

# Post-August 2006 Oil Spill Populations of Penaeid Shrimp in Island and Riverine Mangroves in Guimaras, Central Philippines

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**ABSTRACT.** To evaluate the impact on biota of the release of ~2 million liters of bunker oil off Guimaras Island, central Philippines, the penaeid shrimp populations in a protected island mangrove (Tandog) and a riverine mangrove (Sibunag) were surveyed by pocket seine 2-3 months after the August 2006 spill; results are compared to 1993 baseline data. A total of 529 individuals belonging to three penaeid species were collected – *Metapenaeus anchistus* in Tandog, and *M. ensis* and *Penaeus merguensis* in Sibunag. Shrimp densities were significantly higher in Tandog Island in 2006 compared to 1993 but remained similar in the riverine mangrove. This suggests that protection may have a greater impact than the Oil Spill *per se* because Tandog is part of the protected Taklong National Marine Reserve. In contrast to abundance, shrimp sizes (carapace length) were significantly smaller in 2006 compared to 1993 for both sites.

## Keywords:

penaeids, marine shrimp, Guimaras Island, M/T Solar 1, oil spill

## Introduction

In recent years, commercial shipping accidents, e.g., the MV Noli Schedar in Lingayen Gulf (February 2000), MV Island Explorer in Apo Manor Reef, Mindoro Island (January 2004), and Semirara Island (January 2006) (<http://www.marinergroup.com/oil-spill-history.htm>) have introduced oil contaminants to marine habitats in the Philippines. On 11 August 2006, the M/T Solar 1 sank off the southern coast of Guimaras, an island in central Philippines. The tanker was stranded on the sea bottom at a depth of about 1,000 m and released ~ 2 million liters of bunker fuel. A post-Oil Spill conference comprising an interdisciplinary team of scientists and researchers recommended the monitoring of changes in biodiversity and numbers of various flora and faunal groups. Baseline data on species composition and abundance in Guimaras are available for the marine shrimp of the Family Penaeidae (Primavera, 1998), hence a post-Oil Spill survey was conducted on this invertebrate group. The paper reports the results of

the short-term survey and discusses their implications.

## Materials and Methods

For comparability, the same Guimaras island and riverine mangrove sites sampled in 1993 (Primavera, 1998) (Fig. 1) were surveyed in 2006. The riverine mangrove comprised a narrow band of second-growth *Avicennia marina*, *A. officinalis*, *Rhizophora apiculata*, *R. mucronata*, *Sonneratia alba* and other species along Sibunag River (10°27' N, 122°37' E). The other site is an overwash mangrove in Tandog Island (10°25' N, 122°30' E) at the southwestern tip of Guimaras which is part of the 1,143-ha Taklong National Marine Reserve (TINMAR) declared by Presidential Proclamation No. 525 in 1990. Tidal amplitude at both sites is around 2 m. The substrate of Sibunag River is muddy while the island mangrove is sandy-muddy.

Shrimps were sampled on 28 October 2006 and 26 November 2006 for the island and riverine mangrove, respectively. Sites were sampled by pulling a pocket seine 6 m long, 2 m wide, and 1 m high (mesh size 2-3 mm) parallel to the shoreline over a distance of 50 m; three replicates were taken per site (Primavera, 1998). In the field, penaeids were sorted out from other crustaceans, molluscs, fish and detritus and immediately preserved in 5-10%

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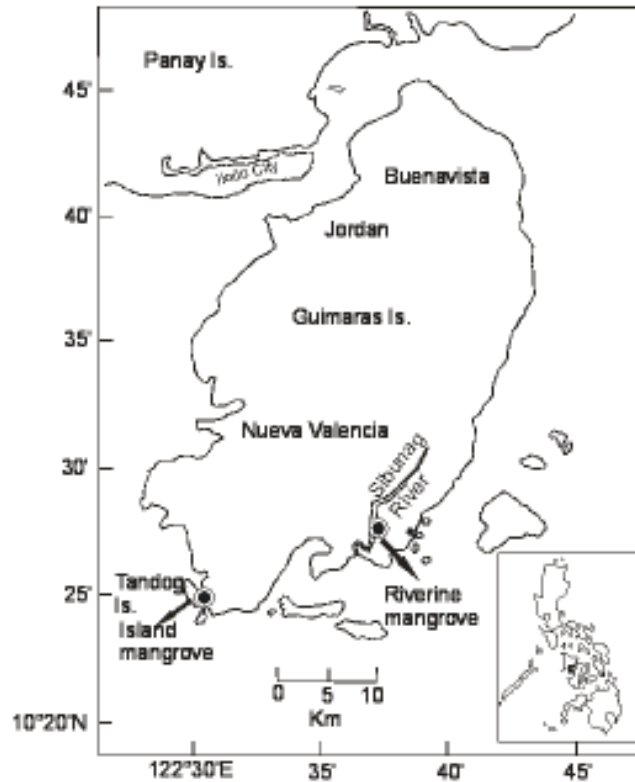


Fig. 1. Map of Guimaras Island, central Philippines showing locations of the study sites.

seawater-formalin. Specimens were later identified to species level based on penaeid keys (Grey et al. 1983, Motoh and Buri 1984, Chaitiamvong and Spongpan 1992). Carapace length (CL) was measured to the nearest 0.1 mm using dial calipers. Shrimp catches were expressed as density = no/m<sup>2</sup>, the total area sampled per replicate being 100 m<sup>2</sup> (50 m by 2 m width of pocket seine opening). Shrimp densities and sizes before and after the Oil Spill were compared by t-test. Salinity and temperature were also measured.

## Results and Discussion

Water temperature was stable in the riverine mangrove –  $29.6 \pm 0.1$  °C in 1993 and  $29.7 \pm 0.1$  °C in 2006, but was lower in 1993 ( $29.9 \pm 0.1$  °C) compared to 2006 ( $23.5$  °C) in the island mangrove. (Only one reading was recorded in Tandog Island.) Salinity was higher in 2006 compared to 1993 for both riverine ( $31.28 \pm 0.1$  ppt vs  $19.9 \pm 0.1$  ppt) and island mangrove ( $34.7$  ppt vs  $29.9 \pm 0.1$  ppt).

### Species composition

A total of 529 penaeids comprising three species were collected in the island (n=113) and

riverine (n=416) mangroves in Guimaras in October and November 2006, respectively. The number of species decreased in the riverine mangrove (4-5 in 1993 vs 2-3 in 2006), but remained a single species (*Metapenaeus anchistus*) in Tandog. Sibunag River penaeids were predominantly *Metapenaeus ensis* (97.8%) and a few *Penaeus merguianensis*/*P. indicus* (2.2%) (Table 1).

### Density

Mean shrimp densities were 0.38/m<sup>2</sup> and 0.69/m<sup>2</sup> in the island and riverine mangrove, respectively (Table 2). From 1993 to 2006, mean densities increased more than 3 times in Tandog Island, in contrast to riverine populations which remained the same. The significantly higher shrimp counts for Tandog may be traced to the full protection of mangroves in TINMAR whereas the similar densities for Sibunag River suggest that the Oil Spill had no impact on their numbers. Shrimp are able to swim away from oil and other contaminants and may therefore avoid effects of oil in the sediment, unlike sessile fauna such as corals and barnacles, and infauna such as bivalves that remain in the substrate.

**Table 1. Numbers (%) of penaeid shrimp caught by pocket seine (total of 3 replicates) in Tandog Island and Sibunag River, Guimaras Island, central Philippines in 1993 (data from Primavera, 1998) and 2006.**

Species	Tandog Island		Sibunag River	
	1993	2006	1993	2006
<i>Metapenaeus anchistus</i>	34 (100)	113 (100)	0 (0)	0 (0)
<i>M. ensis</i>	0 (0)	0 (0)	453 (81.47)	407 (97.83)
<i>Metapenaeus</i> spp.	0 (0)	0 (0)	19 (3.42)	0 (0)
<i>Penaeus merguensis</i> / <i>P. indicus</i>	0 (0)	0 (0)	82 (14.75)	9 (2.16)
<i>P. monodon</i>	0 (0)	0 (0)	2 (0.36)	0 (0)
Total	34 (100)	113 (100)	556 (100)	416 (100)

**Table 2. Density and size of juvenile penaeid shrimp in Tandog and Sibunag, Guimaras Island, central Philippines in 1993 (data from Primavera, 1998) and 2006, compared by t-test.**

	Density (no/m <sup>2</sup> )			Carapace length (mm)		
	1993	2006	p	1993	2006	p
Tandog Island	0.11±0.01	0.38±0.16	0.041*	13.25±0.65	8.52±0.10	0.00**
Sibunag River	0.72±0.10	0.69±0.24	0.379ns	8.22±0.02	5.82±0.03	0.00**

\*Significant, \*\* Highly Significant, ns Not Significant. All the animals collected had CL <20 mm and are therefore classified as juveniles (Primavera, 1998). Shrimp were significantly smaller in 2006 compared to 1993 (Table 2) for both island (8.52 vs 13.25 mm CL) and riverine (5.82 vs 8.22 mm CL) mangrove, perhaps related to sublethal effects of the Oil Spill including slower growth rates and delayed spawning (which indirectly leads to smaller sizes).

Comparing sites, juvenile sizes were consistently smaller in the river vs. the island indicating a) nursery function, and b) overfishing and habitat loss. Compared to 1993, there are more fishing gears presently deployed and wider areas of mangrove have been converted to ponds based on interviews of local communities and fishermen.

## Conclusion and Recommendations

The present study found that protection had greater impact than the Oil Spill *per se* on shrimp abundance in Tandog Island, but this did not apply to the unprotected riverine mangrove which showed similar shrimp numbers before and after. Moreover, the higher absolute numbers of shrimp in the riverine

mangrove compared to the island mangrove in both 1993 and 2006 reflect the greater nursery value of the former for juvenile shrimp. Therefore it should also be protected, like Tandog Island.

Nevertheless, the increase in shrimp juveniles observed in Tandog but not Sibunag may be partly or mostly due to the protected status of TINMAR. Such protection is in stark contrast to the ongoing mangrove clearing and overexploitation of fisheries in Sibunag. Laws protecting mangroves such as Rep. Act 7161 which bans the cutting of all mangroves (Primavera et al., 2004) should be enforced by local government units and national government agencies. For future evaluation of shrimp populations, a control site not contaminated by the 2006 Oil Spill (e.g., in the eastern or northern side of Guimaras) should be added to the experimental sites of Tandog and Sibunag River.

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