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Fish diversity and fish community in seagrass beds at Ban Pak Klong, Trang Province, Thailand

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Abstract
Fish diversity and fish community in seagrass beds at Ban Pak Khlong Trang Province, Thailand, 62 taxa in 35 families were conducted using three different mesh size gill net (2.0, 3.5 and 5.0 cm) between January to December 2012. The dominant families were Leiognathidae, Engraulidae, Gerreidae, Hemiramphidae, Platycephalidae and Tetraodontidae, while the dominant species were *Sillago sihama*, *Leiognathus jonesi* and *Gerres erythrourus*. The highest of occurrence frequency were *Sillago aeolus*, (91.67 %), *Sillago sihama* (83.33 %) and *Gerres erythrourus* (66.67 %). They were highly abundant of specimens on August, less in October. Mean Shannon indices was closely 1.9. The relationships of fish diversity and environmental parameter were indicated for fish community in seagrass beds.

Keywords: Diversity, Fish, Seagrass, Andaman, Taxonomy.

1. Introduction
Diversity of marine fishes are important for the study of the biology, life history, fisheries biology, population dynamics and ecology of fish, it can be applied to fisheries managements, economics, socials, and environment. Seagrass beds area at Trang Province are 3,435 hectare, with 11 species, also in Ban Pak Khlong has seagrass area 187.15 hectare. Seagrasses are considered a valuable component of coastal ecosystems, such as aquatic resources and different ecological functions for human benefit and environmental reserve seagrass beds provide an important habitat for numerous fish, invertebrates and other animals. It provided a protein sources security and occupation for coastal populations [1, 2, 3] and providing a permanent habitat to fulfill aquatic animal life cycle, a temporary nursery area for juvenile stages [4, 5], a feeding area for life stages and predation [6, 7], important tropical marine habitat, covering large shallow sub-tidal and intertidal areas in the Indo-Pacific [8] and forming an important component of tropical coastal ecosystems [9]. Few works has been done in seagrass beds fish diversity in Thailand.
In this study we examine the fish diversity in the seagrass beds of Ban Pak Khlong, Trang Province, Thailand. This result can be use as data base to compare with other seagrass beds area. And shore line aquatic resources conservation will be prepare for environmental protection purpose.

2. Material and Methods
2.1 Study area
The study area was in Ban Pak Khlong (7°36’29”N, 99°16’53”) (Figure 1). It located in Sikao Bay, Trang province, southern of Thailand, during January to December 2012.

2.2 Fish data
Three experimental gillnets fishing sets were conducted using three different mesh sizes, stretched mesh, i.e. 2.0, 3.5 and 5.0 cm (180 m long and 1.5 m depth) and they were connected into one set for fish sampling. The fishing times were operated during the night time. Specimens were fixed in 10% formalin for a month and changed to ethanol 30%, 50% and finally preserved in 70% ethanol and re-checked and taxonomically identified into species [10, 11, 12, 13, 14, 15] at the Maejo Aquatic Resources Natural Museum (MARNM), Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Chiangmai, Thailand.

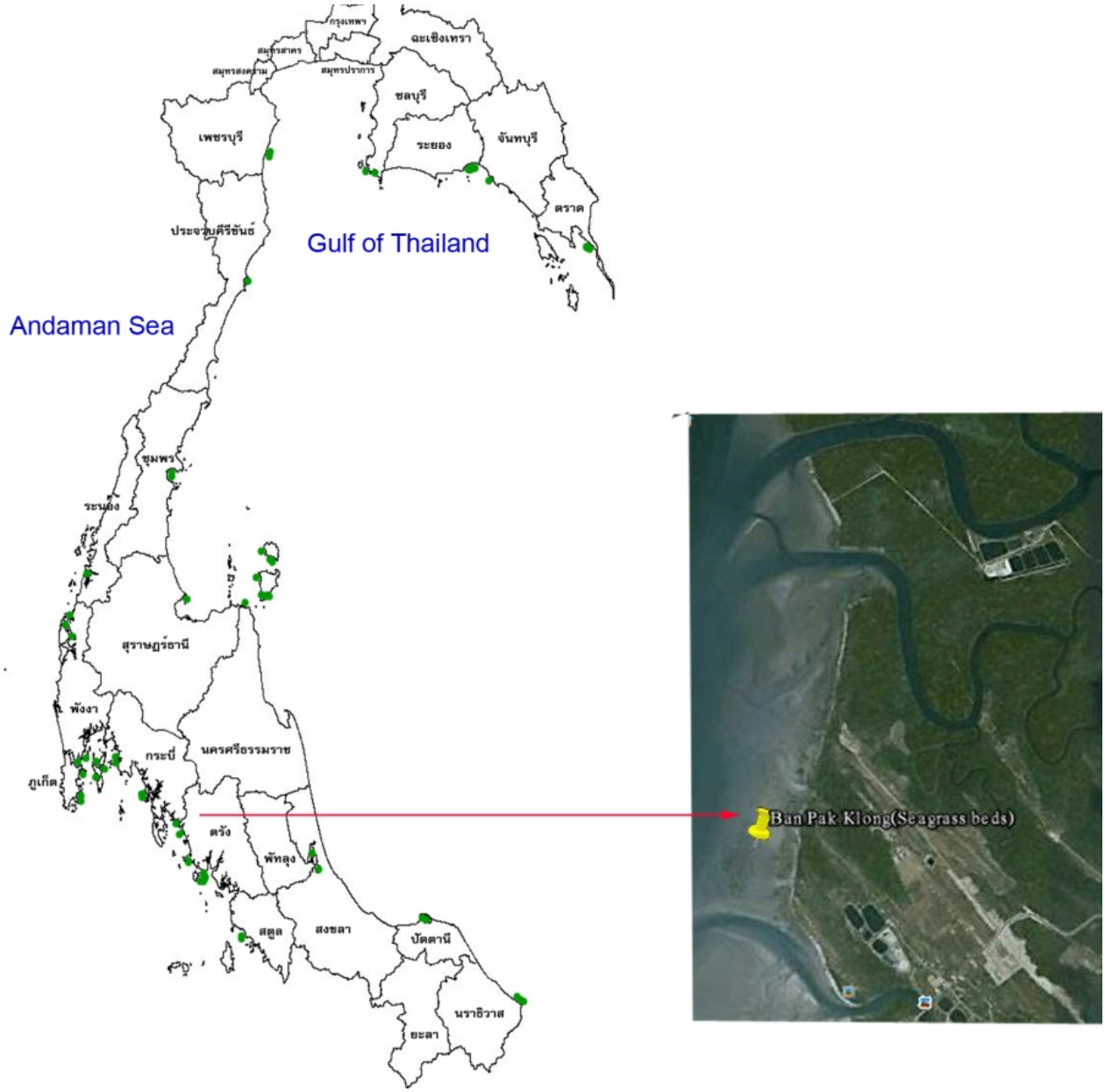

Fig 1: Seagrass beds at Ban Pak Khlong, Trang Province, Thailand..

2.3 Environmental parameter

The physico-chemical water quality parameters were measured in situ using a YSI 556 (MPS) muti-probe system, i.e. conductivity (Con), total dissolved solid (TDS), salinity (Sal), dissolved oxygen (DO), pH, temperature (Tem), transparency (Tra). And other parameters were sampled for laboratory analyses i.e., ammonia (Amm), nitrite (Nti), nitrate (Nta), orthophosphate (Ort) and Chlorophyll a (Chl), with the standard methods [16].

2.4 Statistical analyses

The data set were presented as the percentages of occurrence frequency (% OF), species richness, Shannon diversity index (H'-index) [17], and used to examined the relationships between species richness and environmental parameters were examined by Canonical Correspondence Analysis (CCA), an ordination technique designed for direct analysis of relationships between multivariate ecological data [18]. All statistical analyses were performed by using an R-statistical software, using packages "stats" [19, 20].

3. Results

A total of 1,922 fishes were collected representing 62 species in 35 families. The dominant families were Leiognathidae 7 species (*Leiognathus stercorarius, L. jonesi, L. decorus, L. splendens, L. equulus, Secutor insidiator* and *Gazza minuta*), Engraulidae 3 species (*Thryssa hamiltonii, Stolephorus indicus* and *Thryssa scratchleyi*), Gerreidae 3 species (*Gerres erythrourus, G. oyena* and *G. filamentosus*), Hemiramphidae 3 species (*Hyporhamphus limbatus, Halichoeres bicolor* and *Zenarchopterus buffonis*), Platycephalidae 3 species (*Grammoplites scaber, Platycephalus indicus* and *Cociella punctata*) and Tetraodontidae 3 species (*Lagocephalus spadiceus, Lagocephalus lunaris* and *Chelonodon patoca*). While, the dominant species were *Sillago sihama, Leiognathus jonesi* and *Gerres erythrourus*. The highest of occurrence frequency (% OF) were *Sillago aeolus, Sillago sihama* and *Gerres erythrourus*, 91.67, 83.33 and 66.67 %, respectively (Figure 2). They were mostly abundant in the rainy season such as on May (327 fishes), August (355 fishes) and December (248 fishes) and species richness were mostly found

in the rainy season such as on June (26 species), July (26 species) and August (19 species), (Figure 3). Mean Shannon indices (H'-index) was close to 1.9.

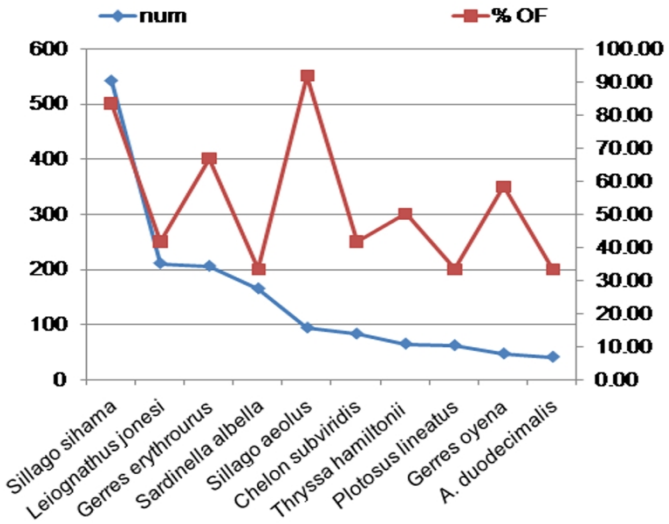

Fig 2: The number of dominant species (num) and occurrence frequency (% OF) of fishes in seagrass beds at Ban Pak Khlong, Trang Province, Thailand.

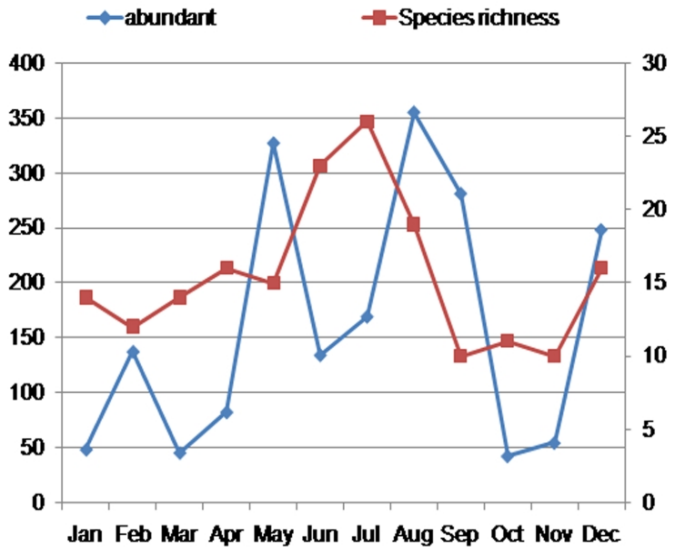

Fig 3: The specimens highly abundant and species richness of fishes in seagrass beds at Ban Pak Khlong, Trang Province, Thailand.

The physico-chemical water parameters average were conductivity 56.38 µs/cm, TDS 33.50 mg/l, Salinity 33.74 ppt, DO 7.26 mg/l, pH 8.28, temperature 29.93 °C, Transparency 129.58 cm., Ammonia 0.01 mg/l, Nitrite 0.01 mg/l, Nitrate 0.08 mg/l, Orthophosphate 0.02 mg/l and Chlorophyll a 1.17 µg/l (Figure 4)

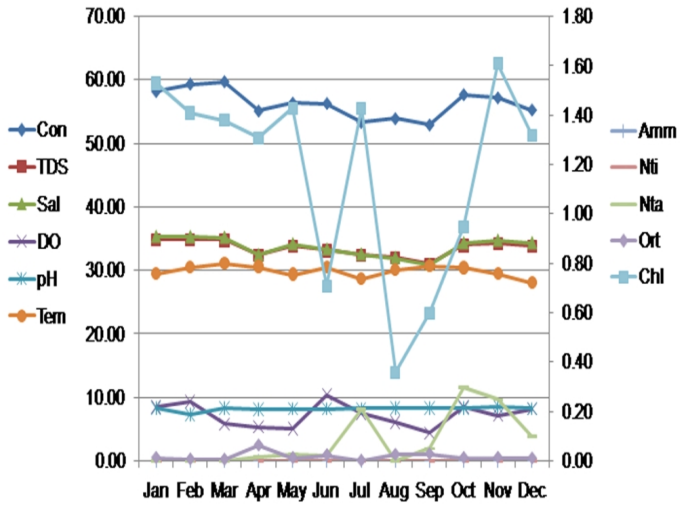

Fig 4: Water qualities in seagrass beds at Ban Pak Khlong, Trang Province, Thailand.

3.1 Relationships of fish diversity and environmental parameters

Sixty-two species and twelve environmental variables were analysis by Canonical Correspondence Analysis (CCA) can found common fish species such as *Sillago sihama*, *Leiognathus jonesi*, *Gerres erythrourus*, *Sardinella albella*, *Sillago aeolus*, *Chelon subviridis*, *Thryssa hamiltonii*, *Plotosus lineatus*, *Gerres oyena* and *Atherinomorus duodecimalis* etc. and can be classified into 4 groups (Figure 5).The first group (A1) was represented species in August, September and October (main rainy season) e.g. *Sillago sihama*, *Chelon subviridis* and *Gerres erythrourus* etc., relative with temperature and ammonia. The group II (A2) was found during in June and July (beginning of rainy season) e.g. *Thryssa hamiltonii*, *Plotosus lineatus* and *Sillago sihama*, positively correlated to CCA1, relative with Nitrate. The group III (B2) was found fish species during in January, February and November (beginning of dry season) e.g. *Atherinomorus duodecimalis*, *Ambassis vachelleri*, *Sillago sihama*, and *Sillago aeolus* etc., positively correlated to CCA2, relative with TDS, salinity, and transparency. The group IV (B1) was found fish species during March, April, May and December (dry season) e.g. *Protosus lineatus*, *Sillago sihama*, and *Sillago aeolus* etc., negatively correlated to CCA1 and CCA2, relative with conductivities. Cluster dendrogram summarizing similarity on their species richness and environmental parameters (plot by CCA). Cluster analysis of composition in the sampling site on along the year (Figure 5C). It can be classified into 2 main groups i.e. A group, divided into 2 groups such as: A1 a main rainy season (August, September and October) and A2 a beginning of rainy season (June and July), the most dominant species were *Sillago sihama*, *Leiognathus jonesi*, and *Gerres erythrourus* and B group, divided into 2 groups suchas: B1 a dry season (Mar, Apr and May) and B2 a late raining season (Nov, Jan and Feb), the most dominant fish species *Sillago sihama*, *Sillago aeolus* and *Atherinomorus duodecimalis*.

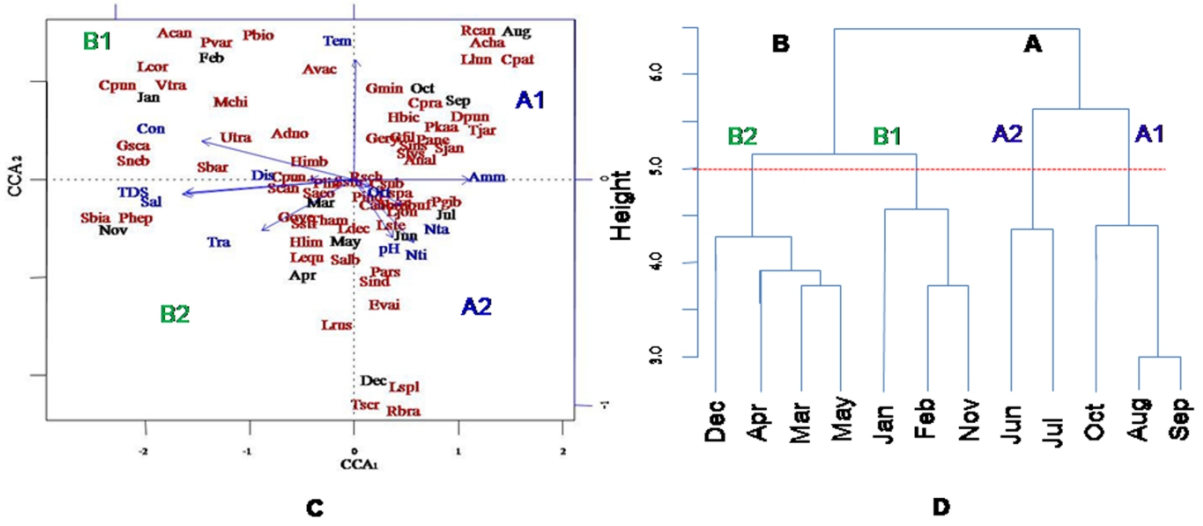

Fig 5: CCA ordination with the species richness related to the environmental factors in seagrass beds (C) and dendrogram of species richness (D) at Ban Pak Khlong, Trang Province, Thailand.

4. Discussion

In the present study, the species diversity in Ban Pak Khlong was relative with seagrass beds, the results were shown 62 toxons in 35 families, which similar of Phinrub *et al.*, [21] who were found 65 toxons in 35 families from fish diversity and water quality in seagrass beds at Kham Bay, Trang Province, Thailand and Khalaf *et al.*, [22] were found 35 families.

Another similarity Kuriandewa *et al.*, [23] found permanent residents are defined by the presence of all life history stages within the habitat. In the presented study, juveniles of 32 taxa were recorded. Some common species (*Cheilio inermis*, *Halichoeres argus*, *Halichoeres chloropterus*, *Pentapodus trivittatus*, *Apogon margaritophorus*) were found regularly as both adults and juveniles in the seagrass beds while other species were found exclusively as juveniles of reef-associated families that might utilize adjacent seagrass beds as nurseries such as Chaetodontidae, Haemulidae and Ephippidae and Nakamura and Sano [24] found the most abundant fish species were from the families Labridae, Siganidae, Atherinidae, Pomacentridae and Nemipteridae, with variations between the study sites. *Halichoeres argus* was the most abundant species at intertidal sites and *Atherinomorus lacunosus* at subtidal sites. Similarly, Labridae, Gobiidae and Scaridae comprised the most abundant families in a Japanese seagrass beds.

White *et al.*, [25] reported 36 species of fish from 24 families from spatial patterns in fish herbivory in a temperate Australian seagrass meadow, by conducting diver surveys and Jelbart *et al.*, [26] reported 42 fish species, 36 species and 27 species were collected from seagrass in the two studies area which area 2 fish species less than this study.

Dorothie *et al.*, [27] found 87 species of juvenile from the study fish assemblages in Caribbean seagrass beds, by the seine nets during the day and the capechade at night. Richard *et al.*, [28] were found 81 fish species, showed *Atherinomorus lacunosus* and four species of Apogonidae to be the most abundant fish, and that many species were rare indicating uneven, yet species rich fish assemblages.

Vivien [29] using poison as a sampling technique, found 189 species in 46 families, mainly from *Thalassia*. Phinrub *et al.*, [30] were the presented 70 toxons from fish diversity in seagrass beds at Sai Cape, Trang Province, Thailand. A total 249 fish species of fish in 62 families from seine net catches and 61 species in 24 families from fish traps were identified by Fiona and Gell [31]. Totally fishes diversity were more diversed than this study.

These observations from Canonical correspondence analysis (CCA) showed indicate that patterns of distribution reflect local environmental variability such as temperature, conductivity, TDS and salinity etc. appeared to be important water variables explaining spatial variation in abundant fish species and fish species richness similary with Mwandya *et al.*, [32] who studied in mangrove creeks.

5. Conclusion

This study confirms the seagrass beds relationship with marine fishes, and providing a permanent, temporary habitat for commercial fishes such as *Sillago sihama*, *Gerres erythrourus*, *Sillago aeolus*, *Sardinella albella*, *Thryssa hamiltonii*, *Plotosus lineatus*, *Gerres oyena* and *Atherinomorus duodecimalis* etc. The dominant species were *Sillago sihama*, *Leiognathus jonesi* and *Gerres erythrourus*. Fish abundant were different in seasonal, highly abundant of fish numbers on rainy season (August) and species richness were highly on dry season (July). The physico-chemical parameters were observed i.e. conductivity, TDS, salinity, DO, pH, temperature, transparency, ammonia, nitrite and orthophosphate base on coastal water quality standard.

Fish diversity and environmental parameters in seagrass beds can be indicate for the relationship of them, and ecological understanding can be promote for local fishermen and tourism propose for the seagrass beds conservation program.

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