

Comparing recruitment of *Pocillopora damicornis* affected by the 2010 bleaching event



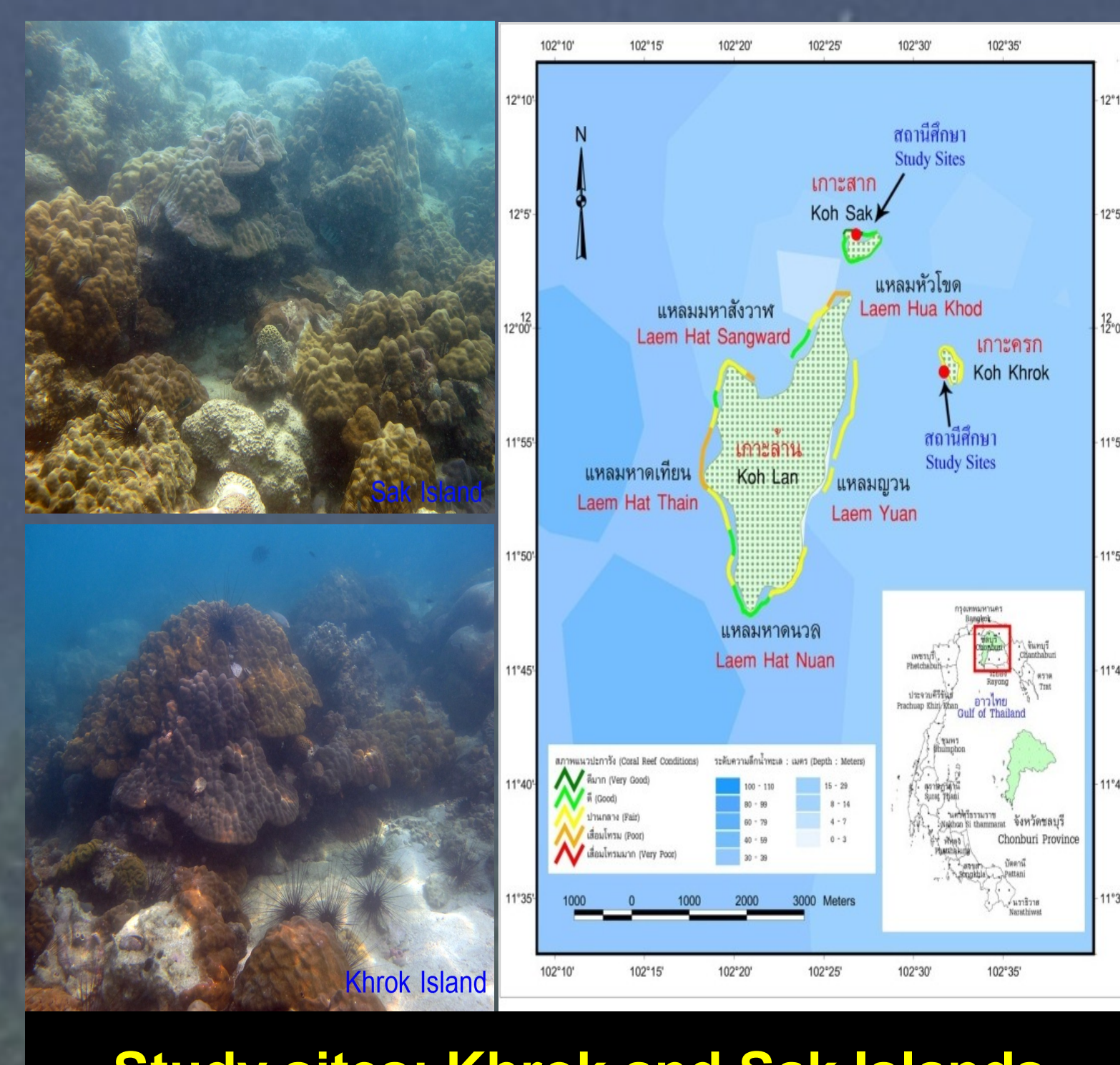
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Summary: Coral bleaching, caused by high seawater temperature, occurred throughout the Gulf of Thailand in May to September 2010. This study compares recruitment of the brooding coral *Pocillopora damicornis* before, during and after the 2010 bleaching event, in a settlement plate experiment, at Khrok Island and Sak Island, in the inner Gulf of Thailand. Before the bleaching event, the averages of coral recruitment were 4.9 ± 0.23 colonies.m⁻² for Khrok Island and 6.8 ± 0.51 colonies.m⁻² for Sak Island. In contrast, during the bleaching event, there were no coral recruits at Khrok Island and the average of coral recruitment at Sak Island was only 0.62 ± 0.02 colony.m⁻². Recruitment rates increased after the bleaching event (September 2010-May 2011) compared with during the bleaching event, 0.69 ± 0.01 colony.m⁻² for Khrok Island and 1.23 ± 0.09 colonies.m⁻² for Sak Island. Low density of adult colonies of *P. damicornis* in the inner Gulf of Thailand after the bleaching event would result in its low coral recruitment. Therefore recovery to the former levels of abundance of *P. damicornis* at Khrok Island and Sak Island will depend on successful settlement of planulae which is likely to be low. To give this coral species the best chance to maintain their populations in the face of coral bleaching events, additional anthropogenic stressors must be mitigated.



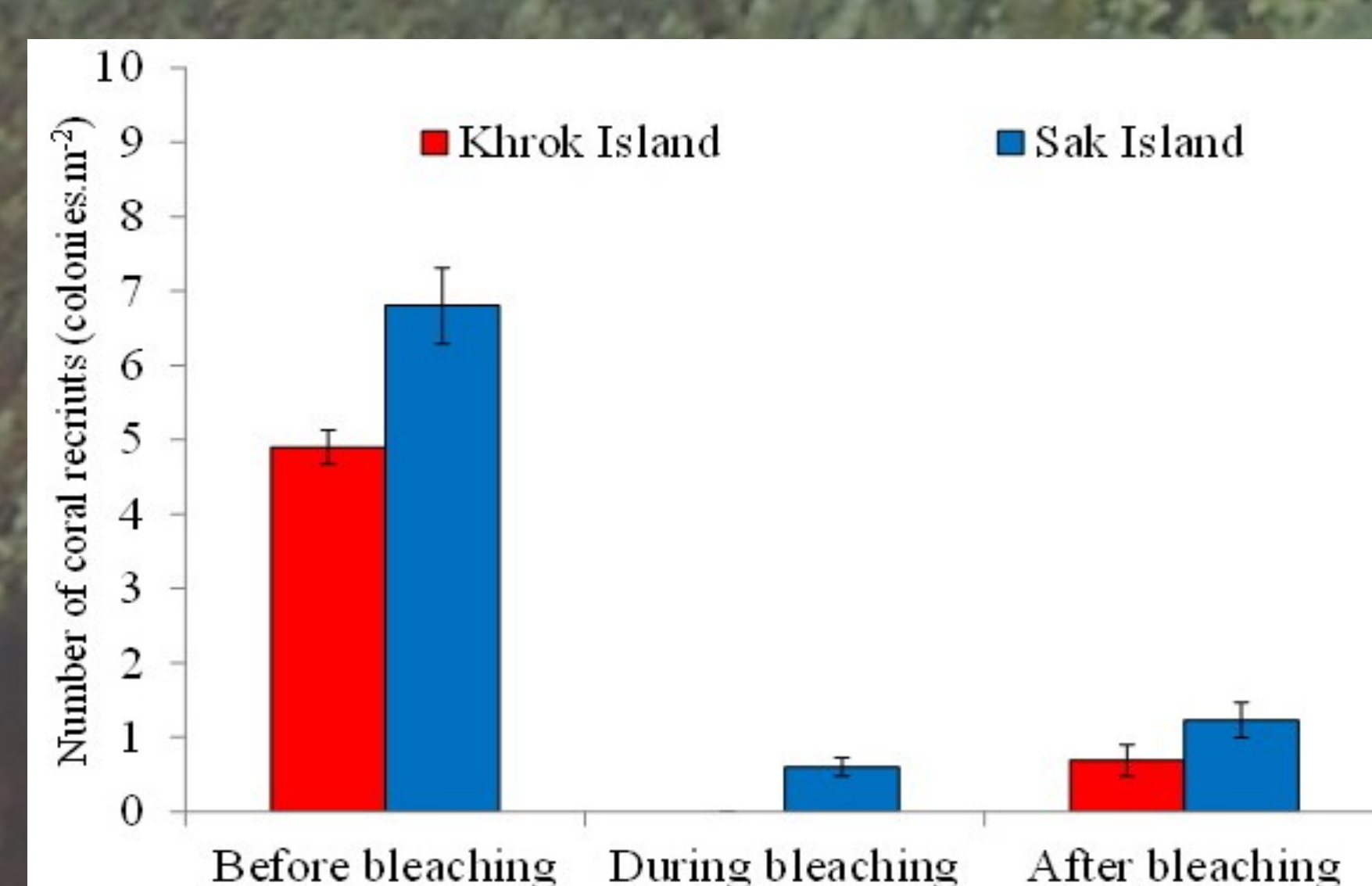
Study sites: Khrok and Sak Islands

Introduction: The severe mass coral bleaching, caused by high seawater temperature, occurred throughout the Gulf of Thailand in May to September 2010. One of the potential effects of coral bleaching event is reduction in reproductive output or reduction in recruitment survivorship of larvae (McClanahan et al. 2009). Our long-term study on coral communities in the inner Gulf of Thailand provides an opportunity to quantify impacts of the 2010 bleaching event on coral settlement and recruitment rates. The aim of this study was to compare recruitment of the brooding coral *Pocillopora damicornis* before, during and after the 2010 bleaching event, through the settlement panel experiments, at Khrok and Sak Islands, in the inner Gulf of Thailand.

Material and Methods: The study sites were located at Khrok and Sak Islands, the tourism hotspots, in the inner Gulf of Thailand. Settlement panels were made of locally available gypsum plates and were deployed in three periods, i.e., before the bleaching event (June 2009-March 2010), during the bleaching event (April 2010-August 2010) and after the bleaching event (September 2010-May 2011). Planulation of *P. damicornis* in the inner Gulf of Thailand occurs year-round (Janena et al. 1996). However there are no scientific results showing whether reproduction is through sexual or a sexual brooding. The panel size was 15x15 cm². Twelve panels were attached to the iron frames in vertical, horizontal and oblique positions, four panels for each. There were three iron frames for each study site. Settlement panels were collected, labeled and transported back to the laboratory for initial search of coral recruits using a dissection microscope. All coral recruits were counted and marked. The panels were bleached in a chlorine solution and air dried for further identification of coral recruits. The recruits were identified to family or genus levels (English et al. 1997, Babcock et al. 2003). In this paper we report only the recruits of *P. damicornis*, one of the dominant recruits in the Gulf of Thailand. *P. damicornis* is the only species of Pocilloporidae found in the inner Gulf of Thailand. The coral recruit density data were analyzed with a two-way ANOVA using time and location as fixed factors. Where significant differences were established, Turkey HSD test was employed to determine which groups differed.

Results: The densities of coral recruits at both study sites before, during and after the 2010 coral bleaching event differed significantly. Before the bleaching event, the averages of coral recruitment were 4.9 ± 0.23 colonies.m⁻² for Khrok Island and 6.8 ± 0.51 colonies.m⁻² for Sak Island. In contrast, during the bleaching event, there were no coral recruits at Khrok Island and the average of coral recruitment at Sak Island was only 0.62 ± 0.02 colony.m⁻². The settlement panel experiments after the bleaching event (September 2010-May 2011) showed higher recruitment rates compared with during the bleaching event, 0.69 ± 0.01 colony.m⁻² for Khrok Island and 1.23 ± 0.09 colonies.m⁻² for Sak Island.

Discussion: We quantitatively documented a significantly higher density of coral recruits before the 2010 mass coral bleaching event. These results support the impacts of coral bleaching on reduction in recruitment survivorship of coral larvae (Michalek-Wagner and Willis 2001, McClanahan et al. 2009). Recruitment rates of *P. damicornis* at our study sites were relatively low, in comparison to other regions (Glasson et al. 2004). Reproductive mode of *P. damicornis* can be planulae brooding or gametes spawning (Baird et al. 2009). It is recognized that *P. damicornis* in the inner Gulf of Thailand is a brooding coral (Janena et al. 1996). Further studies are needed for examining whether *P. damicornis* in the Gulf of Thailand spawns asexual planula larvae or gametes. Our results provide useful data in terms of coral settlement and recruitment in the context of coral recovery from degradation and disturbance, especially from the climate changes derived coral bleaching. As Sak and Krok Islands are located in the inner Gulf of Thailand which is near the river mouths, we suggest that coral recovery may be delayed on coral communities dominated by algal turfs, particularly those stresses by high sedimentation (Birrel et al. 2005). Low density of adult colonies of *P. damicornis* in the inner Gulf of Thailand after the bleaching event would also result in its low coral recruitments in the future. A previous review papers stated that coral recovery periods may up to 20–25 years. Coral recovery to pre-disturbance states may require decades (to restore former levels of coral cover and species diversity) to centuries (to reconstruct lost reef frameworks) (Baker et al. 2008). To give *P. damicornis* the best chance to maintain their populations in the inner Gulf of Thailand in the face of coral bleaching events, additional anthropogenic stressors must be mitigated by proper implementation of a good management plan.



Densities of coral recruit before, during and after the 2010 bleaching event at Khrok and Sak Islands (mean no. colonies.m⁻² ± SE).

Source of variation	df	Mean square	p
Station	1	0.225	0.318
Time	2	2.527	0.001*
Station X Time	2	0.020	0.908
Error	12	0.207	
Total	18	0.225	
Turkey HSD test			
Before bleaching versus During bleaching			0.002*
Before bleaching versus After bleaching			0.006*

Densities of coral recruit were compared among factors surveyed before, during and after the 2010 bleaching event. Results of two-way ANOVA and Turkey HSD test examining the influence of time and station on recruit density. The data were square root transformed.

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