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**DISCUSSION
PAPER**



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1. Introduction

Located within the Coral Triangle marine biodiversity hotspot, Nusa Penida Marine Protected Area (NP MPA) is situated approximately 32 kilometers (km) off the Southeast coast of Bali Island. As a popular tourism destination, NP-MPA receives some 200,000 tourists annually.¹

Established in 2010, NP-MPA is a District Marine Conservation Area (a Kawasan Konservasi Perairan Daerah: KKPD). Although recognized by the Ministry of Marine Affairs and Fisheries (MMAF) as an MPA, its management is the responsibility of the district (Kabupaten) of Klungkung through the District Fisheries and Marine Agency (Dinas Perikanan dan Kelautan: DPK), supported at the national level by the Marine and Coastal Resource Management Agency of the MMAF (BPSPL) Denpasar. In effect, MPA management is a coordinated effort between a Technical Implementation Unit (Unit Pelaksana Teknis: UPT) made up of DPK staff; the BPSPL; community groups; and the Coral Triangle Center (CTC; a local NGO). Since 2014, NP-MPA has been recognized as having the E-KKP3K² ‘blue level’ of management effectiveness, a notch lower than the ‘gold standard’ for sustainable MPA management within Indonesia.

The MPA consists of three small islands and covers an area of 20,057 hectares: Nusa Penida, Nusa Lembongan, and Nusa Ceningan. Of the three islands, Nusa Penida is the largest and its name is often used to represent the other two islands.

NP MPA is host to a highly diverse coral ecosystem (with 296 species of coral and 576 species of reef fish), and is home to marine megafauna, including the mola mola (ocean sunfish) and manta rays that can be seen year round with some certainty. In 2015, NP-MPA’s manta-specific dive spots attracted approximately 3,500³ divers or snorkelers.

In 2014 in recognition of their value to Indonesian tourism, and the threat of overfishing faced by the species, mantas were listed as a protected species within all Indonesian waters. The result was a ban on all fishing of manta species within Indonesia’s Economic Exclusion Zone. However, manta rays continue to face challenges to their survival. Nusa Penida’s manta population faces continuing threats from illegal fishing, as well as consequences from non-targeted and unsustainable practices such as bomb fishing. What’s more, tourism, the sector that initially promoted manta protection, has been shown to have negative implications for manta conservation. In NP-MPA, increasing visitor numbers at manta dive spots and low diver compliance with the manta code of conduct also raises concerns. During high season, divers commonly impede mantas from accessing their cleaning stations, thus disturbing an important behavior. High volumes of unregulated boat traffic increase occurrences of in-water strikes, injury and disturbance. Management efforts have not been able to keep up with the implication of the growing tourism sector.

¹ BPSPL. 2016, pers comm.

² The E-KKP3K, that stands for Evaluation on Management Effectiveness of Marine, Coastal, and Small Islands Conservation Area, is an award granted by the MMAF to MPAs that demonstrate co-management between local government and other stakeholders, and management based on MMAF published guidelines.

³ NLDC. 2016. Nusa Lembongan Dive Center Association, pers comm.

In line with a growing consensus that tourism should, at a minimum, offset any associated negative externalities it causes, self-financing mechanisms for MPAs have long been explored more broadly. Indeed, more recently, Minister Susi Pudjiastuti (Indonesia's current Minister of Maritime Affairs and Fisheries) has encouraged conservation efforts in MPAs to develop such mechanisms.

In 2012, CTC in collaboration with the UPT and Brawijaya University carried out a willingness to pay (WTP) study to establish an entry fee for NP-MPA. The study indicated that visitors' WTP to enter the park was US\$ 5 – 10. However, resistance from other stakeholders and a general lack of understanding by key stakeholders over the WTP methodology resulted in the much lower fee of approximately US\$ 0.5 (7,000 IDR) being implemented.

Furthermore, this fee is only collected from three cruise/ferry operations. In addition, monies collected go directly to the District, to be reallocated between various sectors, and are not earmarked for NP-MPA management. As such, revenues remain insufficient to cover park management costs, let alone accommodate manta management and protection. In reality, little tourism infrastructure exists within the park, and reallocated money covers UPT staff salaries and a limited number of activities. Patrol boats, monthly patrols and technical support are largely provided by CTC outside of park budgets.

BPSPL observes that dive tourism represents the highest value visitor type to NP MPA, generally spending more than other tourists. At the same time, as a nationally protected species, the manta is one of the priority species for BPSPL and the MMAF. The combination of scope for administrative reform and willingness to pay significantly higher fees than those currently charged suggests that implementing an permit fee scheme for manta divers is one viable option for increasing MPA revenue and funding for management of the MPA.

This study describes a second WTP exercise, carried out in 2016 by BPSPL and Conservation Strategy Fund (CSF) with the support of CTC, aimed at determining the feasibility and optimum pricing of a potential manta dive fee. Development of an appropriately priced manta dive fee, which maximizes revenues from dive tourism and directs these towards manta protection, has potential to be an important component in the NP MPA business plan. Results from this study also have broader implications, addressing the issue of whether this iconic species can self-finance its conservation across Indonesia.

2. Methodology

2.1 Study area and sampling

The study area covered divers visiting all dive sites within NP MPA, including the manta dive sites to be permitted; the permit scheme would apply to three dive sites at which divers have a high certainty of seeing manta rays.

Data from the provincial tourism agency in 2015, stated that some 200,000⁴ visitors came to NP MPA for various purposes. The data classify visitors based on their purpose, so this number does not represent the population of our study (manta divers). The relevant population was provided by the Dive Center Association of Nusa Lembongan. Based on the dive logbooks from the 18 members of the association, roughly 3,500 tourists visited Nusa Lembongan with the intention of diving or snorkeling with mantas in 2015. It is important to note that additional divers visit NP MPA using services from non-association dive operators based in Sanur (on the Bali mainland). The exact number of visitors using these dive operators is not known. However, given that there are currently three to five active operators, we assume these operations account for an additional 20% in manta divers; assuming them to be of similar size as recorded association members. We therefore assume the total number of manta divers is 4,200 individuals in 2016. Using this data point as a baseline for manta visitor numbers, we aimed for 300 respondents, or 7% of the estimated visitors to NP MPA in 2015.

Piloting of surveys occurred in the last week of July. Based on language barriers and comprehension issues between enumerators and interviews, self-administered surveys were selected over face-to-face interviews. Final surveys were self-administered in English, as most of the visitors are foreigners, with enumerator supervision and guidance where necessary.

In all 290 surveys were collected, of which 61 were dropped as described below. Final sample size was 229. Sampling occurred during August – October, representing the end of the low season and the start of the high season, in order to capture possible seasonal differences in WTP. Of the three islands, tourism activity is centered on Nusa Lembongan. It houses the majority of dive centers, as well as hotels and guest houses, and represents the main entry point for visitors wanting to dive or snorkel with manta rays. Nusa Penida island is a well chosen break point for diver operators. Trained enumerators, in coordination with 18 local dive operators, interviewed guests at Nusa Penida during this rest period or in Nusa Lembongan as they returned from dive and snorkel trips.

2.2 Contingent Valuation Method

This study aims to provide a WTP value for manta diving in NP MPA, as a means to inform the potential of establishing a manta ray dive permit scheme. The approach used is the Contingent Valuation Method (CVM), a common and standard approach to measure the economic value of goods and services for which well-developed competitive markets do not exist. This includes both non-market values (e.g., the value people feel simply knowing that a particular species exists), as well as for those market contexts in which a buyer's response to different prices or new goods cannot be observed, as is the case here. The CVM method relies on creating a hypothetical scenario in which respondents state their WTP to access or improve the quality of an environmental good, or conversely to avoid loss of access or quality of the good.^{5,6}

⁴ BPSPL. 2016, pers comm.

⁵ Mitchell, R., & Carson. R. 1989, Using surveys to value public goods. The contingent valuation method. Resources for the

Survey design was based on current known best practises for generating reliable CV results as suggested by Bateman et al. (2002)⁷ and Maldonado and Sanchez (2014)⁸. The survey included the following sections: (i) Introduction describing the initiative and clarifying confidentiality; (ii) visitor profile describing visitors' preference and pattern in visiting NP MPA; (iii) valuation scenario describing the current and new scenario, including the introduction of the potential daily permit fee and payment vehicle; (iv) follow up questions clarifying respondents confidence in and reasons for stated WTP value as well as preference regarding management decisions and (iv) a final attitudes and demographics section. The full survey is presented in Annex 1.

For elicitation of WTP, an open-ended approach was used. Recently, the dichotomous choice approach has gained favor, and initially, after piloting, was implemented. However, a downside of the dichotomous choice approach is efficiency, with accurate results requiring larger sample sizes. Early on in the sampling process, Nusa Penida suffered adverse weather conditions lowering the expected visitation; it became clear that achieving an appropriate sample size for viable analysis would be difficult. In addition, studies indicate that open-ended WTP elicitation often yields lower (more conservative) welfare values than other methods, which is desirable in the present context.^{9,10} Sixty-one dichotomous choice surveys were omitted from the final analyses.

The contingent valuation scenario provided to visitors was as follows:

In 2014, manta rays were given full protection status in Indonesian waters. However they are facing decline in population due to inadequate protection as one of the reasons. In Nusa Penida, manta rays can only be found in two dive spots: the Manta Point, and the New Manta Point. Here, there are a number of manta conservation efforts, such as manta photo ID (the work of MMAF, Manta Trust, and Coral Triangle Center) and manta genetic research (collaboration of MMAF, TNC, IPB, and CI).

Mantas in Nusa Penida are not fully safe from threats. The most common threats are:

- 1. Overcrowding of tourist coming to dive or snorkel,*
- 2. Mantas getting caught in pole line and hook,*
- 3. Coral bleaching that reduced the cleaning station function of coral ecosystem,*
- 4. Noise from boats*
- 5. Divers who do not comply to the code of conduct.*

At the moment, there is a IDR 7,000 (USD 0.50) fee to enter the Nusa Penida MPA. But the money,

Future, Washington D.C.

⁶ Pearce, D. 2002, An Intellectual History of Environmental Economics, Annual Review of Energy & the Environment, 27: 57 - 81

⁷ Bateman et al. 2002, Economic valuation with stated preference techniques: A manual, Edward Elgar, Cheltenham.

⁸ Maldonado, J.H., and R.C. Sanchez. 2014. Valoración económica del Parque Nacional Natural Corales de Profundidad. Service Contract No. INVEMAR-CPS-001 DE 2014. Bogota.

⁹ Hausman, J.A. (ed) 1996. Contingent valuation: a critical assessment. North-Holland. Amsterdam, The Netherlands.

¹⁰ Kerr, G. 2001. Contingent valuation elicitation effects: revisiting the payment card method. Paper presented to Australian Agricultural and Resource Economics Society, Adelaide, 23-25 January 2001:
<http://ageconsearch.umn.edu/bitstream/125686/2/Kerr1.pdf>

collected by the Tourism Agency of Kabupaten Klungkung, is not all allocated management of the MPA, as it is not considered as priority for the government.

Therefore, we have a plan to implement a per person daily user-fee for manta diving. This fee will be used for:

- 1. Improving manta monitoring effort, in the form of additional personnel, more frequent monitoring, and additional monitoring equipment.*
- 2. Improving tourist facilities, such as road, electricity, lights, and mooring buoy.*

Please consider the following question. I'd like to ask you to think seriously about it before answering. Taking into account:

- a. Your income;*
- b. The amount spent on this type of trip;*
- c. That fees go to management of manta rays in NP MPA;*
- d. That fees are per person per day*
- e. That any additional expense would represent money not available for other things you might wish to buy;*
- f. That if fees increase, they would affect all people visiting the parks*

Bearing in mind that that your answer will inform policy, please be as sincere as possible in your response.

This description was followed by the following WTP elicitation question:

Q12. What is the maximum daily amount you would be willing to pay as a daily entrance-fee to enter these dive sites? _____ This one-time payment would cover all manta dive sites for the course of that given day.

Confirm currency _____

2.3 Analysis

Initial descriptive statistics were calculated to provide an overview visitor profile. We also calculated summary statistics regarding knowledge of park fees and willingness to pay above and beyond current fee.

Attempts were made to model the WTP demand curve using both Ordinary Least Squares (OLS) regression analyses and a general linear model (GLM) more suited to skewed data. However no models were found that satisfactorily explained the observed variance in WTP, therefore a demand curve was generated from the distribution of stated WTP bids. While it is preferable to use regression analysis to predict the demand curve, when this is not possible it is deemed appropriate to use the distribution of stated WTP bids.¹¹ This curve was used to predict optimal

¹¹ Alberto Lara et al. 2016. Valoración de Servicios Ecosistémicos del Parque Nacional Cabo Pulmo. CSF consultation report for Comisión Nacional de Áreas Naturales Protegidas en el contexto del Proyecto de Valoración de los Servicios Ecosistémicos de las Áreas Naturales Protegidas de México.

fee levels. Mean, median and optimal revenue-generating fee levels are reported and discussed in the results section.

Protest votes are considered to be those who answered “0” to Q18, (the WTP elicitation question) and selected the follow up reason to be either: “Don’t trust money to be used appropriately” or “Not enough information to respond”.

As no current manta fee is in place, maximum revenue is calculated based on:

$$R = F \times PV$$

Where R is revenue generated, F represented the introduced daily permit fee and PV is the predicted visitation under the newly introduced permit fee. It is assumed that the introduction of the permit fee will not affect overall island visitation rates. Results presented are based on a conservative assumption of one-day manta diving per diver (i.e. one permit per recorded manta diver).

Potential revenue is calculated over a 1-, 10- and 20-year period, assuming that the annual tourism growth rate of 7.7% over the past 10 years continues.¹² Less conservative scenarios whereby divers dive with manta rays on three days of their total visit and demand elasticity is lower are also explored. As this is not a cost-benefit-analysis and presents only the revenue generated from the potential permit fee and not any associated management cost, results are presented without applying a discount rate.

3. Results

Of the 229 viable surveys collected, 172 were carried out on Nusa Lembongan and 57 on Nusa Penida. The vast majority of interviewees surveyed were foreigner visitors (89.5%); only 7.0% were Indonesian nationals and the remaining 3.5% were expatriates living in Indonesia. For the purposes of analysis we present results for foreigners and Indonesia residents (including both Indonesians and expats) separately. Subsequent sections provide more information on visitor profiles.

3.1 Socioeconomic characteristics

The total respondent pool was contained slightly men in all groups, albeit only slightly. Average age for all groups was 30, and almost all respondents had a college education or higher. Average monthly income, after tax, was reported as US \$4,400. However, it should be noted that over a third of respondents choose not to answer this question, likely deeming it too sensitive.

¹² BDS. 2016. The National Statistics Agency, available at: <https://www.bps.go.id/linkTabelStatistik/view/id/1387>

Table 1. Summary of socioeconomic characteristics

	All visitors	Foreign visitor	Indonesia-based
Residence (% sample)		89.5	10.5
Male (%)	57.7	58.3	52.2
Age (mean)	30.4 (8.7)	30.4 (8.8)	30.3 (7.2)
Group size (mean)	2.7 (2.2)	2.7 (2.1)	2.9 (3.1)
College education or above (%)	92.6	91.7	100.0
Monthly taxed HH Income US\$ (mean)	4,404.7 (5331.0)	4,603.8 (4803.2)	3,074.2 (8080.0)
range	0 – 36,001	0 – 27,178	20 – 36,001
observations	146	127	19

mean: standard deviations displayed in ()

3.2 Visitor profile

Most visitors to NP MPA had visited Indonesia previously, i.e., only 38.1% of foreign visitors were first time visitors to Indonesia. The average length of stay on NP MPA islands was 6.1 days, although variation was large. This value was substantially longer for Indonesian-based visitors who are perhaps more likely to be visiting with family. On the other hand, foreign visitors were more likely to be on a longer total trip; 45.5% of Indonesian-based visitors intended only to visit NP-MPA compared with only 7.8% of foreign visitors. Considering both groups, the majority of the sample were visiting as part of a longer trip that included other diving destinations (69.0%).

In all samples, some three quarters of respondents indicated diving or snorkelling with manta rays to be their primary motivation for visiting NP MPA on the day in question.

Table 2. Summary of visitor profile (% , unless otherwise stated)

	All visitors	Foreign visitor	Indonesia-based
1 st time to Indonesia		38.1	-
Average no of days spent (mean)	6.1 (14.1)	4.9 (7.3)	17.7 (38.9)
Trip type			
Longer trip including other dive spots	69.0	72.1	40.9
Longer trip not including other dive spots	19.5	20.1	13.6
Only visiting here	11.5	7.8	45.5
Mantas are main reason for visiting NP MPA today	74.5	74.1	78.2

mean: standard deviations displayed in ()

3.3 Park fees and manta knowledge

Only 9.2% of all visitors were aware of the NP MPA entrance fee. While very low, this is not surprising given the collection method being limited to a few ferries. Of those visitors aware of the park fee, most perceived the fee to be affordable or cheaper. Only one respondent considered the fee to be expensive. Knowledge of the fee was a little higher among Indonesia-based visitors (33.3% of the sub-sample). Similarly few visitors knew of the legal status of mantas as a fully protected species within Indonesian waters. This, again, was better known among Indonesia-based visitors (45.8%). Full results are displayed in Table 3 and 4 below.

Table 3. Knowledge and opinion of park fee (%)

	All visitors	Foreign visitor	Indonesia-based
Knowledge of park fee	9.2	6.3	33.3
Rate NP MPA fee			
<i>Very cheap</i>	45.6	50.0	37.5
<i>Cheap</i>	5.6	0.0	12.5
<i>Affordable</i>	45.6	50.0	37.5
<i>Expensive</i>	5.6	0.0	12.5
<i>Very expensive</i>	0.0	0.0	0.0

Table 4. Knowledge of manta protection status and in-water behaviors (%)

	All visitors	Foreign visitor	Indonesia-based
Knowledge of manta's full protection	19.2	16.1	45.8
In-water behaviors			
<i>Taking photos/videos</i>	64.2	64.4	62.5
<i>Following instructor direction</i>	86.9	87.8	79.2
<i>Touching mantas</i>	3.5	2.4	12.5
<i>Closely following mantas</i>	10.5	8.8	25.0
<i>Keeping distance from mantas</i>	86.9	87.8	79.2

Concerns regarding the compliance to the manta code of conduct may be warranted. Ten percent of the sample admitted to closely following mantas and 3.5% admitted touching of mantas; both actions disrupt manta behavior. If this percentage is representative of the larger population, this represents some 150 divers touching mantas each year. While these numbers appear low, it is likely that some interviewees did not admit such actions knowing them to be inappropriate.

3.4 Willingness to pay for manta permits

17 respondents gave a 0 WTP bid. Of these, 10 were categorized as protest votes due to respondents indicating that their WTP was due either to distrust that fees would be used appropriately, or to not receiving enough information to give a bid. Details are provided in Table 5.

Visitors were overwhelmingly in favor of a fee-based manta permit; excluding protest votes 96.8% of the sample was willing to pay some fee as part of a permit scheme. Mean WTP was found to be US \$10.0. Median WTP was also US \$10.0. Mean WTP of Indonesia-based visitors was slightly lower, at US \$7.2. Stated WTP values ranged from US \$0 to 94.

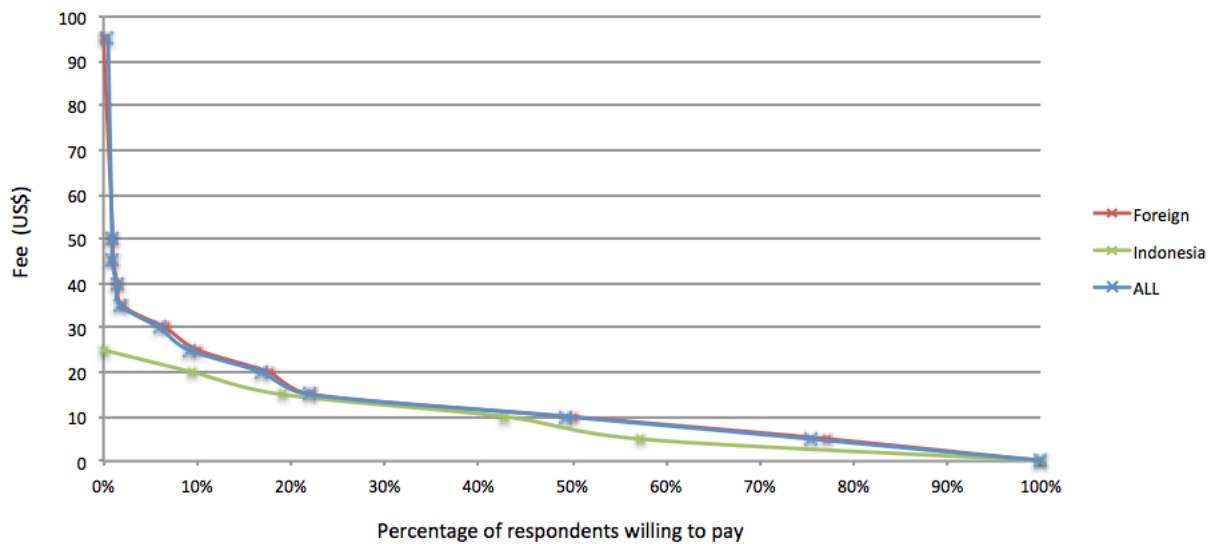
Demand curves for all subgroups appear similar, with only small variances in distribution; the most notable being the maximum WTP bound of US \$22 for Indonesia-based visitors (as compared to US \$94 for foreign visitors). Demand curves for all groups are displayed in Figure 1. Approximately half of current visitors would be willing to pay the mean permit fee of US \$10; this value is only a little lower for Indonesia-based visitors at 42.9%. At a US \$5 permit fee, percentage of visitors willing to pay increases to 75.3% overall, and 57.1% for Indonesia-based visitors.

Table 5. WTP summary statistics

	All visitors	Foreign visitor	Indonesia-based
Willing to pay additional fee (%)	96.8	97.4	90.5
Mean WTP	10.0 (10.2)	10.3 (10.5)	7.2 (6.6)
Median WTP	10.0	10.0	10.0
Reason for no WTP (% of protests)			
<i>Fee already high enough</i>	0.0	0.0	0.0
<i>Trip costs high enough</i>	5.0	0.0	16.7
<i>Don't trust money to be used appropriately</i>	60.0	64.3	50.0
<i>Not tourist's responsibility</i>	0.0	0.0	0.0
<i>Not enough information to respond</i>	30.0	35.7	16.7
<i>Prefer to go elsewhere instead</i>	0.0	0.0	0.0
<i>Other</i>	5.0	0.0	16.7

mean: standard deviations displayed in ()

Figure 1. Demand curve for manta permits



3.5 Revenue Maximization

Potential demand curve models, derived by simply fitting a curve to the observed distribution of WTP bids, are presented in Figure 2 and 3.

Figure 2. Predicted probabilities of visitation: linear model

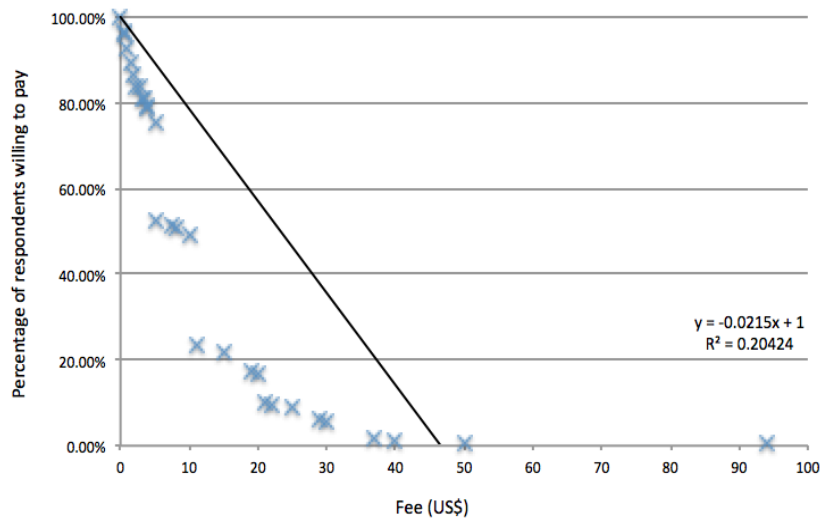
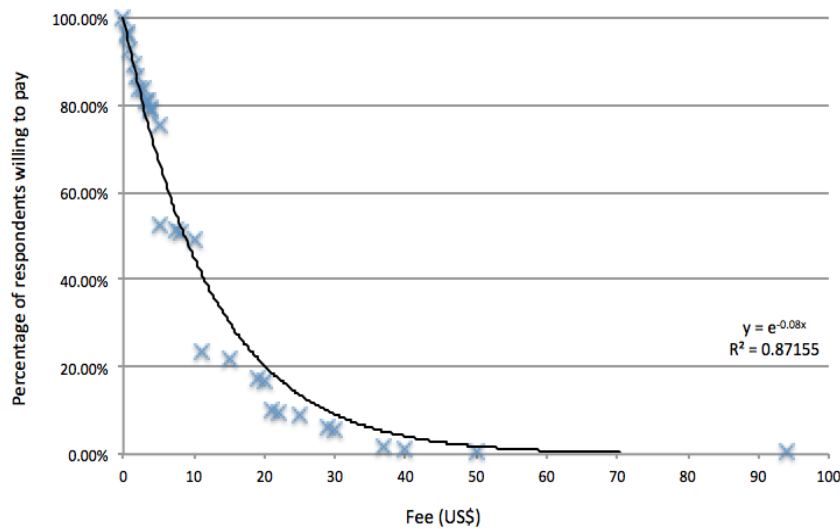


Figure 3. Predicted probabilities of visitation: exponential model



Under the linear and exponential model, revenue maximization is found to occur at a permit price of US \$16.0 and US \$12.5 and would result in a revenue stream of US \$42,445 and US \$24,128 in 2018, respectively.

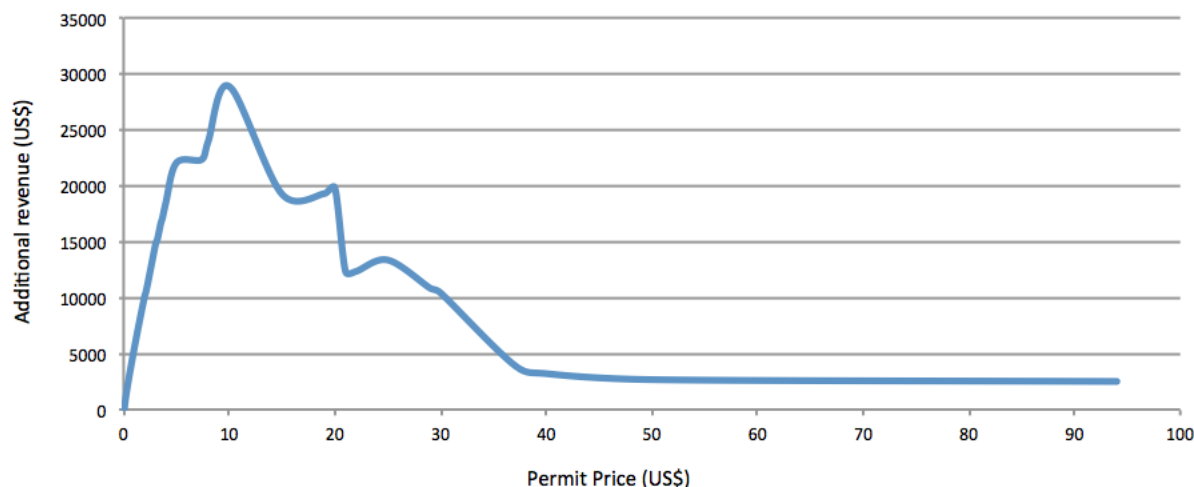
The exponential model can be seen to more closely fit the data ($r^2=0.87$ as compared to $r^2=0.20$); the linear model is more affected by the larger values and likely overestimates the probability of visitation at the lower values. However, under the exponential model optimal revenue generating permit price of US \$12.5, 63.2% of the current population would be unwilling to visit the manta sites, which might be undesirable on other grounds.

A more conservative permit price of US \$10 is predicted if by simply using the observed original distribution of WTP responses is used directly to indicate demand. Under this scenario, a US \$10 permit price would result in the retention of approximately half current visitor numbers (49.3%), and generate revenue of US \$25,875 in 2018,¹³ the likely first year of implementation. Figure 4 displays potential revenue at various permit prices based on the distributional data.¹⁴

¹³ Based on a tourism growth rate of 7.7%, Indonesia's average over the past 10 years.

¹⁴ Given that only 9.2% of the sample were aware of any NP entrance fee, as well as its low value, it is assumed that changes in visitation will have no implication for current NP entrance fees and these are excluded from the revenue maximization analysis.

Figure 4. Revenue maximization for permit fees in first year of implementation (2018).



3.6 Potential revenue generation for manta management and protection

Of the three models, the WTP estimate predicted from the original data was considered to be most appropriate for permit pricing. Reasons include: higher (i.e., less conservative) WTP estimates were provided by the two fitted models; fitted models were more affected by a few higher bids; fitted models predicted revenue maximization at lower visitation rates and while it is desirable to increase revenue, park authorities also wish to promote tourism.

A US \$10 manta dive permit could generate US \$26,234¹⁵ in 2018, its first year of implementation. Over the course of a 10 year and 20 year period this could represent an income of some US \$324,670 or US \$1,053,976. This is based on the predicted probability of a decline of 50% attendance to NP-MPA due to the US \$10 permit fee implementation.

However, a number of reasons belie this predicted decrease in visitation, or at least the elasticity of demand, i.e. the potential for such a level of decline. For example, manta diving is a highly specialised sport with few substitutes. Indeed, divers are well known to pay huge premiums to dive with iconic species such as manta rays. In Hawaii, a one-tank manta dive is comparable in price with a normal two-tank outing, US \$135 and US \$125 respectively.¹⁶ Mantas may be an exception even among megafauna: in the Maldives, tourists are willing to pay more for manta excursions than for dives with sharks or turtles.¹⁷ In addition, a weakness of the open-ended WTP elicitation method is the underestimation of the value of environmental goods and services, particularly when compared with the dichotomous choice

¹⁵ Value differs slightly from that presented above in Section 3.5 based on difference in visitation rates of 49.3% from original data and 50.0% predicted in Table 5.

¹⁶ <http://www.mantaraydiveshawaii.com/adventures/scuba-diving/>

¹⁷ Waheed A (1998) Economic value of 'marine ecotourism' in the Maldives. Bay of Bengal News 12(2): 23.

approach.^{18,19} Therefore, while a conservative value of US\$ 10 is recommended, these attributes suggest that it is prudent to explore scenarios of lower elasticity.

Potential revenues are explored under the retention of 50%, 65% and 80% of current visitation levels and a US \$10 fee in Table 5. The most conservative values (including those generated above) assume only one-day manta diving per visitor. This is likely also an underestimation, as it is likely that divers may wish to repeat the experience and/or dive at the remaining manta dive sites. As such we also explore scenarios in which it is assumed that divers choose to dive with mantas for three days of their trip.²⁰

Under the most conservative scenario, a daily manta permit fee could generate some US \$1.1 million over the coming 20 years for manta protection and management. Under the least conservative scenarios, potential revenue from a daily manta permit scheme could be as high as US \$125,924 in the first year of implementation (approximately 1,680,581,704 IDR at today's exchange rates).²¹ This could total some US \$5.1 million in revenue over the next twenty years assuming an average of three days diving. Details are given in Table 6. Full annual results are displayed in Annex 2.

Table 6. Potential revenue generation under multiple scenarios

Visitation retained at a \$10 fee	50%	65%	80%
	Revenue (US \$)	Revenue (US \$)	Revenue (US \$)
Average 1 day diving			
1 st yr total	26,234	34,104	41,975
10 yr total	374,670	487,072	599,473
20 yr total	1,053,976	1,370,168	1,686,361
Average 3 day diving			
1 st yr total	78,702	102,313	125,924
10 yr total	1,124,011	1,461,215	1,798,418
20 yr total	3,161,927	4,110,505	5,059,082

¹⁸ Cummings et al. (1986) Valuing environmental goods: assessment of the contingent valuation method. Totowa, NJ: Rowman and Allenheld

¹⁹ Kealy and Turner (1993) A test of the equality of closed-ended and open-ended contingent valuations. American Journal of Agricultural Economics, 73(2): 321-331

²⁰ Based on divers choosing manta dives on 50% of the average stay (6 days).

²¹ 1 US \$ equal to 13,346 IDR, Feb 27th 2017.

3.7 Follow up results

The most commonly stated reason for WTP values among those stating a positive WTP was contribution to marine conservation. However, respondents as a whole were interested in all possible uses of funds, except perhaps contribution to infrastructure that received more neutral support. Full results are displayed in Table 7 below.

Table 7. Reasons for WTP (mean value of level of interest, where 1 is lowest, – 6 highest)

	All visitors	Foreign visitor	Indonesia-based
Contribution to marine conservation	5.7 (0.8)	5.7 (0.7)	5.6 (1.2)
Contribution to infrastructure for tourism	3.8 (1.5)	3.8 (1.5)	4.4 (1.3)
Support sustainability of local enterprises	4.6 (1.3)	4.6 (1.3)	4.7 (1.2)
Improve enforcement & monitoring of non-tourism activities at manta sites	4.9 (1.2)	5.0 (1.2)	4.6 (1.5)
Improve management of divers at manta sites	5.1 (1.1)	5.1 (1.1)	5.4 (1.4)
Improve management of snorkelers at manta sites	5.0 (1.3)	4.9 (1.3)	5.5 (1.5)
Reduce number of divers at manta sites	4.6 (1.5)	4.7 (1.4)	3.8 (2.0)

Standard deviations displayed in ()

Visitor preferences for manta management priorities are displayed in Table 8. Increased patrolling by enforcement officials received the greatest support (24.9%), followed closely by provision of an on-site compliance officer for divers (21.7%) and managing diver numbers at dive sites (20.7%). Management of diver numbers also received significant support as the second and third most important priority.

Over a third of all visitors to NP MPA cited the park authority (UPT) as their preferred administering body. This was followed by the dive operator association, the Lembongan Marine Association (LMA), which received less than half as many supporters. A slight variation was seen in the Indonesia-based subgroup; Indonesian-based visitors preferred both the dive operator association and the collaborative agency equally as the administering body for permit fee revenue. Table 9 provides a summary of the full results.

Table 8. Ranking of preferred manta management options

	Rank 1	Rank 2	Rank 3
Patrolling by the enforcement team	24.9	16.7	7.0
Providing on-site compliance officer	21.7	4.8	6.0
Managing diver number at manta sites	20.7	24.8	16.0
Filling compliance form in dive operator	14.3	11.0	8.0
Disseminating code of conduct (poster, etc.)	10.6	15.7	11.0
Prohibit all other activities except diving/snorkelling	4.2	6.2	36.0
Separating diving and snorkelling area	3.7	15.2	7.5
Installing buoys & signals	0.0	5.2	8.0
Other	0.0	0.5	0.5

Table 9. Preferred administration to collect and allocate funds for conservation (%)

	All visitors	Foreign visitor	Indonesia-based
Park Authority (UPT)	35.8	38.1	16.7
Dive operator association (LMA)	18.8	17.5	29.2
NGO (CTC)	17.4	17.0	20.8
Collaborative agency (UTP NP/LMA/CTC /community)	14.2	12.4	29.2
Government tourism agency	10.1	10.8	4.2
Other	0.5	0.5	0.0
Don't know	3.2	3.6	0.0

4. Discussion of results

A potential manta permit scheme was widely supported amongst visitors to NP MPA (96% of all visitors) and should seriously be considered as a revenue-generating tool by governing authorities for manta protection.

As it was not possible to fit an econometric model to the data predicting demand, a number of viable analyses were presented and compared. The mean, median and predicted optimal revenue generating values converged on a value of US \$10 per daily permit fee. Under the suggested daily manta dive permit price of US \$10 and the prediction of a 50% decline in visitation rates, manta permits could generate some US \$26,234 to US \$78,702 for manta management in their first year of implementation, depending on visitors average number of manta dives. This number could be even higher if average days diving with mantas is greater than three. Scenarios suggest that the potential manta permit scheme could generate somewhere between US \$1 to 5 million over the next 20 years for the management of this iconic species in NP MPA.

Although not analysed within this report, price differentiation for foreign vs. locally-based visitors is common in park systems around the world. Indeed, WTP for local tourists was lower at US \$7.2 vs. 10. Although it was not possible to test if this variance was significant, local ability to pay should be taken into consideration when setting any fee.

Monies collected should be directed towards increased enforcement and patrolling of manta sites as well improving compliance of divers. This latter action will be particularly important as diver numbers grow in the coming years, as Indonesia promotes itself as a tourism destination. While it is not the place of this report to recommend administering bodies, no major hostility or distrust was seen towards the park authority (UPT); only 6 members of the sample claimed distrust that collected revenue would be used inappropriately, and a third of respondents highlighted the group as their preferred administering body. This said, it will be important for the local administering body to design an instrument which enable permit revenue to be channelled back directly to NP MPA and not towards national infrastructure.

While not covered within this document, it would be pertinent for the park authority and collaborators to explore what other potential permit types exist. For example, in Raja Ampat divers pay an annual fee of US \$100 to dive. This one-time permit could be more convenient, administratively more efficient, and could potentially justify a higher entry fee.

The results presented here represent the potential revenue available to NP MPA only, and do not represent the total economic value of manta rays to NP or to Indonesia in a wider context. Nor do results speak to the wider tourism spending in the areas associated with the presence of manta rays in NP MPA. This is important to note when comparing these values with those of other manta valuation studies. The numbers presented here indicate the revenue (one value) that the park authority can capture from manta tourism within NP MPA from manta dive permits. While the annual values may look small in comparison, this revenue of some US \$26,234 to US \$78,702 represents money available for manta protection and management in 2018, and for NP MPA only. This would cover many of the manta management activities currently underfunded and enable an increased staff base.

The results presented herein demonstrate the potential of manta dive permits to fund management activities and contribute to a self-financing model. These findings are not limited to NP MPA and demonstrate the potential of such permitting schemes to work more widely, both for MPAs elsewhere and other iconic species.



5. Recommendations for NP MPA manta permitting scheme

1. Set initial fee for daily manta dive permits at US \$10;
2. Monitor visitation for potential effects of permit introduction, if any;
3. If visitation remains steady, or does not decline drastically, increase permit fee prices slowly and continue to monitor effects;
4. Investigate a more inclusive, per visit (or monthly/annual) permitting scheme, which could include additional species such as the mola mola. This will be particularly relevant if authorities wish to permit mola mola dive sites in the future and less certainty in viewing

exists or there is overlap in sites;

5. Develop collection and dispersal instruments for permit fees that allow the majority if not all of collected revenue to be used for manta protection and management within NP MPA;
6. Work with local stakeholders to ensure a fair and transparent mechanism for fee collection and allocation, particularly the Provincial Fishery and Marine Agency (Dinas KP Bali), the District Fishery and Marine Agency (Dinas KP Klungkung), the NP MPA UPT, as well as NGOs and community groups.
7. Given the existing knowledge gap on NP MPA current entrance fees, amend NP MPAs fee collection method. A potential entrance fee value increase may also exist based on previous WTP studies.

Annex 1. Full Contingent Valuation Survey

 	Visitor Survey: Nusa Penida MPA	<p style="text-align: right;">For enumerator only Date: _____</p> <p style="text-align: right;">Time: _____</p> <p style="text-align: right;">Location: _____</p> <p style="text-align: right;">Dive operator: _____</p> <p style="text-align: right;">Enumerator code: _____</p> <p style="text-align: right;">Interviewee code: _____</p>																																																																																		
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Nationality: _____ Country of residence (if different): _____ Number people in party _____ (adults) _____ (children under 12)		6 Using a scale from 1–6, where 1 is very bad and 6 is very good, please rate the following aspects of your experience in Nusa Penida; <i>Tick the appropriate box</i>																																																																																		
1 What are your main reasons for visiting Nusa Penida today/ on this trip? <i>Please list top 3 reasons, in order of importance where 1 is the most important</i>		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4">Very Bad</th> <th colspan="4">Very Good</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td> <td>5</td><td>6</td> <td>NA</td><td>DK</td> </tr> </tbody> </table>	Very Bad				Very Good						1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK	1	2	3	4	5	6	NA	DK
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Other (specify) _____	1	2	3	4	5	6	DK																																																																										
16 In your opinion, which institution do you think is the most credible to collect the fee ? (tick only one)																																																																																	
<div style="display: flex; justify-content: space-between;"> Park Authority (UPTD Nusa Penida) <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> NGO (Coral Triangle Center/CTC) <div>2</div> </div> <div style="display: flex; justify-content: space-between;"> Dive operator association (LMA) <div>3</div> </div> <div style="display: flex; justify-content: space-between;"> Government tourism agency <div>4</div> </div> <div style="display: flex; justify-content: space-between;"> Collaborative agency (UPTD Nusa Penida, LMA, CTC, Community) <div>5</div> </div> <div style="display: flex; justify-content: space-between;"> Other (specify) _____ <div>6</div> </div>																																																																																	
17 What do you think the Park Authority should prioritise in order to manage manta rays in the future? (choose top 3 priorities)																																																																																	
<div style="display: flex; justify-content: space-between;"> Providing on-site compliance officer <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> Patrolling by the enforcement team <div>2</div> </div> <div style="display: flex; justify-content: space-between;"> Filling compliance form in dive operator <div>3</div> </div> <div style="display: flex; justify-content: space-between;"> Disseminating code of conduct (poster, etc.) <div>4</div> </div> <div style="display: flex; justify-content: space-between;"> Managing diver number at manta sites <div>5</div> </div> <div style="display: flex; justify-content: space-between;"> Separating diving and snorkling area <div>6</div> </div> <div style="display: flex; justify-content: space-between;"> Installing buoys & signals <div>7</div> </div> <div style="display: flex; justify-content: space-between;"> Prohibit all other activities except diving/ snorkling <div>8</div> </div> <div style="display: flex; justify-content: space-between;"> Other (specify) _____ <div>9</div> </div>																																																																																	
DEMOGRAPHICS																																																																																	
The remaining questions are for statistical purposes only.																																																																																	
18 Which of the following best describes your residency?																																																																																	
<div style="display: flex; justify-content: space-between;"> Indonesian citizen <div>1 Skip to q20</div> </div> <div style="display: flex; justify-content: space-between;"> Expatriate living in Indonesia <div>2 Skip to q20</div> </div> <div style="display: flex; justify-content: space-between;"> Citizen of other country (specify) _____ <div>3</div> </div>																																																																																	
19 Have you ever visited Indonesia before? Yes No																																																																																	
<div style="display: flex; justify-content: space-between;"> Yes <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> No <div>2</div> </div>																																																																																	
20. Including yourself, how many people live in your household? _____ adults and _____ children (i.e. under 12s)																																																																																	
21 Respondent’s gender Male Female																																																																																	
<div style="display: flex; justify-content: space-between;"> Male <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> Female <div>2</div> </div>																																																																																	
22 In what year were you born?(write year) _____																																																																																	
23 Which of the following describes your highest level of education?																																																																																	
<div style="display: flex; justify-content: space-between;"> No formal education <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> Primary <div>2</div> </div> <div style="display: flex; justify-content: space-between;"> Secondary/high school <div>3</div> </div> <div style="display: flex; justify-content: space-between;"> University/College <div>4</div> </div> <div style="display: flex; justify-content: space-between;"> Graduate degree or higher <div>5</div> </div>																																																																																	
24 What is your current employment status?																																																																																	
<div style="display: flex; justify-content: space-between;"> Student <div>1</div> </div> <div style="display: flex; justify-content: space-between;"> Self employed <div>2</div> </div> <div style="display: flex; justify-content: space-between;"> Employed full-time (more than 30 hours a week) <div>3</div> </div> <div style="display: flex; justify-content: space-between;"> Employed part-time (under 30 hours a week) <div>4</div> </div> <div style="display: flex; justify-content: space-between;"> Looking after home full time <div>5</div> </div> <div style="display: flex; justify-content: space-between;"> Unpaid voluntary work <div>6</div> </div> <div style="display: flex; justify-content: space-between;"> Unemployed <div>7</div> </div> <div style="display: flex; justify-content: space-between;"> Retired <div>8</div> </div> <div style="display: flex; justify-content: space-between;"> Unable to work due to sickness or disability <div>9</div> </div>																																																																																	

Annex 2. Potential revenue generation under three potential visitation rates and lengths of stay

Table A1. Potential revenue generation under three potential visitation rates under single day diving scenario

Visitation:		50%		65%		80%	
Year	Visitors	Revenue (US \$)	Visitors	Revenue (US \$)	Visitors	Revenue (US \$)	Revenue (US \$)
2018	2623	26234	3410	34104	4197	41975	
2019	2825	28254	3673	36730	4521	45207	
2020	3043	30430	3956	39559	4869	48688	
2021	3277	32773	4260	42605	5244	52436	
2022	3530	35296	4589	45885	5647	56474	
2023	3801	38014	4942	49418	6082	60823	
2024	4094	40941	5322	53224	6551	65506	
2025	4409	44094	5732	57322	7055	70550	
2026	4749	47489	6174	61736	7598	75982	
2027	5115	51146	6649	66489	8183	81833	
2028	5508	55084	7161	71609	8813	88134	
2029	5933	59325	7712	77123	9492	94920	
2030	6389	63893	8306	83061	10223	102229	
2031	6881	68813	8946	89457	11010	110101	
2032	7411	74112	9635	96345	11858	118579	
2033	7982	79818	10376	103764	12771	127709	
2034	8596	85964	11175	111753	13754	137543	
2035	9258	92583	12036	120358	14813	148134	
2036	9971	99712	12963	129626	15954	159540	
2037	10739	107390	13961	139607	17182	171824	
10 yr. total		374670		487072		599473	
20 yr. total		1053976		1370168		1686361	

Table A2. Potential revenue generation under three potential visitation rates under three-day diving scenario

Visitation: 50%			65%		80%	
Year	Visitors	Revenue (US \$)	Visitors	Revenue (US \$)	Visitors	Revenue (US \$)
2018	2623	78702	3410	102313	4197	125924
2019	2825	84762	3673	110191	4521	135620
2020	3043	91289	3956	118676	4869	146063
2021	3277	98318	4260	127814	5244	157309
2022	3530	105889	4589	137656	5647	169422
2023	3801	114042	4942	148255	6082	182468
2024	4094	122824	5322	159671	6551	196518
2025	4409	132281	5732	171965	7055	211650
2026	4749	142467	6174	185207	7598	227947
2027	5115	153437	6649	199468	8183	245499
2028	5508	165251	7161	214827	8813	264402
2029	5933	177976	7712	231368	9492	284761
2030	6389	191680	8306	249184	10223	306688
2031	6881	206439	8946	268371	11010	330302
2032	7411	222335	9635	289035	11858	355736
2033	7982	239455	10376	311291	12771	383127
2034	8596	257893	11175	335260	13754	412628
2035	9258	277750	12036	361075	14813	444401
2036	9971	299137	12963	388878	15954	478619
2037	10739	322171	13961	418822	17182	515473
10 yr. total		1,124,011		1,461,215		1,798,418
20 yr. total		3,161,927		4,110,505		5,059,082