well as NGOs (RAZONATURA, COBI, and others), and Industry. The Steering Committee constantly assess and updates the Chakays eco-label's "Rules of Use" as well as the operations of associated cooperatives. The

initiative as a whole has been created to direct and increase compliance with sustainability policies and management arrangements designed for bettering fishery practices, which are supported mainly through product regulation, and monitoring of the fishery, which are enhanced with market driven interests.

The implementation and application of the “Chakay” eco-labelling scheme, foreseen as a means to meet both commercial demand and sustainability of the lobster population in SKBR & BCBR, recognises the good historical practices of the cooperatives involved, which have managed to maintain a constant catch throughout the last couple of decades with the use of their artisanal fishing practices. This is also the reason for why these two fisheries are currently under the formal assessment process for the Marine Stewardship Council certification. The “Chakay” eco-label, is also intended to function as a tool for permanently leveraging change in fishing practices, as it incites to adapt to future needs of both these fisheries.

Also seen as an integral strategy for bettering management at a regional scale, the initiative has set some clear examples resulting from this initiative. A multidisciplinary project currently promoted by the committee, is the implementation of a permanent monitoring program for the lobster population analysis, with the main aim to produce useful information at all stages of the life cycle with several research institutions involved. Another is the use of artificial shelters ‘casitas’, as a viable alternative for increasing Banco Chinchorro’s juvenile recruitment to the fishery, under the condition that new arrangements of Campos for management are also met (Briones-Fourzán and Lozano-Álvarez 2001), which has happened to Banco Chinchorro after the effects of Hurricane Dean in 2007. If the fishers follow certain rules like respecting the marine plots in which the casitas are to be placed, in the same manner as Sian Ka’an, this also leads to the opportunity for a change of fishing equipment, capture techniques and marketing of live lobsters. This strategy will focus on better selectivity of individuals for management, and better price value for marketing, without having to increase fishing effort.

BUSINESS AND LEGAL ANALYSIS OF THE ENTERPRISE PROJECT

The purpose of developing a feasible eco-labelling system that would recognize and usher the existing organized fisher cooperatives towards sustainable practices, required analysing new or existing conservation enterprise projects, while providing suggestions on project design and ideas. When faced with developing a project based with local fishing communities in these reserves, there was a strong and understandable tendency to focus on one that would lead to income generation or job creation in these communities, which seemed as an appropriate focus, if it was directly linked to the objective of enhancing better

fishing practices.

Fishers engagement in the existing eco-labelling scheme for the trade mark “Chakay” has allowed to improve project design and catalyse pro-conservation attitudes within the participating cooperatives, under the premise that in the 2009 experience it has generated an added value in the chain of custody. It has also revealed that unless there are also disincentives or penalties for fishers engaged in harmful practices, the projects success to reach its goals may not be achieved. Effectiveness of the legal approach to the local socio-economic and cultural context in this case study, has effectively impacted when the cooperatives have internally agreed in incorporating the eco-labels “rules of use” as their own, which refer to penalties for non-compliance with environmental and current fishery regulations, to be met obligatorily when working within the BCBR and SKBR.

While positive and negative incentives focused towards fishers have been crucial in the eco-labelling project design, questions arise whether cooperatives are the only targeted stakeholders, in order to achieve success for sustainability in these lobster populations. The scale of impact that any initiative may have when operating in an open meta-population like *P. argus*, (González-Cano et al. 2001) where larvae and juvenile recruitment may depend from elsewhere in the Caribbean (Briones-Fourzán 1994) and adult coastal migration patterns are still not well defined, (González-Cano 1991) must consider ways to influence behaviour outside of those direct participant stakeholders. Benefits could be achieved with community-wide funding that will capitalize with a certain percentage of revenue from the project, where a larger group of community-stakeholders, should have access to these benefits. Preferably, these should include higher levels in the chain of custody, in order to incorporate all cooperatives, and allow them to engage with the eco-labelling scheme, associated with the new enterprise called Integradora de Pescadores de Quintana Roo. This could encourage supporting enterprises that provide products/services to the anchor project, and create more jobs.

Catalysing the development of a successful, economically-viable sustainable fishery business is a long and expensive process, however, if a payment for environmental service approach is used, the highest levels of direct cash payments should be made to those individuals with the highest opportunity cost to not conserving biodiversity-fishers. This group of six fishing cooperatives have combined efforts to establish a company, which has developed its own brand - “Chakay” - which works with internal bylaws, recognizes and emphasizes the existing regulations and management plans in the same manner of an eco-label which has governmental agencies recognition private certification program. The eco-label is now a tool for marketing but also a way to confirm fishing communities are working under the sustainable program that they have developed which translates as the “Rules of Use”.

The IPQRoo has developed an extensive approach to sustainably harvesting live lobster and lobster tails within the Biosphere reserve. They have developed it accompanied by the lobster monitoring program, promotion of sustainable harvest techniques and try to ensure fair trade business practices, all of which are supported by the eco-label “Chakay”.

Scientific Monitoring of the Lobster Population

An extensive monitoring program in collaboration with several academic and governmental institutions includes initiatives such as the participatory lobster log book register and the use of tags for the labeling system.

As a lever and fine instrument to help scientific monitoring. Whilst recognizing that sustainability has environmental, ecologic, economic and social dimensions, addressing it in relation to these fisheries requires an analysis of the dynamics of the lobster populations and is also a part of this study which is not detailed here. Ecological aspects, survey techniques, and stock assessment simulations are currently under use for a broader understanding that should lead towards bettering sustainability criteria and principles in the fishery. The implementation of the use of pre-numbered labels with the brand is an efficient tool helping biological monitoring and protecting the product both commercially and legally. The identity of the origin under eco-label expects to generate the added value. It will be useful to encourage the good practice recognition amongst final consumers. This system of fair and sustainable trade is an innovative model unique to the country with regard to the use and monitoring of biological marine resources, and the example of the social organization that upholds it.

Fisheries Simulation Models

The relationship between the socio-economic status of the cooperatives whose livelihood depends on these fisheries and the possible bio-economic impact on the lobster population are currently being analysed, and models are under development. A first approach was carried out for the Banco Chinchorro (Chavez and Ley-Cooper 2007), using the FISMO (Fisheries Simulating Model) (Chávez 2005), but fine tuning of the fisheries data, criteria and inputs are still under revision, for which only a chart is to be presented in this paper. The following figure show the relationship between Profits, Fishing Mortality (F) and age of first capture (Tc), and Yield against Fishing Mortality (F) and age of first capture (Tc). It can be observed that there is a fine balance between these variables in which there is an optimal cross point where the fishery is at its maximum in both profits and yield, where $F < 0.15$, $T_c = 3$, or collapses if F increases or Tc decreases. Whether these exact numbers are to be questioned or not, is a matter of the model composition itself, but basic fishery science has shown that the relation-

ship between these criteria exists and sustainability will only be achieved if this balance is not disrupted.

FINANCIAL ISSUES: SUPPLY CHAIN AND SHORT-TERM WORKING CAPITAL

Stuck at the bottom of the supply chain, as in many fishing communities, we found that some middlemen in Cancun take advantage of fishers' lack of financial resources, specifically working capital. The well-financed middlemen are able to pay fishers in cash immediately for their lobster harvest, usually right at the dock, while at the same time they allow buyers such as hotels and restaurants to delay payments for their lobster for up to 60 days. These middlemen have the financial resources that enable them to “carry” buyers for this duration. Fishers are usually unable to bear this payment gap, and the associated uncertainties, and so cannot sell directly to buyers, even when they have the needed connections. Most middlemen also have access to sophisticated storage and freezing facilities. Even if fishers were able to deliver their harvest directly to retailers, and finance the carrying costs, without a facility to freeze and store lobsters they would be unable to take advantage of price escalations during the off-

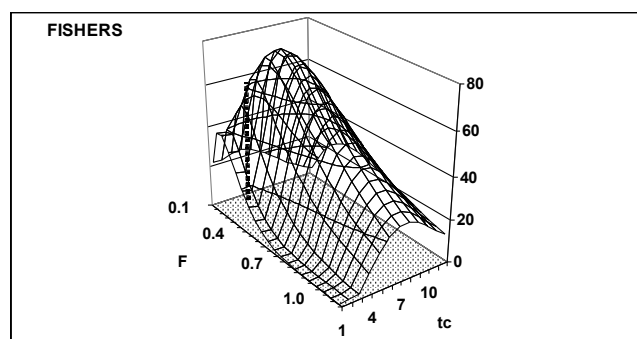


Figure 2. Relationship between Fishing Mortality (F) age of first capture (tc) and production in tons

season, when lobster prices climb up to 30% above their normal prices.

Having developed this eco-label and product, fishers are seeking support to effectively link into the seafood supply chain in Riviera Maya and Cancun tourist-based cities, and to obtain an added value and price premium for their sustainably harvested lobster. As a start up enterprise, whose members have traditionally been at the bottom of the sea-fish supply chain, they are seeking to realize the added value of their product. This should support a marketing plan and strengthen the capacity of the enterprise to address market opportunities. A loan for working capital to finance this integration is fundamental, particularly as the tourism industry can expect up to 60 days of credit, which fishers are not in the position to extend. This loan will also provide the opportunity to build inventory in advance for the closed fishing season.

Funding to develop a marketing plan and to understand the critical success factors in this supply chain. Loan Funding is required to provide working capital to purchase product from associated fishers, allowing the immediate payment to their communities, while also providing trade credit to the tourism industry. In addition, the funds to be used to build lobster inventory in advance of the closed fishing season (between February and June), would allow IPQRoo to have sufficient inventory during the closed season, when prices are typically higher. By building a strong inventory (and paying the fishers), integradora would be able to capitalize on higher prices during the closed season. This opportunity would not be typically available to the fishing community – due to their need for immediate funding; they would normally sell their inventory to middlemen. These middlemen would store the lobsters and capitalize on high prices by releasing small amounts into the market when prices are higher, with at least a 30% gain.

We developed a business plan to address these two issues. They focused on developing a distribution and sales program that is both more efficient and more direct. This program allows participating fishers to obtain higher prices for their lobster products, by eliminating the need to pay middlemen. Integradora should build a cold-storage to accumulate any inventory for sale during the higher off-season prices, allowing cooperating fishers an opportunity to negotiate prices and to hold back inventory during periods where there is excess supply on the market. At the same time, buyers benefit from this arrangement, as they can maintain current business practices, prices and payment terms, while receiving high quality, sustainable local products with a brand that helps their own corporate images, which will facilitate inventory accumulation and sale in the off-season for participating fishers.

An estimation of the cost of live lobster vs. lobster tails, as well as the level of production expected every month, considering the sale price and income for every month, with the expected volume of production commercialized as a new born enterprise was calculated. Based on this data, a cash flow projection for each year was made, in which the monthly income and total annual income as well as the monthly and total annual expenditure can be observed. In this projection, the project's profitability and its payment capacity is observed and summarized in the table below.

The enterprise must repay the loan in which the project's capital outflow will consider an interest rate of 10% for a period of 36 months and which, in agreement with the enterprise's income, is found within the payment capacity determined by the monthly income and profits generated annually by the eco-labelling project.

This initiative is at an early stage of development. While considerable investment has been made in developing a sustainable product, it is yet unclear whether or not the market will support this enterprise. In particular, there

is a probability that current participants in the chain of custody will intentionally exclude this initiative to drive prices down. This represents a significant risk, which will have to be planned for, however the process of direct commerce from the cooperatives has already meant a 30% gain from the prices obtained when sold to intermediaries as proved by the pilot sales.

LINKING SOCIO-ECONOMICS TO SUSTAINABILITY, CONSERVATION, AND IDENTITY

The project represents a direct stimulus for the organizational achievement of numerous workers who have their activity regulated under a eco-label that allows them to reach their main objectives: conserving natural resources, contributing to economic development based on the practice of fair trade and strengthening a direct link between the producer and the consumer. It contributes to the strengthening and development of the state's fishing sector, economics and to regulating the activity, for its development, modernization and arrangement; strengthening the state's identity, by means of the promotion of a resource belonging to the region and exclusive to the Mexican Caribbean Marine Protected Areas

The implementation of sustainable lobster management and monitoring program in collaboration with fishing cooperatives and local NGO's, academia and government agencies, along with sustainable harvest techniques and fair trade business practices combine to support both direct and indirect benefits for conservation and human well being while mitigating ecosystem threats associated with unsustainable fishing. In addition, the enterprise may provide sustainable alternative economic opportunities to the fishing communities, who are typically excluded from realizing any price benefits in the sea fish supply chain.

Initiatives such as this, which seek to develop sustainable management and alternative harvest approaches to fishing resources, need to be supported. Should this initiative succeed, the conservation and human well-being impacts will be significant. It is estimated that approximately 300 families could be impacted directly by this investment, and it would be able to serve as a model for sustainable fishing in multiple marine based locations facing similar issues globally. As this takes place in Mexico, there are some judicial risks associated with the investment. While it is a high risk investment from a business perspective, and will not be scalable without significant upfront investment as has been invested here, the conservation and human well-being returns make this worthwhile.

As well as overcoming the working capital barrier, the financing arrangement may have other benefits for local cooperatives through the eco-label. In pursuing a business loan rather than grant financing to support this endeavor, fishers have been able to develop business capabilities and skills, including conducting financial modeling for the new distribution model. This presents an excellent opportunity to demonstrate that sustainable fishing practices can be

economically viable for local fishermen. Helping support this type of business/ non profit hybrid structure and assisting a fishing cooperative based company shorten their supply chain to capture the value of their good practices is a goal in many parts of world. It is hoped that the “Chakay” experience might be replicable. Key to the conservation success of this venture, but, is the community and organization’s strong and established commitment to sustainable management of the protected area, and the enforcement of fishing regulations in the area. These ensure that the economic incentives to keep the fishing stocks strong and healthy into the future will remain, even as the access to markets and profitability are improved.

DISCUSSION AND CONCLUDING REMARKS

Results obtained on the first year of implementation of “Chakay’s” eco-labelling initiative provided a better understanding of some long term needs for improvement in spiny lobster fisheries in the Caribbean, as well as potential benefits derived from its principles regarding sustainability and livelihoods of the fishers in the region. It is now clear that if hard scientific knowledge suggests certain management policies, these will have a better stakeholder engagement through the success of an initiative similar to that one sketched out in this project. When applying sustainability principles to a fishery in a developing country where a high percentage of the fishers live in poverty conditions, it is a key point to consider socio-economic benefits to the bottom of the commercial chain, given that it will translate into a fairer trade system within a holistic approach. Here it is recognized that law compliance is better achieved where the incentives of active participation in the process, as well as the short, medium and long term benefits have been at reach for all those involved in fishing at the BC and SK Biosphere reserves.

For the above reasons “Chakay” is being recognized as an example and model of national use for collective biological resources derived from natural resources. Overfishing in similar ecosystems is an issue that could readily be helped with the success of initiatives such as the ownership schemes discussed above, which comprehend individual economic returns, from communally owned biological resources that are well managed.

The demand for a delicacy like lobster in Mexico shrunk in the 2009 - 2010 season as it has in other parts of the world due to the drop in the stock market, followed by the recession (Bernard 2010), which diminished the local tourist influx, and therefore, local lobster consumption, also affected by the H1N1 swine flue crisis. The credit crunch has even deprived both small processors and fisher cooperatives of working capital, forced by a cut back in sales and has promoted some significant changes in their commercial dynamics. In comparison to the 2008 - 2009 season, dynamics within the chain of custody show that strong middlemen with working capital capacity, have taken advantage of this general crisis by widening the gap

between fishers and the final retailer, by decreasing the buying price to fishers up to 40%, whilst restaurant sales are at a 20% increase in price.

Mexican *P. argus* fisheries have several issues that must be targeted in terms of management, regulation, compliance, and applying conservation biology strategies for the benefit of the species, however sustainability is bound to collapse more rapidly if the current economic patterns fail to maintain the historical cooperative structures. Due to the conditions in price fishers working outside the Sian Ka’an and Chinchorro protected areas are being forced to bypass their administrative rules, favouring processors and brokers who are willing to buy and to sell direct to the public in an illegal manner. Allowing an illegal fishing market boom of this nature will promote an even stronger competition in price, which in turn will relate to an increase in fishing effort and a lack of legislation compliance.

In developing countries like Mexico, the “Chakay” lobster eco-label case study has shown that schemes which will guarantee a true economical added value/price to those at the beginning of the chain of custody will have better possibilities of success regarding acceptance for regulation and management change proposals than initiatives which stand alone enforcing law compliance. Impoverished artisanal fishers, who are clearly benefited directly and economically for bettering practices and incorporating sustainability principles into management, have shown a positive response to the ongoing suggestions for changes in conservation biology. MSC formal assessment is on its way and cooperatives are willing to adapt to bio-economic proposals focused in balancing fishing effort with yield (Chavez and Ley-Cooper 2007), in the search to ensure sustainability of the fishery in the near future.

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