

Capacity Building and Training on Economic Analysis for Mexican Invasive Alien Species Professionals

Proceedings from the Second Workshop

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Purpose

On 24-27 November 2015, the United Nations Development Programme (UNDP) commissioned Landcare Research New Zealand to lead a workshop entitled “Capacity Building and Training on Economic Analysis for Mexican Invasive Alien Species (IAS) Professionals” for Mexican professionals and practitioners through the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO). Fourteen individuals representing universities, government agencies, and non-governmental organisations were selected to join five CONABIO staff members to participate in the workshop. The workshop consisted of 12 learning sessions and three detailed exercises on cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA), all of which emphasized using a purpose-designed, Excel-based toolkit for economically analysing options for managing IAS. The workshop also included two highly-detailed case studies of using CBA to select and justify strategies for managing specific IAS.

During the first workshop, nine case studies were selected for further investigation. Those responsible for the nine case studies submitted detailed work plans that established milestones for completing the case studies and for presenting the case studies at a workshop to be held in November 2016. Landcare Research staff provided constructive, personalised feedback to participants via email and Skype throughout the year.

The second workshop was held on 3-4 November 2016 at the CONABIO headquarters in Mexico City. The workshop was attended by 12 participants from the first workshop (including staff from CONABIO), eight of whom were involved in developing seven case studies. Participants who worked on the additional two case studies were not in attendance due to unforeseen health problems. The second workshop was also attended by six students and researchers who are currently undertaking economic analyses of managing IAS, a handful of invited faculty from Mexican universities, and the two authors of these proceedings.



These proceedings provide a brief overview of the second workshop and both a general description of the work undertaken to date and our recommendations for concluding each case study.

Overview of the Second Workshop

The two-day workshop was opened by Patricia Koleff (General Director of the Department of Analysis and Priorities, CONABIO), who highlighted the importance of economic analysis in setting priorities for managing IAS and the paucity of existing examples in the Mexican context. Georgia Born-Schmidt (GEF Project Coordinator) then reviewed progress to date in enhancing national capability and implementing Mexico's National Strategy for managing IAS.

The next phase of the workshop, led by Pike Brown and Florian Eppink, reiterated the purpose of economic analysis and the seven fundamental steps of conducting CBA and CEA, emphasizing their application to IAS management. Integral to this review was a new case study of managing invasive mice on an island with both human activity and rich biodiversity. In this case study, workshop participants were reminded of the importance of concepts such as net present value, economic efficiency, discounting, and sensitivity analysis. The two workshop leaders then reviewed progress to date for each of the nine case studies that were progressed since the first workshop.



The remainder of the workshop consisted of presentations on seven case studies followed by discussion and feedback from the workshop leaders, the convenors, and other workshop participants. It concluded with an overview of lessons learned and encouragement to finalise the case studies for presentation to policy and/or academic audiences.



Case Studies

Case Study 1

“Alternatives for preventing invasive freshwater fish release from aquaculture facilities in the State of Morelos, Mexico” (Norman Mercado-Silva and Diego Kanchi Díaz, Centro de Investigación en Biodiversidad y Conservación, Universidad Autónoma del Estado de Morelos)

There are approximately 278 farms in the state of Morelos that produce exotic aquarium fish, mostly for the domestic market. Escapes are common but largely undocumented, and this study aims to develop strategies for preventing marine incursions in the state’s seven major rivers, six major lakes, and 124 ponds in order to protect ten native fish species, three of which are endemic. Most fish farms in Morelos are unregulated and many fish ponds are next to rivers. All fish farmers currently depend on influxes of river water to maintain fish health. 16-18 exotics have been registered in Morelos to date.

This 30-year CEA focuses on prevention of escapes by constructing closed systems, namely aquaponics, recirculating systems, and Biofloc across a diverse range of fish farms. Because all three management approaches completely prevent escapes and because each of the three approaches has different financial costs and benefits, our recommendation is to re-cast this project as a CBA to promote sustainable aquaculture and economic development, allowing the very important benefits to biodiversity resulting from better management to be included as flow-on effects.



Case Study 2

“Reduction of *Tilapia* sp. cf. *zillii* (redbelly tilapia) population in San Ignacio Oasis, Baja California Sur”
(Agueda Karina Ramos-Rendón & Gorgonio Ruíz-Campos, Universidad Autónoma de Baja California)

At least 133 exotic fish species have been recorded in Mexico, including 27 in the northern Baja California peninsula and eight in the southern Baja California peninsula. Redbelly tilapia is particularly widespread, having been intentionally released in the 8.25 hectare San Ignacio Oasis in 1995. At that time, 97% of the fish biomass in the San Ignacio Oasis was comprised of endangered killifish (*Fundulus lima*); by 2005, 85% of the fish biomass was comprised of tilapia.

This case study undertakes a 20-year CEA for reducing the share of fish biomass comprised of tilapia to 50% via active and passive trapping (using minnow traps or gee-minnow traps, gill nets, and hand-cast nets), environmental education (including campaigns at schools and tourism-service providers), and an integrated approach.

We believe that this case study is nearly ready for to be written up, although the efficacy of each intervention must still be reviewed, including understanding the relative merits of each trapping option and how education will translate into smaller numbers of tilapia. One novel approach that is perhaps beyond the scope of this CEA is to consider funding the program with an annual payment for ecosystem services provided by the endangered killifish.



Case Study 3

“Economic study on *Raoiella indica* Hirst (*Tenuipalpidae*) in palm ecosystems located in four natural reserves of Quintana Roo, Mexico” (Mayra Margarita Valdez Lizárraga, CONAFOR)

The red palm mite arrived in Quintana Roo in 2011. In the Caribbean and elsewhere, it has decimated palm stands by attacking the contents of the cells of palm leaves. The main host in Quintana Roo is the coconut tree, but four other threatened and/or protected tree species host the mite as well.

This one-year CBA considers two management options, namely aerial treatments and terrestrial treatments, each of which relies on a different technology to spray affected trees with pesticides. Aerial treatment is less labour intensive but entails significant capital costs than terrestrial treatment. Based on the results obtained using the Excel-based toolkit, the author concludes that the costs of management exceed the benefits.

We recommend three specific changes to this project. First, while the management costs may or may not be incurred in a single year, the benefits of management will accrue over a long time horizon; as such, we recommend changing the time horizon to 20 years or longer. Second, the benefits of management are valued at 1000 pesos per hectare, which is likely a gross underestimate of the benefits of healthy forest ecosystems (which yield provisioning, regulatory, and cultural ecosystem services); hence, the benefit-cost ratio will be more favourable upon fuller consideration of the benefits of management. Third, if the benefits of management prove too difficult to monetise, then this project may easily be re-cast as a CEA. Should the author choose to pursue the CEA option, the case study is now ready to be written up.



Case Study 4

“Economic analysis of invasive lion fish in Cozumel Island, Mexico” (Marilú López-Mejía, Lab. Biología Evolutiva y Genética de Poblaciones, Universidad de Quintana Roo)

Introduced to the Atlantic between 1985 and 1992, lion fish is a pernicious IAS that has few natural predators in the Caribbean and that out-competes native species by eating and displacing fish, crustaceans, and algae on coral reefs. It reproduces beginning at 4 cm in length and can produce 4,000-12,000 eggs every four days. It was reported for the first time in Cozumel in 2009; native species have been estimated to be declining at an annual rate of 57% since its arrival.

Benefits of managing invasive lion fish in Cozumel include restoring native biodiversity, reducing health risks to humans (lion fish spines contain toxins), and a new protein supply. Management options include physical extraction, research and monitoring, consumption, and educational campaigns. The author has obtained detailed information about consumers’ willingness to pay for lion fish meat as well as the costs of extraction. Because lion fish fetches a high price on the international market, the fishing industry has lobbied for a closed lion fish season to allow populations to recover, putting industry at odds with conservation efforts.

Using the Excel-based toolkit, this 50-year CBA finds that extraction is the best management option; however, this analysis is based on secondary data that reports the value of biodiversity to the Mexican public at 40 million pesos per native fish species per year. At a minimum, we recommend that the value of this benefit be subjected to extensive sensitivity analysis in the context of CBA. We also think that this case study is an excellent candidate for CEA.

Because the positive externalities for controlling lion fish exceed the private incentives to do so, we believe that this case study also provides a superb example in which incentivising fishermen to harvest more lionfish than they would otherwise results in a socially optimal outcome. The 25,000 cruise ship passengers who disembark on Cozumel on an average day provide an optimal source of revenue for incentivising such behaviour, particularly if they develop a taste for this invasive species.



Case Study 5

“Goat management in the El Vizcaino biosphere reserve” (Celerino Montes, Reserva de la Biosfera El Vizcaino, CONANP)

Goats were introduced into El Vizcaino by the beginning of the twentieth century. Raising goats has become the primary economic activity in the area, and virtually all families presently raise goats due to their importance for meat, cheese, and leather production. Most families allow goats to roam freely, which puts pressure on endemic plant species as well as two subspecies of bighorn sheep. Goats have denuded some sites in their grazing areas, contributing to soil erosion and diminishing reservoir recharge, and have displaced native bighorn sheep through competition. Given the economic importance of raising goats in the region, eradication is not a viable option.

This 30-year CEA considers two alternative systems for managing domestic goats, namely forage production and restricted grazing (a CBA was not considered given the difficulty of monetising benefits such as erosion control and the fact that the value of biodiversity benefits do not vary across options). Through a detailed survey of 29 ranches, the author has obtained superb data on current practices as well as the costs of each approach within each local context.

As with Case Study 1, we suggest that the author A) re-casts the project as promoting sustainable development in an economically disadvantaged area, and B) treats the important environmental implications of goat management as co-benefits. Because the non-environmental benefits afforded by better management of goats vary across practices, this study is well suited to CBA. We also note that the rich survey data facilitates a wide array of economic analyses, particularly analysis of poverty reduction through changed management practice.



Case Study 6

“Reducing the impact of monk parakeets (*Myiopsitta monachus*) by implementing control measures in Mexico City, Mexico” (Tatjana Sanchez, DGAP, CONABIO)

Escaped and purposefully released monk parakeets have become well established in Mexico City. As of October 2016, there were 571 known nests with some 2,167 individual birds in the Federal District.

Monk parakeets feed on seed, fruit, nut, and berry crops. Inasmuch as damage caused by monk parakeets can be identified and separated from damage caused by naive *Psittaciformes* (and indeed other native birds), the benefits of control may be monetised. Other purported benefits of control such as reducing avian disease, reducing damage to infrastructure, and reducing losses in biodiversity are currently more difficult to monetise because they are not well documented in the scientific literature.

Management options include banning commercial trade in this species, shooting monk parakeets, removing nests, and public education campaigns. Originally proposed as a 30-year CBA, we suggest that the study be re-cast as a CEA in the first instance because the costs of management are immediately available. Should detailed data on crop damages from monk parakeets become available, we suggest that the author may wish to undertake CBA, focusing narrowly on the benefit of avoiding damages to crops.



Case Study 7

“Cost-Benefit Analysis of eradicating and managing feral cat populations on Guadalupe Island”
(Federico Méndez Sánchez, Grupo de Ecología y Conservación de Islas)

Guadalupe Island is located 150 miles off the Baja California peninsula. Prior to human settlement, the island was a biodiverse habitat and home to 11 endemic bird species. Introduced goats denuded the landscape in the early 20th century, facilitating predation of native birds by feral cats; to date, cats have caused the extinction of six bird species on Guadalupe. The island is currently home to approximately 100 abalone and lobster fishermen as well as a detachment of the Mexican navy.

This CBA seeks to answer whether eradication or management is ultimately more cost effective. Using annual donations to Grupo de Ecología y Conservación de Islas for feral cat control as a proxy for the annual market value of the benefit, the authors find that a 5-year eradication programme provides a greater net benefit and a higher benefit-to-cost ratio than either managing feral cat populations at current levels or relaxing the intensity of control over a longer time horizon, even when allowing for long-term monitoring.

We believe that this highly credible CBA should be subjected to sensitivity analysis to establish the robustness of the recommendation. Given the clarity and importance of the findings, we also believe that this analysis should be written up for both policy and academic audiences.



Other case studies

Two additional case studies are being undertaken by researchers who were not able to attend the second workshop. Specifically, Armando T. Wakida-Kusunoki (Centro Regional de Investigación Pesquera de Yucalpeten, Yucatán) is undertaking a study entitled “Economic Analysis of armored catfish *Pterygoplichthys* spp management in the Palizada River, Campeche, Mexico”, and Everardo Barba Macías (ECOSUR-Unidad Villahermosa) is undertaking a study entitled “Control of *Corvicula fluminea* in urban rivers of Villahermosa city”. We have reviewed detailed project plans for each of

these projects and believe that completed CBAs/CEAs will shed light on preferred management strategies of these economically damaging IAS.



Remarks

The November 2015 workshop on “Capacity Building and Training on Economic Analysis for Mexican Invasive Alien Species (IAS) Professionals” introduced the key concepts and tools needed for undertaking CBA and CEA for managing IAS. The November 2016 workshop demonstrated that workshop participants are embracing the economic approach and are able to produce rigorous economic analyses of IAS management. While none of the case studies is yet fully complete, Case Study 7 is now ready to be written up as a full CBA. Case Studies 3 and 6 are ready to be written up as CEAs and may be written up as CBAs with a modest level of additional data collection. Case Studies 2 and 4 will be ready for write up after some additional research on the efficacy of management (Case Study 2) and the costs of management (Case Study 4). Case Studies 1 and 5 will benefit from some conceptual reframing but are otherwise on track. Landcare Research will continue to work with those undertaking CBAs and CEAs, offering guidance both on monetising benefits and using the Excel-based toolkit. Landcare Research and CONABIO are both looking forward to seeing these case studies in print.

