WORKING PAPER 2K

MARINE ECOLOGY ASSESSMENT REPORT

By

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The primary focus of the Marine Ecology component for the DEIA reports on the following:

1. Macrobenthos
2. Phytoplankton
3. Zooplankton
4. Mangroves/Mangrove Carbon
5. Artisanal Fisheries
6. Aquaculture
7. Intertidal and Mangrove habitat use (by local residents)
8. Marine Mammals and Reptiles
9. Harmful Algal Blooms (HABs)
10. Ballast Water and Alien Species

Macrobenthos and Plankton sampling

The macrobenthos was sampled via a Van Veen Grab [mouth area of 255 cm^2 (0.0225m^2)]. Macrobenthos samples were collected in triplicate at each sampling station where they were then pooled as a single sample and sieved through a 500µ (0.5 mm) sieve. In all, 15 macrobenthic samples were collected (**Fig A**). Phytoplankton was sampled utilizing a plankton net having a 20 micron mesh size while the zooplankton was sampled utilizing a plankton net with a mesh size of 153 micron. Six samples each of the zooplankton (preserved in 10% formalin) and phytoplankton (preserved in Lugol's solution) were collected (**Fig A**). The zooplankton and phytoplankton were collected by filtering 100L of surface seawater (**Annex A**). The sampling stations and their coordinates are given in **Table A**.

Mangroves

The mangroves of Pulau Che Mat Zin, Pulau Pintu Gedong, Pulau Carey and the remnant mangroves at the southern tip of Pulau Indah are within the 5km impact zone of the project site. The

mangroves at the southern tip of Pulau Indah was studied with respect to tree species and where possible the associated fauna (**Fig A1**). Gastropods were sampled via the line transect with quadrats (5 X 5 m). Besides primary data, secondary data was sourced through published literature as well as information from the Selangor State Forestry Department.

Fish and Fisheries

Fish data was collected through primary sampling via artisanal gears as used by fishermen plying the shallow coastal waters within the project impact zone (**Fig. A2**). Data on temporal and spatial fish landings was also sourced from the Selangor State Fisheries Department and Lembaga Kemajuan Ikan Malaysia (LKIM). Fishing villages and fishing jetties within the impact zone is reported. Besides artisanal fisheries, data on recreational fisheries is also provided.

Existing Environment

Macrobenthos

A total of 58 taxa were recorded from the sampling stations of the southern Klang coastal waters while the 3 main phyla with respect to taxa richness were Annelida (19 taxa), Mollusca (16 taxa) and Arthropoda (14 taxa) (Table B). The total density of the macrobenthos was 38,520.8 ind/m^2 (mean = 2,568.1 ± 3298.7 ind/m^2). The taxa density was highly variable ranging from 10.4 ind/m^2 (Stomatopda) to 16,052.1 ind/m^2 (Amphipoda). Density wise, the most abundant phyla was Arthropoda (total = 21,130.2 ind/m^2, mean = 1,408.6 ± 2731.8 ind/m^2) followed by Sipuncula (total = 6,536.5 ind/m^2, mean = 435.8 ± 867.9 ind/m^2) and Mollusca (total = 4,260.4 ind/m^2, mean = 284.0 ± 490.3 ind/m^2) (Fig B1). Taxa wise, the 4 most abundant macrobenthos were Amphipoda (total = 16,052.1 ind/m^2, mean = 10,70.1 ± 2321.5 ind/m^2) (Phylum Arthropoda), *Pseudorotalia schroeteriana* (total = 2,760.4 ind/m^2, mean = 184.0 ± 269.5 ind/m^2) (Phylum Foraminifera), Corbulidae (total = 1,760.4 ind/m^2, mean = 117.4 ± 240.9 ind/m^2) (Phylum Mollusca) and Tanadaicea (total = 1,515.6 ind/m^2, mean = 101.0 ± 206.2 ind/m^2) (Phylum Arthropoda). The most distributed taxa among the sampling stations was the Glyceridae (Phylum Annelida), Amphipoda & Tanadaicea (Phylum Arthropoda) and *Pseudorotalia schroeteriana* (Phylum Foraminifera).

Station wise, the highest taxa was recorded from S9 (28 taxa) followed by S5A (26 taxa), S12 (25 taxa), S2 (25 taxa), S6 (21 taxa) and S3 (20 taxa) (**Table B**). The seabed at these stations mainly constituted mud (see Table B). Taxa richness ranged from 2 [S5 & S7] to 28 taxa (S9). Five stations recorded high density, namely S2 (total = 11,234.4 ind/m^2, mean =1404.2 ± 3695 ind/m^2), S12 (total = 7,187.5 ind/m^2 , mean = 898.4 ± 1262.2 ind/m^2), S5A (total = 5,796.9 ind/m^2, mean = 724.6 ± 1067.1 ind/m^2), S9 (total = 4,781.25 ind/m^2, mean = 597.7 ± 946.6 ind/m^2) and S3 (total = 3,359.4 ind/m^2, mean = 419.9 ± 381.2 ind/m^2) (**Fig B2**). The high macrobenthos density of these stations was due to the high density of Amphipoda in the samples.

The overall Margalefs index (D) was 5.49 which can be considered as moderate taxa richness. With respect to sampling stations, the index ranged from 0.16 (S5) to 3.24 (S9) (**Table C**). The overall Shannon-Weiner index (H') was 2.22 which reflects moderate diversity of the sampling area. It ranged from 0.9 (S2) to 2.43 (S6) with respect to sampling stations. The overall Pielou (J) index was 0.54 and can be considered low. The low value of the eveness index was due to the dominance by the Amphipoda at certain sampling stations (S2, S5A, S9 & S12) and ranged from 0.21 (S5) to 0.91 (S7). The density, diversity and the taxa richness shows that there is high variability in the distribution of the macrobenthos within the sampling area. Margalefs, D was highest at S9 (3.14); Shannon-Weiner, H' was highest at S6 (2.43); Pielou, J was highest at S7 (0.91).

The DEIA (2004) study of the Westports extension showed that taxa wise, the macrobenthos was also dominated by Polychaetes (12 taxa) followed by the crustaceans (6 taxa). The current study however recorded 19 taxa of polychaetes and 14 taxa of crustaceans. The dominant polychate was from the family Capitellidae (DEIA, 2004) as contrast to the Glyceridae from the current study. The differences in the taxa richness between the two studies could be related to disturbance and the area sampled as the DEIA (2014) study site was smaller and in a much more disturbed area of a port. In a study of the macrobenthos of the mangrove channel between Westports and the Klang Islands (Pulau Che Mat Zin & Pulau Klang) Tavakoly Sany *et al*. (2015) recorded moderate disturbances temporally to the benthic community where the Shannon-Weiner diversity index (H') ranged from 2.55 – 2.9 (present study overall H' = 2.22) (**Table D**). The density of the macrobenthos ranged from 899.53 ind/m^2 to 1,228.58 ind/m^2. The authors also stated that the density of the macrobenthos was higher from stations closer to the islands (Pulau Che Mat Zin & Pulau Klang) as compared to those closer to the harbour area due to lower disturbance and higher organic content output from the mangroves. The density of the macrobenthos from the current study however ranged from 62.5 ind/m^2 to 11,234.4 ind/m^2 where the latter density was much higher than that recorded by Tavakoly Sany *et al*. (2015).

Besides the coastal waters, there is also a large expanse of mudflats in the Klang coast (see **Fig. H**) which also house a large community of macrobenthos. In a study of the mudflats of Pulau Tengah (Klang Islands), Sasekumar & Chong (1986) noted polychaetes, sea anemones, bivalves (*Galauconome virens*, *Tellina* sp., *Meretrix lusoria*, *Anadara granosa*, *Solen* sp. and unidentified bivalve), gastropods (*Cerithidea cingulata*, *Natica maculosa* and *Nassarius* spp.), crustaceans (*Macropthalmus* sp., other brachyuran, juveniles of Panaeidae and Caridea, hermit crabs) and fish (gobiid fish and mudskippers). Lai *et al*. (2020) noted 79 taxa of macrobenthos from 3 mudflats, namely Kuala Sangga Besar in Perak, Bagan Nahkoda Omar and Bagan Sungai Buloh in Selangor where the last site is nearest to the current project site. The authors documented 27 mollusc taxa, 26 crustacean taxa, 18 fish taxa and 8 other taxa suggesting high diversity of macrobenthos on the mudflats (**Table E**). The comparison of the parameters measured from Lai *et al*. (2020) are given in (**Table F**). The diversity indices are somewhat similar but the density measures differ greatly between the mudlats and the current study. This is perhaps related to the difference in sampling

method where on the mudflats (Lai *et al*., 2020) a cockle dredge was used, while for the current study a Van Veen grab was utilized and the soil sieved.

Zooplankton

A total of 40 taxa were recorded from the sampling stations. The zooplankton community was represented by the Arthropoda (29 taxa constituting 87% of the zooplankton density), Cnidaria (3 taxa), Mollusca (2 taxa) and a taxa each for Bryozoa, Annelida, Echinodermata, Chaetognatha and Chordata (**Table G**). The total density of the zooplankton was 62,539 ind/m^3 while the mean density was 1,563 ± 2826 ind/m^3. Among the zooplankton, the Hexanauplia (copepods) were the dominant taxa (total = 50,949 ind/m^3, mean = 8,492 ± 4012 ind/m^3) which far exceeded other taxa and constituted 81.4% of the zooplankton community having a taxa richness of 22. The dominant zooplankton were *Parvocalanus crassirostris* (total = 15,605 ind/m^3, mean = 2,601 ± 2437 ind/m^3) followed by *Bestiolina similis* (total = 6,814 ind/m^3, mean = 1,136 ± 830 ind/m^3), *Oithona attenuate* (total = 6,667 ind/m^3, mean = 1,111 ± 700 ind/m^3), *Paracalanus aculeatus* (total = 4,458 ind/m^3, mean = 743 ± 722 ind/m^3), *Euterpina acutifrons* (total = 3,716 ind/m^3, mean = 619 ± 483 ind/m^3), *Corycaeus andrewsi* (total = 3,439 ind/m^3, mean = 573 ± 514 ind/m^3) and *Subeucalanus subcrassus* (total = 3,079 ind/m^3, mean = 513 ± 551 ind/m^3). The widely distributed zooplankton among the sampling stations were the copepods *Parvocalanus crassirostris*, *Bestiolina similis*, *Oithona attenuate* and *Euterpina acutifrons* (**Table G**).

Highest taxa richness was recorded from S1 (26 taxa) followed by S4 (23 taxa), S13 (20 taxa), S10 (19 taxa) and, S8 & S12 (18 taxa) (**Table G**). Taxa richness ranged from 18 (S8 & S12) to 26 (S1). Three sampling stations namely, S12 (total = 17,452 ind/m^3, mean = 436 ± 1191 ind/m^3), S1 (total = 13,885 ind/m^3, mean = 347 ± 541 ind/m^3) and S4 (total = 11,847 ind/m^3, mean = 296 ± 680 ind/m^3) recorded higher zooplankton densities (**Fig. C1**). The copepods constituted at least 70% of the zooplankton density at all sampling station (**Fig. C2**).

The overall Margalefs index (D) was 3.53 and this can be considered as low taxa richness. The index ranged from 1.88 (S8) to 2.62 (S1) (**Table H**). The overall Shannon-Weiner (H') index was 2.78 and this can be considered moderate. It ranged from 2.12 (S12) to 2.77 (S1). The overall Pielou (J) index was 0.75 and this is considered high. It ranged from 0.72 (S4) to 0.85 (S1). The density, diversity and taxa richness suggests moderate variability of the zooplankton distribution within the sampling area. The diversity indices were highest at S1.

The study of zooplankton in Malaysian waters has been extensive and most studies report on the dominance by copepods (Chua & Chong, 1975; Rezai *et al*., 2003, 2004, 2005 & 2011; Chan, 2013; Chew *et al*., 2008; Chew, 2102; Chew & Chong, 2011, 2016; Chew *et al*., 2015a, 2015b; Johan *et al*., 2013; & Metillo *et al*., 2018). This was also demonstrated by the current study.

As with the current study (81% composition of zooplankton by copepods), Chan (2013) also noted copepod populations as the dominant group from Manjung (71%) and the Penang National Park

(PNP) (72%) marine waters. 51 zooplankton taxa (mean abundance = 3,689.96 ± 663.31 ind/m^3) were recorded at Manjung while 49 zooplankton taxa (mean abundance = 1,449.99 ± 158.51 ind/m^3) were recorded at PNP. The current study recorded 40 zooplankton taxa with an abundance of 1,563 ± 2826 ind/m^3. The Westports DEIA (2004) also showed that the copepods were the largest zooplankton recorded followed by decapod larvae and copepod nauplii where the mean density of zooplankton was 765.4 ± 1259.8 ind/m^3 which was much lower than the current study. The Shannon-Weiner, H' ranged from 0.08 to 1.86 which was also lower than the current study. Chua & Chong (1975) noted higher zooplankton density in the marine waters of the central part of the Straits of Malacca. Rezai *et al.*, (2003) also noted high zooplankton biomass in the Malacca Straits between Lumut and Klang (central waters) and the authors attributed this to the presence of higher amount of nutrients and organic matter by run off from large rivers, presence of extensive mangrove forests along the coastal areas and the occurrence of upwelling at the One Fathom Bank.

Chew & Chong (2011) noted high abundance of copepods from the Matang estuary where abundance was highest at nearshore waters (20,311 ind/m^3), but decreased toward both upstream of rivers (15,572 ind/m^3) and offshore waters (12,330 ind/m^3). The authors noted *Parvocalanus crassirostris*, *Acartia spinicauda*, *Acartia copepodid* and *Oithona simplex* as the abundant taxa in their samples. *Parvocalanus crassirostris* (copepod) was also the most abundant zooplankton from the current study. Metillo *et al*., (2018) recorded 129 zooplankton taxa from the marine waters of Sibu and Tinggi Islands of which 69 taxa were copepods where smaller copepods (100-335 µm) dominated (76%) while larger copepods (>335 µm) comprised 44% of the zooplankton community. Johan *et al*., (2013) recorded 49 copepod taxa with an abundance of 868.2 ± 399.6 ind/m^3 from the Bintulu marine waters. The copepod richness from the current study amounts to 22 taxa which is however lower as compared to Chew *et al*., (2008) (71 taxa), Chew (2012) (51 taxa), Chew *et al*., (2015a) (47 taxa), Metillo *et al*., (2018) (69) and Johan *et al*., (2013) (49). The low value may be related to frequency of sampling as the previous studies were research studies based on spatial and temporal sampling protocols. In total, 117 copepod species are known from the Straits of Malacca (Rezai *et al*., 2004) where the areas of high abundance noted were near-coastal waters of Lumut to Port Klang.

Phytoplankton

A total of 36 taxa represented the phytoplankton community from the sampling stations. The phytoplankton was represented by the phyla Ciliophora (2 taxa), Cyanobacteria, Euglenozoa (1 taxa), Myzozoa (4 taxa) and Ocrophyta (28 taxa constituting 99.5% of the phytoplankton density from the Class Bacillariophyceae). Among the Bacillariophyceae, the most abundant taxa was *Skeletonema* sp. (total = 631,683 cells/L, mean = 10,5281 ± 106,045 cells/L) constituting 95.7% of the phytoplankton density followed by lower densities of *Nitzschia longissima* (total = 5,545 cells/L, mean = 924 ± 726 cells/L), *Nitzschia* sp. (total = 3,001 cells/L, mean = 500 ± 603 cells/L), *Coscinodiscus* sp. (total = 2,714 cells/L, mean = 452 ± 417 cells/L), *Chaetoceros* sp. (total = 2,235 cells/L, mean = 373 ± 212 cells/L) and *Biddulphia* sp. (total = 1,160 cells/L, mean = 193 ± 163

cells/L) (**Table I**). *Nitzschia longissima*, *Nitzschia* sp., *Coscinodiscus* sp., *Biddulphia* sp., *Ditylum* sp., *Navicula* sp., *Pleurosigma* sp., *Rhizosolenia* sp., *Thalassiothrix* sp., *Cyclotella* sp. and *Skeletonema* sp. were widely distributed among the sampling stations.

Highest taxa richness was recorded from S10 (27 taxa) followed by S1 (26 taxa), S8 (25 taxa), S4 (23 taxa), S13 (22) taxa and S12 (20 taxa). Taxa richness ranged from 20 (S12) to 27 (S10). Phytoplankton density was highest at S12 (total = 296,541 cells/L, mean = 8,237 ± 47,838 cells/L) followed by S4 (total = 16,9667 cells/L, mean = 4,713 ± 2,7234 cells/L) and lowest at S10 (total = 1,8936 cells/L , mean = 526 ± 2,853 cells/L) and S1 (total = 11,940 cells/L, mean = 332 ± 1,375 cells/L) (**Fig. D**).

The overall Marglefs Index (D) was 3.01 which can be considered as low taxa richness; the overall Shannon-Weiner (H') Index was 0.29 which was very low; while the Pielou Index (J) was 0.08 which is extremely low (**Table J**). The Shannon-Weiner and the Pielou indices were very much affected by the extremely high density of *Skeletonema* sp. The diversity indices were highest at S1.

Salleh (2012) noted 52 taxa of phytoplankton in the Klang Straits from 3 divisions namely, Bacillariophta, Pyrrophyta and Cyanophyta. The author noted that the Bacillariophyta dominated with respect to cell density (853,000 cell/L, or 98.7%) and taxa richness (49 out of 52). Similar results from the current study was also noted for the Bacillariophyta for total cell density (656,718 cell/L, or 99.5%) and taxa richness (27 out of 36). *Skeletonema*, *Rhizosolenia*, *Chaetoceros*, *Coscinodiscus*, *Nitzchia* and *Thalassiothrix* were the abundant genera in the Klang Straits (Salleh, 2012). These taxa were also noted in the current study. Ke *et al.* (2016) noted higher abundance of phytoplankton form the middle of the Malacca Straits (Lumut to Klang waters) and stated that the dominant phytoplankton were *Skeletonema*, *Pseudo-nitzschia*, *Navicula*, and *Thalassionema* all of which were sampled from the current study. The Westports DEIA (2004) also noted the dominance by the Bacillariophyta with high density of *Rhizosollenia delicatula*. The Shannon-Weiner, H' ranged from 2.94 to 3.33 which was however, much higher than the current study.

Fisheries and Fishes

Fisheries

Two fishing districts that are closest to the project site are the Klang and Kuala Langat districts. Data from the Department of Fisheries (DOF) shows that the Klang district has 24 jetties with 1803 fishermen while the Kuala Langat district has 14 jetties with 667 fishermen (total = 2470 fishermen) (**Fig. E**) (**Table K1 & K2**). The number of licensed and unlicensed boats at Kuala Langat are 439 and 187 respectively while the number of boats operating within zon A amount to 434. The number of licensed and unlicensed boats in 2016 in Klang amounts to 681 and 658 respectively. Lembaga Kemajuan Ikan Malaysia (LKIM) lists 6 jetties with 1389 fishermen from the Klang and Kuala Langat districts from two fishermen associations (Persatuan Nelayan Klang & Kuala Langat). The data suggests that there is a large number of artisanal fishermen (Zone A, 0-5 nm) that are dependent on

the coastal waters for their livelihoods and that the fishing area for the artisanal fishermen includes the coastal waters at the project site as well as the water ways/channels of the Klang Islands. The gear used by the artisanal fishermen includes bagnets nets (bakul), barrier net (rentang/belat), drift net (pukat hanyut), hook & line (rawai/pancing), traps (bubu), push net (sungkor/sorong) and miscellaneous (rampaian) that includes shellfish collection. The types of nets that are used includes jaring tenggiri, jaring bawal & udang (tiga lapis – trammel net), jaring senohong/kurau, jarring siakap. Besides these, tagan (submerged nets), fish and crab traps are also utilized.

The Selangor state fisheries statistics show that the largest fish landings among the artisanal gears was from the drift nets constituting 76% of the total landing from 2008 to 2018 (**Table L**). The fish landings from the drift nets (pukat hanyut) has been increasing on a yearly basis (**Fig. F**) while that of the bagnet have been declining but other gears have remained somewhat stable and low. Among the LKIM fish landing declaration sites, Pulau Ketam recorded the largest fish landing amounting to 91.6% as compared to other landing sites (Pandamran, Pelabuhan Klang, Sijangkang/Simpang Telok) (**Table M**). This was probably related to the larger number of fishermen as well as greater number of fishing vessels at the former.

Both Klang and Kuala Langat recorded drift nets (pukat hanyut) as the major artisanal fishing gear (66%) for fish landings and these districts are the closest to the project site (**Table N**). The fish landing from the Klang district increased from 2016 to 2019 while that of Kuala Langat decreased from 2014 to 2018 (based on state artisanal fish landings). The demersal (44.3%) fish landings was higher than the pelagic (22.8%) fish landings at Klang while the pelagic (47.2%) fish landings was higher than the demersal (30.3%) landings at Kuala Langat. The Penaeidae (prawns) landings was larger at Klang (18.8%) as compared to Kuala Langat (8%) (**Table N1**). Jelly fish was landed in Klang while squids were landed in Kuala Langat.

Among the commercial fish landings at Kuala Langat (2017 to 2018), the most abundant landing was of the Chirocentridae (20.95%) followed by Scombridae (12.5%), Portunidae (8.58%) and the Penaeidae (8.48%) which comprised half of the fish landed. Other fishes of commercial importance landed were the Ariidae, Clupeidae, Dasyatidae/Gymnuridae, Lutjanidae, Polynemidae, Pristigestriidae, Sciaeinidae, Silliganidae and Stromateidae (**Table N2A**). The important commercial fish landings at Klang (2014 to 2018) was of the Panaeidae (18.1%) followed by Dasyatidae/Gymnuridae (12.7%), Ariidae (12.1%), and Scombridae and Polynemidae (8.5% each) which comprised more than half of the landings. Other fishes of commercial importance landed were Stromateidae, Sciaenidae, Portunidae, Mugilidae, Sergestidae and Jelly fish (**Table N2B**).

LKIM landings (by order of importance) shows that the Mugilidae (belanak/kedara/loban), Clupeidae, Ariidae (duri/pulutan/jahan/utek), Synodontidae (lumi) and Penaeidae were the major fish groups landed at Simpang Telok/Sijangkang (**Table O1**); *Acetes* sp. (udang baring), other fish, Ariidae, mixed fish, Sciaenidae (gelama/tengkerong), trash fish and *Rastrelliger kanagurta* (kembong) were major fish landed at Pulau Ketam (**Table O2**); the Ariidae, *Acetes* sp., Dasyatidae (pari), Sciaenidae,

Clupeidae (puput) and Polynemidae (senagin/kurau/senohong) were the major fish landed at Pelabuhan Klang (**Table O3**); Ariidae, *Anodontostoma chacunda* (selangat), Sciaenidae, Dasyatidae, Mugilidae and *Pampus argenteus* (bawal putih) were the major fish landed at Pandamaran (**Table O4**).

Fishes and Invertebrates

51 fish taxa from 26 families were recorded (sampling and observations) from the Sg. Pinang and Orang Asli jetties situated at Pulau Indah (**Table OA**). All the fish, prawns and crabs landed have commercial value (**Annex B1-B6 & C**). A total of 258 fish taxa from 72 families are known from the coastal waters of Selangor (**Table P**) (Chong *et al*., 2012; Lee *et al*., 2016; Teoh *et al*., 2017). The fish families with high species richness (>10 taxa) includes Sciaenidae (18), Gobiidae (16 taxa), Ariidae & Carangidae (15 taxa), Clupeidae & Engraulidae (11 taxa) and Dasyatidae & Leiognathidae (10 taxa). Except for the Gobiidae, the rest of the above mentioned fish families have commercial value as shown by the fish landing in **Tables O1 – O4**. This however, does not discount other fish families that have commercial importance *albeit* low.

Among the fishes in the Selangor coastal waters, 21 families have low commercial value but are consumed, while 27 fish families are commercially exploited (**Table P**). Besides fishes, invertebrates are also a big part of the coastal community. Chong *et al*. (2012) and Teoh *et al*. (2017) noted 89 invertebrate taxa from trawl samples in the Selangor coastal waters (**Table Q**). The largest representation was by the Penaeidae (prawns) (22 taxa) followed by the Portunidae (crabs) (11 taxa) and the Squillidae/Harposquillidae (udang lipan) (6 taxa). These invertebrates have high commercial value together with the Paleomonidae (udang galah), Sergestidae (udang baring) and Sepiidae/Lolliginidae (sotong) (**Table Q**).

Teoh *et al*. (2017) recorded 65 fish species from Selat Lumut, Klang Islands (Pulau Pintu Gedong, Pulau Tengah, Selat Che Mat Zin & Selat Kering) and the south coastal waters of Carey Island. Together with the fish, 20 invertebrate taxa of commercial importance were sampled from these waters which are fishing grounds of the fishermen from Pulau Indah and Pulau Carey (especially Kampung Sg. Kurau, Kampung Judah and Kampung Melayu). Teoh *et al*. (2017) noted high fish density and biomass in Sungai Langat followed by South Carey Island and Selat Lumut (**Table Q1**). Invertebrate density however was highest at South Carey Island followed by Sungai Langat and Selat Lumut while the biomass was highest at Selat Lumut followed by South Carey Island and Sungai Langat.

According to Chong *et al*. (2012), there are 216 fish species from the Klang coastal waters of which 139 fish species are in the Klang Islands vicinity alone. Teoh *et al*. (2017) noted that the Klang Islands hosts commercially important carangids, polynemids, lutjanids, dasyatids and penaeid prawns, but was dominated by ariids (catfishs), sciaenids (croakers) and penaeid prawns. Lee *et al*., (2016) recorded 111 fish species from the coastal mudflats of Bagan Pasir and Sg. Buloh. Among the two sites, the Sg. Buloh mudflats (adjacent to the Klang Islands) recorded 98 fish species of

which, 38 species were also recorded from the Klang Islands and Selat Lumut by Teoh *et al*. (2017). The Westports DEIA (2004) recorded 64 fish taxa from 34 families where the fish community was dominated by the Sciaenidae, Clupeidae, Gerridae and Leiognathidae. Hajisamae *et al*. (2006) noted the abundance of Leiognathidae, Centropomidae, Siganidae, Engraulidae, Atheriniidae, Clupeidae and Ariidae in the mangrove lined Pattani Bay, Southern Thailand.

Morphometric measurements (standard length, SL) showed that fishes sampled from Selat Lumut recorded smaller SL than those sampled from the coastal waters. This was evident for *Drepane punctata, Eleutheronema tertadactylum, Hexanematichthys sagor, Johnius belangerii, Lutjanus johnii* and *Pomadasys argenteus* (**Table QA**). Selat Lumut appears to function as a nursery area for these species. The mean SL/Max length suggest that the fishes are either juveniles or subadults except for *Anodontostoma chacunda* (mean SL/Max SL = 0.65) which was probably adults. The Max SL was derived from Fishbase (www.fishbase.org).

Recreational Fishing

Besides capture fisheries there is also boat based recreational fisheries from the jetties at Pulau Indah (fishermen jetties and at Anglers Resort). Recreational fishing is conducted mainly utilising rods (pancing) and the activity is carried out in the coastal waters and channels around P. Pintu Gedong, P. Selat Kering, P. Tengah, Pulau Klang and P. Ketam. The recreational fishermen generally go for large fish like the Serranidae (kerapu), Polynemidae (senangin/kurau senohong), Lutjanidae (tanda/merah/jenahak), Latidae (siakap), Haemulidae (tebal pipi/kaci), Stromatidae (bawal) and Drepanidae (daun baharu) (**Annex D**). There is no official record of recreational fishers but anecdotal estimates from local operators suggests between 300-1000 boats (Osman, pers. comm.). Some examples of fishes reeled and their weight range (where available) are given in **Table Q2**. There is also land based recreational fishing via make shift barrier nets on the beach by individuals for personal consumption at Tanjung Piai (**Annex E**).

Molluscs and Crabs

Besides the commercial invertebrates landed by fishing gear, there is also collection of gastropods and bivalves from the mudflats and mangroves of Pulau Carey and the Klang Islands. The shellfish collection is mostly carried out by the orang asli from Pulau Carey and Pulau Indah. 32 taxa from 21 families of both gastropods and bivalves are collected and are listed in **Table R**., but there has been a decline over years of the collection primarily attributed to environmental and anthropogenic causes (Wong & Teh, 2019). The most harvested mollusc species however, are *Meretrix lyrate* (kepah/ kepah gading) and *Solen* sp. (katip/katep) followed by *Cerithidea obtusa* (siput hisap/siput sedut), *Glauconome virens* (kijing/siput buji nangka), *Tegillarca granosa* (kerang) and *Gelonia expansa* (lokan/lokan tongot) (Wong & Teh, 2019). *Gelonia expansa* (lokan/lokan tongot), *Meretrix lyrata* (kepah/kepah gading) and *Cerithedia obtusa* (siput hisap/siput sedut) is targeted by the orang asli from Pulau Indah (**Annex F**). The shellfish collection (from 2008 to 2018) was 1.61% of the artisanal landings and 0.41% of the yearly landings for the state of Selangor and has been declining since

2014 (see **Table L**). *Scylla serrata* (ketam bakau) is also caught using traps (bentoh) and hand collection by the orang asli (see **Annex C**). This activity is carried out in the mangroves of Pulau Carey and the Klang Islands.

Aquaculture

The aquaculture activity closest to the project site is located at the Klang Islands (cage culture) (in the channels between Pulau Ketam and Pulau Tengah; between Pulau Tengah and Pulau Klang; and between Pulau Klang and Pulau Selat Kering) and at Kampung Melayu, Pulau Carey (pond culture) (**Fig. G**). The total area for the cage culture at the Klang Islands amounts to 24.1 ha (**Table S**) while the coordinates for the cage culture are given in **Annex G**. Aquaculture activity at Klang Islands is mainly carried out by cage culture and includes rearing of fishes like merah (*Lutjanus malabaricus*), siakap (*Lates calcarifer*), kerapu (*Epinephelus sp.* – hybrid of giant grouper, *E. lanceolatus* and tiger/marble grouper, *E. fuscoguttatus*), snapper (*Lutjanus johnii*) and silver pomfret/bawal emas (*Trachinotus blochi* – imported from Taiwan) (KA Aquaculture, pers. comm.). Feed for the cage culture fishes comprises pellets as well as trash fish. The pond culture at Kg. Melayu, Pulau Carey on the other hand caters for prawns (*Penaeus monodon* & *Penaeus vannamei*) covering an area approximately 40 ha (source: Selangor State Fisheries Department). The aquaculture production for Kuala Langat and Klang is given in **Table S1**. The production is higher at Kuala Langat as compared to Klang.

Harmful Algal Blooms (HABs)

Harmful algal blooms (HAB) have been reported in Malaysian coastal waters of Sabah, Sarawak, Johor, Kelantan, Perak and Penang (Lim *et al*., 2012; Lim *et al*., 2013; Lim *et al.,* 2014; Lau *et al*., 2017). Paralytic shellfish poisoning due to harmful algal blooms was reported in November 2013 and August 2014 from the Kuantan Port where 10 people were hospitalized after consuming shellfish (Normawaty *et al*., 2018). Some noted events of the HABs in Malaysian waters are given in **Table S2**. Cysts of the HAB causing dinoflagellate, *Gymnodinium catenatum* have been reported from the Selangor coastal waters north of the Klang Islands (Bagan Nahkoda Omar, Sungai Besar, Sekinchan and Kuala Selangor) but in very low densities (Su-Myat *et al.,* 2012). There has not been any reports of detrimental outbreaks of harmful algal blooms in the Selangor waters to date.

In a review of the HABs of South East Asia, Yñigueza *et al*. (2020) reported on the toxic species from Malaysian waters that includes *Pyrodinium bahamense, Alexandrium tamiyavanichii, A. minutum, Margalefidinium polykrikoides, Noctiluca scintillans, Karlodinium australe, Chattonella sp., Gymnodinium catenatum, Alexandrium tamiyavanichii, Psuedonitzchia kodamae, P. abrensis, P. batesiana, P. fukuyoi, and P. subfraudulenta, Gambierdiscus balechii, G. caribaeus, G. pacificus, Coolia malayensis, C. tropicalis, C. palmyrensis, Fukuyoa paulensis, Amphidinium spp., Neoceratium furca, Prorocentrum lima, P. caipirignum, P. malayense, P. concavum, P. emarginatum, P. mexicanum* and *P. cordatum*. These HAB taxa however, were not recorded from the plankton samples in the present study.

Ballast Water & Alien Species

Ballast water is known to move toxic organisms between oceans (Hallegraeff & Bolch, 1992; Chiang, 1994; Hallegraeff, 1998, David & Gollasch, 2014). There is however, paucity of the reporting on the alien species movement by ships in Malaysian ports through ballast water. Ballast water is not regarded as a pollutant in Malaysia and as such, its movement is unmanaged and unregulated (Kaur, 2010). There are also no records of ballast water uptake and removal from Westports database. Kaur (2010) listed 10 organisms (cholera, cladoceran water flea, mitten crab, toxic algae, round goby, North American comb jelly, North Pacific sea star, Zebra mussel, Asian kelp and European green crab) that have been introduced to foreign waters by ballast water.

Mangroves and Mudflats

Mangrove loss from anthropogenic activities for the Klang Islands from 1975 to 1999 was between 38.9% (P. Klang) - 100% (P. Lumut) (Sasekumar *et al*., 2012). Pulau Indah specifically lost 6,258 ha of mangroves from 1975 to 1999 currently existing only as fringing mangroves (Sasekumar *et al*., 2012). Islands like P. Ketam, P. Klang, P. Tengah, P. Che Mat Zin, P. Selat Kering, P. Selat Mahang, P. Selat Meriam, P. Rusa, P. Tonggok and P. Pintu Gedong which are state forest reserves are somewhat intact. Pulau Carey on the other hand has also lost a bulk of its mangroves to anthropogenic activities, mainly to oil palm plantations. Current estimates of the mangrove forest reserves is approximately 5880 ha at Pulau Klang, 2206 ha at P. Tengah, 1462 ha at P. Che Mat Zin, 1111 ha at P. Selat Kering, 702 ha at P. Pintu Gedong, 1363 at Teluk Gong, 2365 ha at P. Ketam and 322 ha at smaller islands (P. Selat Mahang, P. Selat Meriam, P. Rusa & P. Tonggok) (source: Selangor State Forestry, pers. comm., 2019). Besides mangroves, there are extensive mudflats bordering the Klang Islands (**Fig. H**). Among the islands, only P. Ketam, P. Carey and P. Indah have human settlements.

Mangrove tree taxa of the Klang Islands is represented by 21 tree species from 5 families (**Table T).** The tree taxa sampled from the mangroves south of Westports includes *Avicennia alba, Brugueira gymnorhiza, Brugueira parviflora, Rhizophora apiculata, Rhizophora mucronata, Sonneratia alba, Avicennia alba, Avicennia officinalis* and *Xylocarpus* sp. These mangroves are somewhat disturbed as a result of tree cutting and clearance, have high number of saplings and are eroded along the Tanjung Piai beach (**Annex H**). The beach at Tanjung Piai has a somewhat gentle slope, is sandy with mud mixture and during low tide, exposes the soldier crab (*Dotilla myctiroides*) community which comes out to feed (**Annex I**).

Mangrove Fauna

Eight species of gastropods from 4 familes (**Annex J**) were sampled from the mangroves located at the southern end of Westports (**Table U**, and see **Fig. A1**). Singh & Norashekin (2017) however, recorded 27 gastropod taxa from 8 families comprising 15 genera from the Klang Island mangroves (P. Klang, P. Che Mat Zin and P. Ketam) (**Table V**). Other reports of mangrove gastropods are by

Singh & Norashekin (2016) who recorded 52 taxa from 13 families comprising 24 genera from the coastal mangroves of Selangor; Singh (2013) who recorded 50 taxa from 9 families comprising 23 genera from the mangroves of Tanjung Tuan, P. Merambong (Johor) and P. Besar (Melaka); and Singh & Wan Mohamad Nabil (2019a) recorded 33 and 16 taxa from the N. Sembilan and Melaka mangroves respectively. A comparison of the gastropod communities from various sampling sites is given in **Table W**.

The species richness of the P. Indah mangroves is low as compared to other mangrove areas sampled. This is perhaps reflected by the low sampling frequency and as well as disturbance within the mangroves (tree cutting and high density of saplings and young trees). The Shanon-Weiner Index is low for the P. Indah gastropod community (1.91) while its density is comparable to P. Klang mangroves.

Besides gastropods, the mangrove fauna also includes meiofauna and crabs. Sasekumar (1994) noted large presence of nematodes (80 – 93%) followed by harpacticoids, oligochaetes, kinorhynch and other meiofauna in the Selangor mangrove shore sediments (**Table X**). The author noted 51 taxa and unidentified nematodes from the *Avicennia* station, 29 taxa and unidentified nematodes from the *Rhizophora* station and 40 taxa and unidentified nematodes from the *Bruguiera* station. Ribero *et al*. (2019), reported on the mangrove crabs of the Selangor coast and noted 19 taxa dominated by the by the Sesarmidae (**Table Y**). The study although conducted at Kuala Selangor would reflect the grapsoid (crab) taxa richness in the Selangor mangroves but may be lower in the mangroves at the project site as the mangrove is disturbed. Leh *et al*. (2010) recorded 10 crab taxa from the mangroves of Kapar (adjacent to P. Klang). Crabs holes (**Annex K**), *Metaplex* sp., *Parasesarma* sp. and *Metopograpsus* sp. were noted in the mangroves at the project site. Sasekumar (1974) recorded the dominance of gastropods (24 taxa), crustaceans (46 taxa) and polychaetes (9 taxa) from the mangroves of P. Tengah and Kapar while Sasekumar & Chong (1998) recorded 14 gastropod taxa from the varying age stands (mature, 15 year, 2 year) at the Matang mangroves.

Mangrove Carbon

The carbon stock estimation of the mangroves at the Project site was determined based on a recent study by Muhamad Hafiz Afham (2020) on the mangroves of Sg. Chandong, Pulau Indah (north of the project site). The Sg. Chandong mangroves recorded a total above ground tree biomass (AGT) of 166.87 tonnes per hectare (t/ha) (mean = 18.54±10.425 t/ha) and a below ground root biomass (BGR) of 54.64 t/ha (mean = 6.072±3.588 t/ha). The total biomass (AGT, BGR, wood debris, litter, seedlings and dead trees) was 284.78 t/ha (mean = 31.64±12.50 t/ha). The above ground tree biomass at Sg. Chandong was higher to that recorded for the Carey Island mangroves (51.4 t/ha) (Saraswathy et al., 2009).

The total above ground tree (AGT) carbon stock at Sg. Chandong was 83.43 t C/ha (mean = 9.27±5.20 t C/ha), the total below ground root (BGR) carbon stock was 21.31 t C/ha (mean =

2.36±1.39 t C/ha) while the total soil carbon stock was 6731.36 t C/ha (mean = 747.92±80.72 t C/ha). The total carbon stock of the mangroves at Sg. Chandong (AGT, BGR, soil, wood debris, litter, seedlings and dead trees) was estimated at 6867.51 t C/ha (mean = 763.06±38.23 t C/ha) (Muhamad Hafiz Afham, 2020). The author stated that the Sg. Chandong mangroves were in a disturbed state with high amount of debris and tree cutting. This was also observed from the mangroves at the current project site. The mangrove area also shows signs of erosion at the beach of Tg. Piai (south of Westports).

The total tree carbon stock (AGT + BGR) of the Sg. Chandong mangroves (104.75 t C ha^{-1}) (Muhamad Hafiz Afham, 2020) was lower than that of the Kuala Selangor Nature Park (246.21 t C ha^{-1}) and Sungai Haji Dorani (151.40 t C ha^{-1}) mangroves (Lui et al., 2017), but higher than the degraded mangroves at Pulau Klang (83.96 t C ha^{-1}) (Rozainah et al., 2018a) and Kuala Selangor Nature Park (83.82 t C ha^{-1}) (Mahmood, 2014). The soil carbon of the Sg. Chandong mangroves was, however, larger compared to that of Delta Kelantan (512.51 t C ha^{-1}) and Johor Parks (427.88 t C ha^{-1}) mangroves (Rozainah et al., 2018b) and that of Kuala Selangor Nature Park (488.04 t C ha^{-1}) (Mahmood, 2014). Assuming the mangrove community (tree structure and soil) at the project site is similar to that at Sg. Chandong, the estimate (with caution) of the total carbon stock of the project area comprising 97 ha of mangroves, can be derived to be 666,099 tonnes of C.

Birds

The mudflats and the mangroves stretching from the Klang Islands to Sungai Bernam (100 km) is an important waterbird migratory site of the North-Central Selangor Coast which covers approximately 28,000 ha (Wong *et al*., 2017). Among the Klang Islands, P. Ketam and P. Tengah are important roosting and feeding sites for migratory birds (Li *et al*., 2007; Yeap *et al.,* 2007). More than 30 shorebird species are known from the coastline of which some are listed in the IUCN globally threatened and near threatened species (Normann's Greenshank – *Tringa guttifer*; Spoon-billed Sandpiper – *Calidris pygmea*; Chinese Egret – *Egretta eulophotes*; Asian Dowitcher - *Limnodromus semipalmatus*; Lesser Adjutant – *Leptoptilus javanicus* (Yeap *et al*., 2007). The coastline also supports 1% of the global population of 16 waterbird species. Norhayati *et al*. (2009) listed 58 bird species from the Klang Island Mangrove Forest Reserve (KIMFR) (**Table YA**).

Bakewell (2009) reported on the migratory birds at the Kapar power station. He recorded 29 wader taxa, 5 tern taxa and 1 gull taxa (**Table YB**) where internationally significant species were counted, namely the Lesser Sand-Plover (*Charadrius mongolus*), Greater Sand-Plover (*Charadrius leschenaultia*), Eurasian Curlew (*Numenius arquata*), Whimbrel (*Numenius phaeopus*), Common Redshank (*Tringa tetanus*), Nordmann's Greenshank (*Tringa guttifer*) and the erek Sandpiper (*Xenus cinereus*). The Kapar power station is close to the Klang Islands and the bird species are known to move between the areas to feed and roost (**Fig. I**). Five species of conservation concern were recorded, namely the globally threatened Nordmann's Greenshank (Endangered) and Spoon-billed Sandpiper (*Eurynorhynchus pygmaeus*) (Critically endangered) and near-threatened Black-

tailed Godwit (*Limosa limosa*), Asian Dowitcher (*Limnodromus semipalmatus*) and Eurasian Curlew. Small numbers of a newly described and probably endangered taxon, White-faced Plover (*Charadrius (alexandrinus) dealbatus*) were also recorded.

Mammals

Mammals have also been listed from the Klang Islands (Norhayati *et al.,* 2009) (**Table YC**). Two of the mammals listed are protected (*Macaca fascicularis* and *Paradoxus hermaphroditus*) and totally protected (*Trachypethicus obscurus* and *Amblonyx cinera*). MNS (2010) and Yeap *et al*. (2007) have also listed other threatened mammals like the Smooth Otter (*Lutrogale perspillata*/*Lutra perspicillata*), Sivered-leaf Monkey (*Trachypithecus cristatus*/*Presbytis cristata*) and the Indo Pacific Hump-backed Dolphin (*Sousa chinensis*) from the coastal areas of Selangor. Kuit *et al.* (2019) reported that the Irrawaddy dolphin (*Orcaella brevirostris*) was most frequently encountered in the coastal waters of Matang followed by the Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) and the Indo-Pacific humpback dolphin (*Sousa chinensis*). Anecdotal evidence from fishermen and also a personal sighting shows that there are dolphins in the Klang coastal waters but as to the species, it is uncertain. Besides the species noted above, Norma-Rashid & Teoh (2012) reported on the presence of the Common long-tounged fruit bat (Macroglossus minimus), Cecadu gua (*Eonycteris spelaea*), Short-tailed mongoose (*Herpester brachyursu*) and the Leopard cat (*Felis bengalensis*) in the mangrove forest of the Klang Straits.

Impacts of Reclamation and Dredging

Loss of Mangroves, Mudflats and Coastal Waters

The mangroves (97 ha), the associated mudflats as well as parts of the coastal waters at the project site will be filled in during the reclamation activity and this will result in loss of habitat for the multitude of organisms that are dependent on these habitats. Besides invertebrates (crustaceans, gastropods, bivalves, polychaetes, etc.), vertebrates (fish, reptiles, birds) are also dependent on mangroves and mudflats (Nagelkerken *et al*., 2008), and the coastal waters (Singh & Chong, 2010). The mangroves, mudflats and shallow coastal waters function as nursery, shelter, feeding, spawning and breeding grounds for coastal organisms that utilizes the habitat during part of their life cycle or for their full life cycle (Leh & Sasekumar, 1985; Sasekumar *et al*., 1992; Chavez & Otto, 1999; Chaves & Bouchereau, 2000; Laegdsgaard & Johnson, 2001; Sheridan & Hays, 2003; Singh, 2003; lee, 2006; Hajisamae *et al*., 2006; Chong *et al*., 1990, 1996, 2001; Chong, 2007; Sheaves *et al*., 2012: Zagars *et al*., 2013; Nanjo *et al.,* 2014; Carrasquilla-Henao *et al*., 2019).

Ronnback (1999) reported that about 27 fish familes of commercial importance utilize the mangroves to complete their life cycle (**Table YD**). All of the mentioned fish families are found in the Klang coastal waters. The mangroves, mudflats and coastal waters provide products and ecosystem

services (Barbier *et al*., 2011: Barbier *et al*., 2016; Lee, 2016) (**Table Z**) and are important for the livelihoods of local populace (UNEP, 2014). The reclamation and dredging will result in the loss of the ecological services of the mangroves, associated mudflats and the coastal waters. Zu Ermgassen et al. (2019) reported that Atherino*morus lacunosus, Gerres filamentosus, Lutjanus argentimaculatus, Lutjanus argentiventris, Lutjanus russellii, Monodactylus argenteus, Siganus canaliculatus, Sillago sihama* and *Terapon jarbua* as highly affiliated with mangroves (>70% relative density). These fishes (genera or species) are found in the coastal waters and mangroves of the Klang Islands.

Loss of Carbon Sequestration

The carbon sequestration potential of mitigating climate change will be lost when the mangroves at the project site are removed. Malaysia lost approximately 21,417 ha of mangroves from 1990 to 2017 and this has translated to a removal of 3,876,409 Mg C, 14,226,422 Mg CO_2 emissions with a yearly emission rate of 526,905 Mg CO_2 yr^{-1} (Omar, *et al*., 2018). Based on the above values, the carbon loss from the 97 ha of mangroves at the project site would amount to loss of 17,557 Mg C, 64,408 Mg CO_2 emission and a yearly emission rate of 2,425 Mg CO_2 yr^{-1}. Even though there are no reports based on ground studies of CO_2 emissions from mangroves in Malaysia, the data by Omar *et al*. (2018) can be used as a benchmark, but may be precise as it was obtained by satellite, and furthermore, it did not include soil carbon. It is however, indicative of the amount of carbon sequestration potential loss. Mangrove deforestation in Cambodia resulted in 40% loss in the Total Ecosystem Carbon (TEC – above ground, below ground and soil carbon) with an emission of 1771 Mg CO_2 ha^{-1} (Sharma *et al*., 2020). Besides mangroves, mudflats also store carbon. Sasmito *et al*. (2020) in a study at Bintuni Bay, West Papua showed that mangrove mudflats store approximately 62 Mg C ha^{-1}.

Loss of Subtidal and Intertidal Habitats

There will be complete decimation of the subtidal and the intertidal habitats with their respective biotic communities during the reclamation and dredging activities at the project site. Meiofauna and macrofauna show similar and strongly related (negative) responses to coastal reclamation and dredging (Austen & Widdicombe, 2006). Lu *et al*. (2002) showed that benthic organisms generally decrease close to reclaimed areas but increase away from such activities with their macrobenthic infauna changing significantly over time. Naser (2011) reported that reclamation and dredging activity in Bahrain physically smothered coastal and subtidal habitats resulting in changes to abundance and distribution of microbenthic assemblages. The author noted a survival percentage of only 41.8% for all of the selected species that were studied. The macrobenthos (subtidal) are important diet components of demersal fishes (Singh & Sasekumar, 1994; Singh, 2003; Singh *et al*. 2019b) as are the meiobenthos (Ellis & Coull, 1989) and both play important role in the coastal food chain.

Dredging and reclamation not only results in decimation of benthos but significantly lowers density, biomass, diversity and changes the benthos feeding guilds implying poor environmental conditions even to sites adjacent to such activities (Rethitha *et al*., 2017). Ryu *et al*. (2014) noted that reclamation of the Saemangum tidal flats in South Korea resulted in long-term change in the benthic community structure due to changes in tidal energy. Li *et al*. (2010) noted drastic reduction of the Shannon-Weiner index for plankton (phytoplankton and zooplankton index decreased from 3.01 to 1.71 and 1.7 to 0.58 respectively) and benthos (index decreases from 1.28 to 0) due to reclamation activities at Tianjin Harbour, China. Chee & Sim (2016) showed higher macroinvertebrate diversity in undisturbed and unreclaimed areas as compared to reclaimed areas in Penang, and further stated that land reclamation reduces species diversity and evenness, and to a lesser extent, species richness. Duan *et al*. (2016) noted that coastal reclamation in China resulted in ecosystem damage, geological disasters and deterioration in marine environmental quality resulting from polluted air, water, soil, and sediments.

The reclamation and dredging activity to be carried out at the current project site may also impact on benthic and intertidal communities adjacent to the project site especially the coastal waters and the mangrove islands. There will however be recovery of the benthic community post dredging and reclamation due to natural ecological succession. The benthic community that recovers will attain a new stable point (equilibrium). Benthic communities living in estuaries are characterized by large populations of a variety of species that are adapted to rapid recolonisation subjected to frequent disturbance with recovery between 6-8 months (Newell *et al*., 1998).

Reduction in Coastal Water Quality

Reclamation and dredging activities elevates sediments from both filled material and dredged spoils which can be transported by currents and tides to adjacent areas. It is important to note that the shallow coastal waters of Selangor, more so the waters of the Klang Islands, are already at their limits and that reclamation and dredging activities will further increase sediments into the water column. Excessive increase in sediments may smother mangroves and increase sediment deposition on mudflats (Gao *et al*., 2018a & 2018b) in adjacent areas (Klang Islands and Carey Island). The increased sediments (turbidity) may reduce dissolved oxygen, affect water pH, reduce light penetration, clog gills of marine organisms resulting in their lowered productivity (Iannuzzi, *et al*., 1996; Priyandes & Rafee Majid, 2009) and affect the filtering capacity of wetlands (Riese, 2005) as well as the filter feeding mechanisms of invertebrates. This will be detrimental to the non-mobile and slow moving members of the benthic community such as polychaetes, bivalves, gastropods and prawns while mobile organism like fish can move away. High turbidity also impacts visibility and swimming ability which disorientates coastal organisms. Most affected organisms will be larvae and juveniles of commercial finfish and shellfish and non-mobile invertebrates. Kodama & Horiguchi (2011) noted hypoxia among benthos due to reclamation in the Tokyo Bay.

Kjelland *et al*. (2015) in a study of sediment dynamics and fish populations states that high sediment loads often translates into short-term physiological and behavioral effects in fishes and that environmental disturbances like dredging may lead to epigenetic changes that may cause cascade population effects. Yokohama *et al*. (2005) noted the importance of phytoplankton as a food source for macrobenthos and high turbidity lowers light penetration in the water column affecting primary (phytoplankton) production which in turn will affect secondary production of the coastal food chain. This however, should be temporary until the reclamation and dredging activities ceases.

The physicochemical parameters (ph, salinity, temperature & dissolved oxygen) of the coastal waters of the Klang Islands recorded at the aquaculture farms by KS Aquaculture Sdn Bhd from 2013 – 2018 (monthly means) shows that the water parameters did not unduly fluctuate and have been stable during the period, except for dissolved oxygen with minor fluctuations (**Fig. J**). pH, dissolve oxygen, temperature and salinity of the Klang Island coastal waters is within the limits for coastal organisms to survive [ph: 6.5 – 9.0 (Bhatnagar & Devi, 2013); dissolved oxygen: >5 mg/l (Bhatnagar & Devi, 2013); water temperature: 25 - 32^{o}C (Boyd & Pillai, 1984); and salinity: 15 – 34 ppt (Zweig *et al*., 1999)].

The current water quality report showed that the marine water samples collected in the vicinity of the project area can be classified as “moderate” to “excellent”, with an MMWQI ranging from 54-96 (SMHB report, current DEIA). Dissolved Oxygen (DO) was above the range of standard limit of 5mg/L; DO levels reached a high range 8.39-8.58mg/L during high tide; total suspended solids (TSS) were generally below the standard limit of 100mg/L for Class 3 and 30mg/L for Class E1, except for bottom scouring during high tide with a reading of 124mg/L; ph levels were within typical range of 6.5-9.0 except for bottom scouring during high tide; turbidity levels were recorded to be fairly low except for bottom scouring during high tide (114NTU). The hydraulic study shows that the proposed development will induce localised changes in currents and sediment transport within the project area but will not cause any significant impact beyond the project area limits.

Coastal Contamination

The impact of dredged material depends on the nature of the material (inorganic, organically enriched, contaminated) and the characteristics of the disposal area (accumulative or dispersive areas) (SOAEFD 1996). A variety of harmful substances, including heavy metals, oil, TBT, PCBs and pesticides, can be locked into river mouth and seabed sediments. These contaminants in the dredged spoils often of historic origin or from distant sources inland may contain such pullutants which may then be released and dispersed during the dredging activity. Nayar *et al*. (2004) showed significant copper, nickel and lead toxicity to phytoplankton and autotrophic bacteria from dredged and re-suspended sediments as a result of reclamation, dredging, construction and shipping activities in the Ponggol Estuary, Singapore.

Contaminants can enter the coastal food chain via bioaccumulation and biomagnification and can also result in the localised removal of oxygen from the surrounding water. The removal of oxygen

from the water however, may only be temporary, as tidal exchange and currents would quickly replenish oxygen supply. Dredged spoils which may contain high nutrient levels may be beneficial as this may increase phytoplankton primary productivity and its knock on effect to the coastal food chain but prolonged exposure may result in eutrophication and high turbidity. The current water quality report (SMHB Sdn Bhd) notes that contaminant of concern in the coastal waters of the project site are NH_3, NO_3, Al, Cu and fecal coliform.

Changes to Coastal Currents, Erosion and Sea Level Rise

The reclamation, dredging and port extension design may affect local current flow patterns (speed and direction) which may impact sediment transport (sediment deposition and sediment rates) and erosion of the adjacent areas (mangrove islands and the coastal areas of the mainland). It is to be noted that the mangrove acerage of P. Klang, P. Che Mat Zin, P. Selat Kering and Telok Gong have increased and changes in the local currents may cause sedimentation and/or erosion at the mangrove islands in the long term which may affect their mangroves and the associated mudflats. Nicholls *et al*. (2013) predicts sea level rise in the Straits of Malacca within the 21st century while Ehsan *et al.* (2019) noted that the coast of Selangor experiences high coastal erosion (1878.5 ha) and that a 1 m rise in sea level will cause the Port Klang area to lose 40.67% of its development area.

Fishermen, Fisheries and Livelihoods

Land reclamation as well as dredging in coastal areas bring about effects to fish catches and also to fish species decline. The growing numbers of constructions and other physical and structural alterations of shorelines often take place in nursery and spawning habitats of many fish and other aquatic species and this results in marked declines in abundance and diversity (Breber & Provilanskas, 2008; Macura *et al.,* 2016). Priyandes & Rafee (2009) noted flooding, erosions, sedimentations, and adverse influences on seawater quality, sea biota, local depletion of several kinds of fishes such as snappers, groupers, and shrimps. These impacts reduce income of the local fishermen, forcing them to switch to other professions such as becoming tradesmen, laborers, and farmers which they may not prefer. The port extension area to be reclaimed and dredged are fishing grounds for the artisanal fishermen (Zone A) from the Langat and Klang districts. The loss of mangroves and mudflats at the project site will impact on the ability of the orang asli to collect bivalves and gastropods within these habitats.

Presently, the fishermen especially from the Klang district and some from the Kula Langat district (Kg. Sg. Kurau, Kg. Judah and Kg. Melayu) fish within the footprint of the project site. During the reclamation and dredging activity, their fishing ground will be out of bounds and the fishermen will have to travel further or take a longer route to conduct their fishing activity elsewhere and this will incur cost on their part. The increase in sediments, noise from dredging, reclamation and extra boat movement within the coastal waters at the project site will also bring about a decline in their fish

catch affecting their livelihoods. The chances of accidents between fishing boats, barges, dredgers and material filling ships may also increase.

Harmful Algal Blooms (HABs)

Although no incidences of HABs have been reported in the Klang waters but caution needs to be taken as the Klang waters are polluted and highly eutrophic (Lee & Bong, 2006: Lee *et al.,*2015). During dredging the spoils and fill in material for reclamation which has locked up nutrients may seep into the coastal waters and may cause increase in nutrient levels.

Ballast Water and Alien Species

One of the critical issues highlighted by Kaur (2010) on ballast water was the possible movement of HAB causing organisms between ports where in the past, HAB was only recorded from Sabah, but presently it is found in Peninsular Malaysia (see section on Harmful Algal Blooms). Invasive species through ballast waters could impact Malaysia's food security (fisheries and aquaculture) and tourism. Consideration for ballast water should be given as the increase in terminal capacity of Westports which will bring in more ships and hence release of more ballast water into Malaysian coastal waters.

Oil and Grease

Leakage of oil and grease from poorly maintained engines of either on-land vehicles, tow boats, barges, dredges and other transport vehicles will contaminate the coastal waters affecting its flora and fauna.

Impacts During Construction of Port and Terminal Facilities

Interference to Fishing Activity

The construction of the port structure and terminal facilities will involve barges and tugboats which may interfere with the route of the fishermen moving to their fishing grounds and this may also cause potential increase in accidents and well as conflicts. As the area will be cordoned off, the fishermen will have to travel further to new fishing grounds.

Solid Waste and Sewage

The construction of the port structure and terminal facilities will require a substantial work force to be placed at the project site. This will require housing for these workers. There will be increase in solid waste and sewage from the settlement areas of the work force. If not managed well, the solid waste and sewage may make its way into the coastal waters.

Excess Construction Materials

Construction materials may make their way into the coastal waters due to illegal dumping of any excess of such materials as it will be cheaper to dispose as compared to land based disposal.

Oil & Grease

During the construction phase of the port and the terminal facilities, there will be utilization of lorries, tractors and other heavy machinery. If not managed, oil and grease leaks from these engines will ultimately make its way into the coastal waters. With the increase in the force work, canteens may also contribute to the oil and grease moving into the coastal waters.

Impacts During Operation of Port and Terminals Facilities

Increase in Shipping Activity and Port Limit Size – Interference to Fishing Activity

There will be increase in ship activity within the coastal waters as well as the size of the port limit. This will further impact on the travel route for fishermen as they will not be allowed to fish within the new port limits and will have to travel further to new fishing grounds thus affecting their livelihoods. The chances of accidents between barges and ships with fishing boats may further increase.

Oil and Grease

With the increase in the footprint of Westports, there will be more ships plying its terminals as well as container lorries. This may lead to greater oil and grease leakage from engines (boats, barges, ships, lorries, cranes) which may make their way into the coastal waters ultimately affecting the coastal habitats. The oil and grease from canteens should also not be discounted.

Ballast Water and Alien Species

The operation of the new terminals will see an increase in ship numbers and activity. This will also bring about greater exchange of ballast water and may bring in alien species into Malaysian coastal waters.

Solid Waste and Sewage

With port and terminal running at full capacity, there will be an increase in the solid waste and sewage. Mismanagement of these wastes will result in contamination of the coastal waters.

Maintenance Dredging

The impacts of the maintenance dredging will relate to the suspended sediments and the sediment plume generated as per the initial dredging of the channels.

Mitigation Measures

Mangroves

The reclamation will see 97 hectares of the mangroves at project site removed. To mitigate for carbon sequestration and its ecological function, it is suggested that the project proponent replant the mangroves. Advice on the planting area can be obtained from Jabatan Perhutanan Semenanjung Malaysia (JPSM) (Forestry Department), advice on techniques for replanting can be obtained from the Forest Research Institute Malaysia (FRIM) and hydrodynamics advice for replanting can be obtained from NAHRIM (National Hydraulic Research Institute Malaysia).

Coastal Water Quality

It is of utmost importance that the dredge spoils be properly contained while the fill in material for reclamation be washed off for excessive sediments. The use of functional silt curtains is imperative to minimize the spread of the sediments and sediment plume during reclamation and dredging activities. The silt curtains (or other technologies) must be continuously maintained for optimum functioning as the surrounding areas of the project site are sensitive receptors (mangroves and coastal waters). Dredging activities should be confined to times when the coastal currents are low so as to minimize the spread of sediments. Coastal water quality must be monitored on a weekly basis during reclamation and dredging activities, and on a quarterly basis during operation.

Safety Issues

Strict safety protocols must be placed during reclamation and dredging, during construction and operation to prevent mishaps and accidents. This relates to barges, tug boats, dredgers and other heavy marine equipment during their movement in the coastal waters. With the port limit increased together with ship density, new route/s for fishermen moving towards their fishing ground/s must established to prevent mishaps, accidents and conflicts.

Fishermen Livelihoods

Continuous engagement with fishermen communities must be carried out to determine if their catches and livelihoods are affected, and how alternate livelihoods can be established for them.

Waste Management

Proper storage and transport of solid waste management as well as sewage treatment facilities will be required. It is recommended that the waste management systems are to be of highest and up to date standards and facilities.

Oil & Grease

All vehicles/tug boats/dredgers used for reclamation and dredging as well as for port and terminal construction must be placed in special designated areas and their engines regularly checked for oil and grease leakages and maintained on a scheduled basis. Vehicle workshops on land must also be placed in designated areas. All canteens/food shops must have oil and grease traps and these should be serviced and maintained at regular intervals.

Construction Materials

Excess construction material must be disposed off as per set protocols and must never be dumped into the coastal waters.

Figure A Macrobenthos and Plankton (Phytoplankton and Zooplankton) sampling stations (st 1 – 14) (yellow pins)

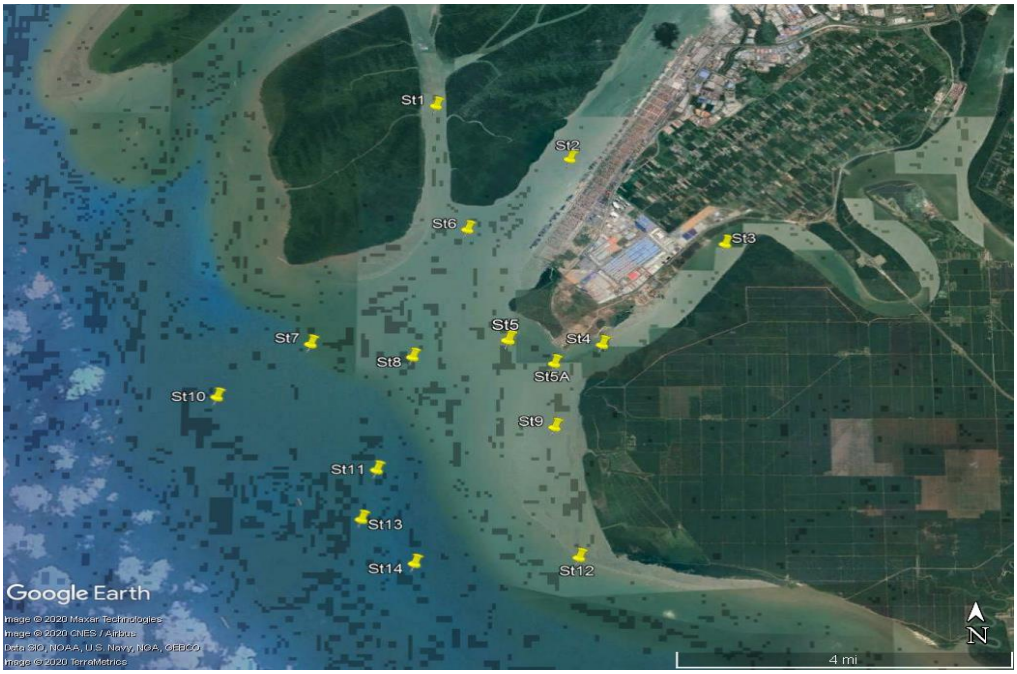


Figure A1 Mangrove gastropod sampling transect (G1 & G2)

Figure A2 Fish sampling stations (F1 & F2 - coastal; F3 - Selat Lumut)

Figure B1 Density of Macrobenthos phyla sampled from the Klang waters in the vicinity of the project site

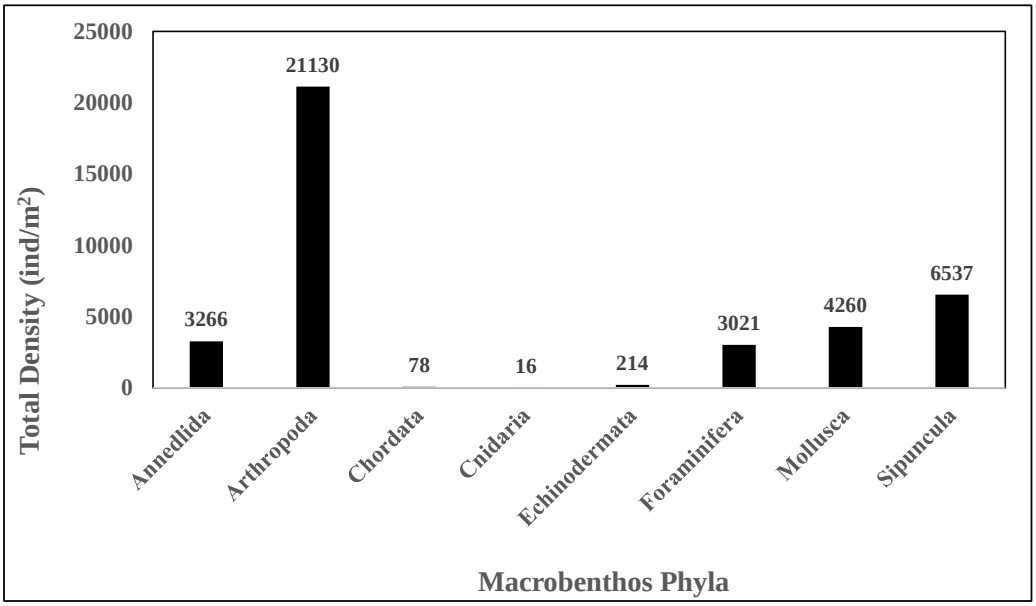


Figure B2 Density of Macrobenthos from sampling stations from the Klang waters in the vicinity of the project site

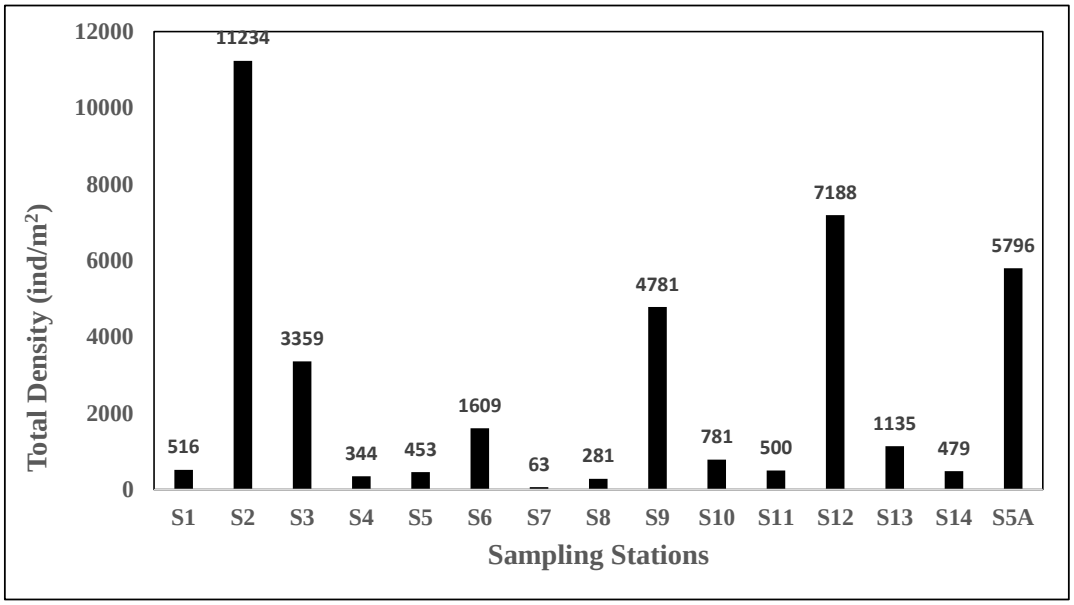


Figure C1 Density of Zooplankton from sampling station from the Klang waters in the vicinity of the project site

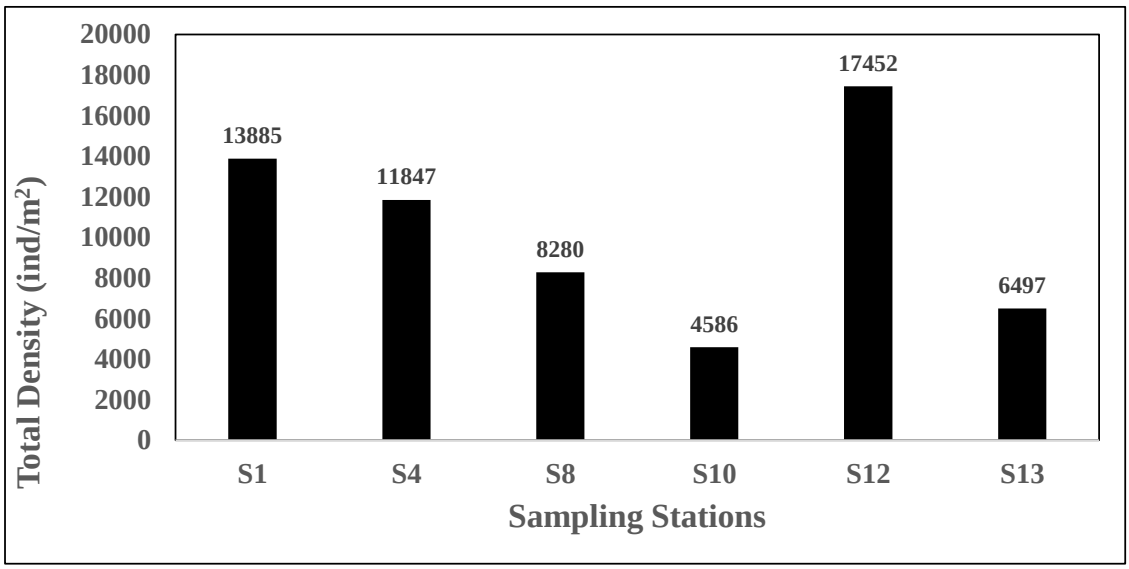


Figure C2 Density of Copepods (%) from sampling station from the Klang waters in the vicinity of the project site

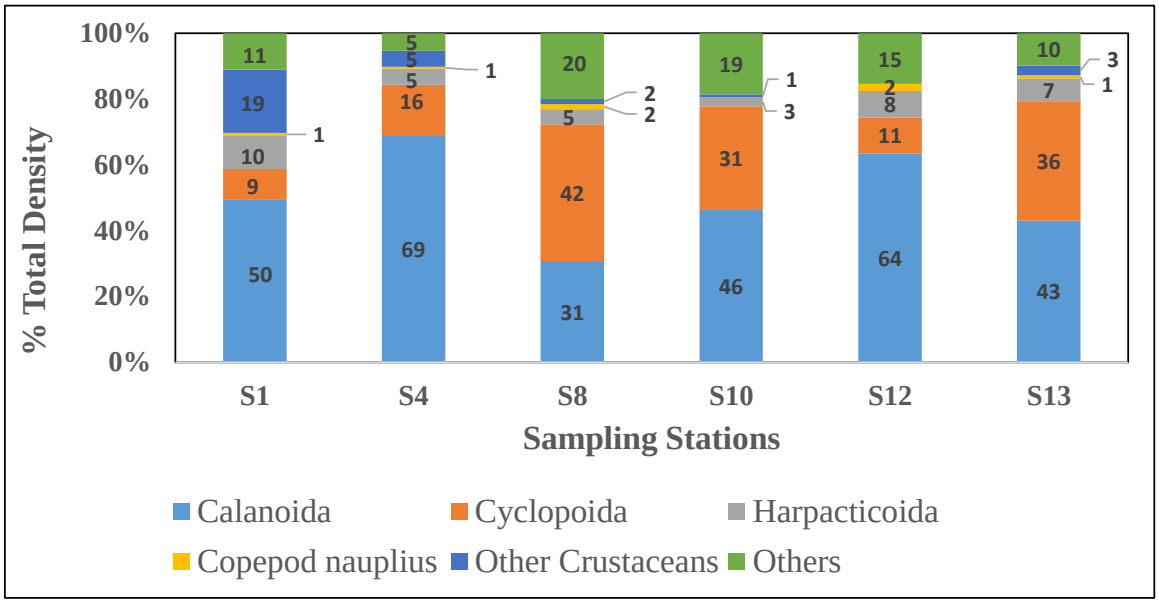


Figure D Density of Bacillariophyceae and total phytoplankton density at the sampling stations from the Klang waters in the vicinity of the project site

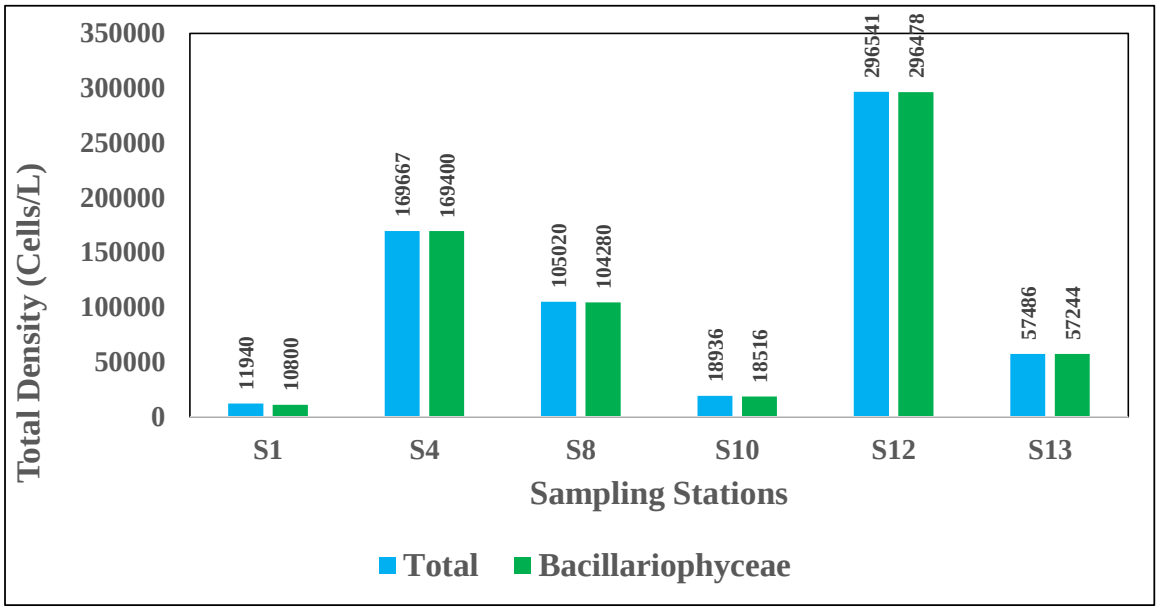


Figure E Fishing jetties (yellow pins) in the vicinity of the project site

(1 – Sg. Lima; 2- Pulau Ketam; 3 – Sg. Kembong; 4 – Teluk Nipah; 5 – Sg. Pinang; 6 – Orang Asli; 7 – Sg. Chandong; 8 – Sg. Kurau; 9 – Sg. Judah; 10 - Kg. Melayu; 11 – Sg. Udang; 12 – Jeti Nelayan; 13 – Perajurit; 14 – Telok Gong; 15 – Pendamar; 16 – Pandamaran; 17 – Jeti Nelayan; 18 – Sg. Delek; 19 – SDS Rantau Panjang; 20 – Jalan Genting; 21 – Sg. Keramat; 22 – Sementa; 23 – Tok Muda; 24 – Sg. Kapar)

Figure F Artisanal fish landing in Selangor from 2008 – 2018 (DN – drift net; TR – traps; H&L – hook & line; BG – bagnet; BN – barrier net; PN – push net; SF – shellfish; MI - miscellaneous

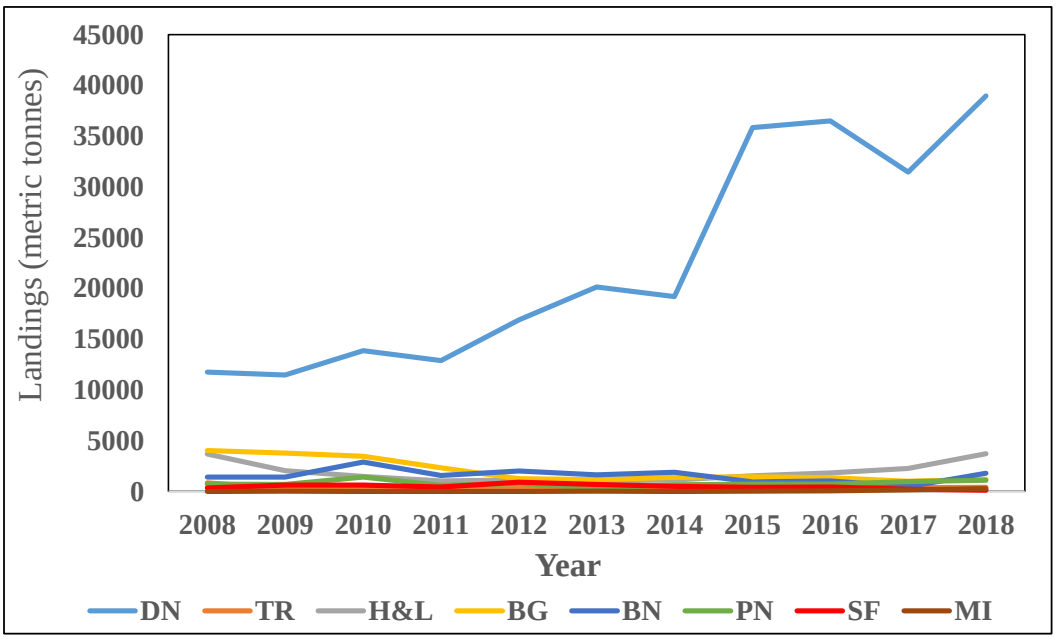


Figure G Aquaculture activity (yellow pins) close to the vicinity of the project site (source: State Fisheries Department)

Figure H Mudflats (yellow pins) location at the Klang Islands

Figure I Map indicating feeding areas and flight paths of waders arriving at Kapar ash ponds high tide roost (source: Sebastian *et al.* 1993)

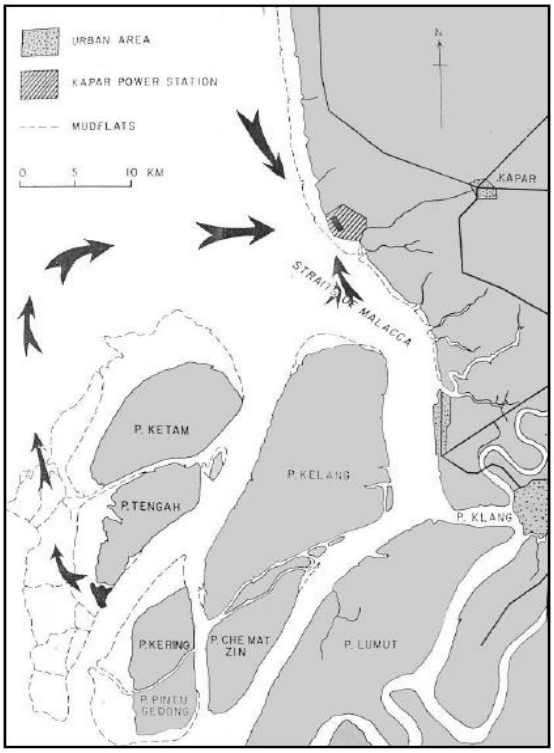


Figure J pH, salinity, dissolved oxygen and temperature recordings from KS Aquaculture Sdn Bhd for the period 2014 -2018

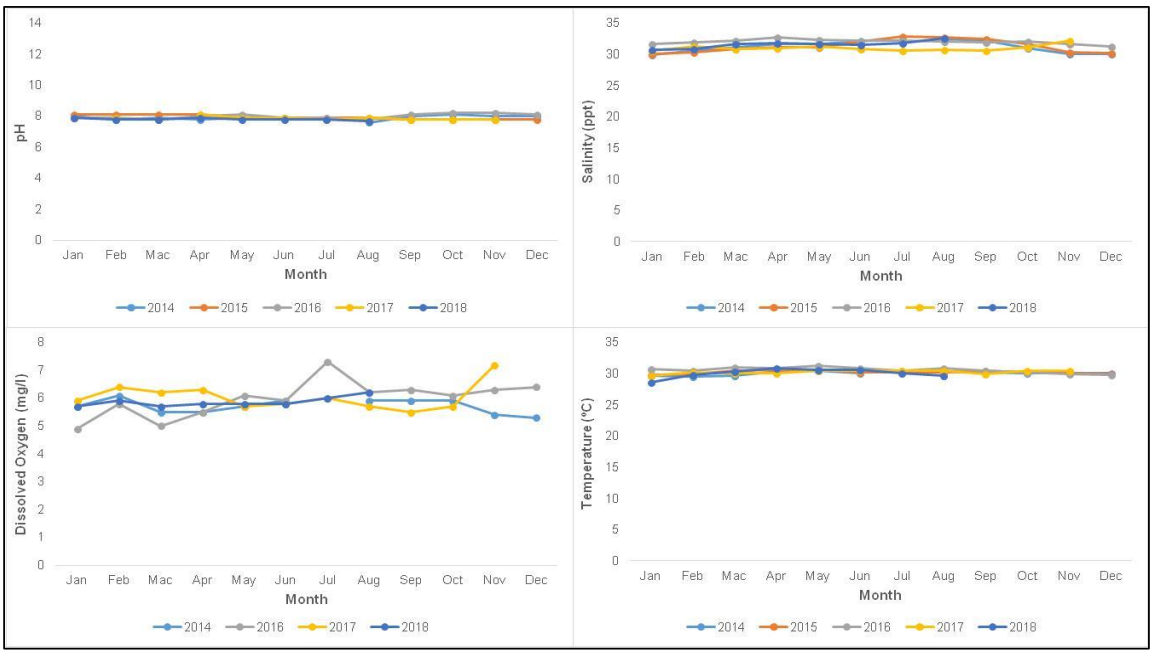


Table A Macbrobenthos (B) and Plankton (P) sampling stations with their coordinates and sea bed description

Station	Depth (m)	Samples Taken	Environmetal Description	Coordinates
S1	7.4	B + P	Mud Bottom	N 02 56' 22.6", E 101 15' 39.9"
S2	11.1	B	Mud Bottom	N 02 55' 36.6", E 101 17' 07.4"
S3	12	B	Mud Bottom	N 02 54' 26.8", E 101 18' 49.0"
S4	9.6	B + P	Mud-Sand Bottom	N 02 53' 0.61", E 101 17' 27.1"
S5	4	B	Sand-Mud Bottom	N 02 53' 03.4", E 101 16' 26.9"
S5A	6.1	B	Mud Bottom	N 02 52' 44.8", E 101 16' 56.6"
S6	9.2	B	Mud Bottom	N 02 54' 36.7", E 101 16' 00.9"
S7	8.6	B	Sand Bottom	N 02 53' 01.0", E 101 14' 20.8"
S8	11.2	B + P	Mud Bottom	N 02 52' 50.2", E 101 15' 26.1"
S9	6	B	Mud Bottom	N 02 51' 52.9", E 101 16' 56.7"
S10	22.5	B + P	Sand Bottom	N 02 52' 17.5", E 101 13' 21.8"
S11	16.4	B	Sand-Mud Bottom	N 02 51' 18.4", E 101 15' 04.1"
S12	14.3	B + P	Mud Bottom	N 02 50' 08.5", E 101 17' 11.6"
S13	26	B + P	Sand Bottom	N 02 50' 38.8", E 101 14' 54.9"
S14	33	B	Sand Bottom	N 02 50' 03.8", E 101 15' 28.5"

Table B Macrobenthos taxa sampled from the coastal waters of Klang in the vicinity of the project site (values are ind/m^2) (shaded represents abundant taxa)

Taxa	Sampling Stations															Total	Mean
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S5A		
Phylum: Annelida																	
Fam. Capitellidae		15.6	171.9	234.4		46.9			171.9						171.9	812.5	54.1 ± 85.4
Fam. Chaetopteridae		15.6														15.6	
Fam. Cirratulidae			31.3												31.3	62.5	4.2 ± 11.0
Fam. Cossuridae			31.3	15.6												46.9	3.1 ± 8.8
Fam. Glyceridae	15.6			15.6	15.6	46.9		15.6	93.8		31.3	93.8	62.5	93.8	109.4	593.8	39.6 ± 40.4
Fam. Goniadidae			15.6						15.6					10.4		41.7	2.8 ± 5.9
Fam. Hesionidae			78.1						31.3			31.3		31.3		171.9	11.5 ± 22.5
Fam. Lumbrineridae		15.6	46.9			31.3			46.9			15.6				156.3	10.4 ± 17.4
Fam. Maldanidae									31.3						31.3	62.5	4.2 ± 11.0
Fam. Nephtyidae			234.4			15.6						15.6			46.9	312.5	20.8 ± 60.4
Fam. Nereididae		31.3	78.1						46.9			31.3			62.5	250.0	16.7 ± 26.7
Fam. Onuphidae													10.4	10.4		20.8	1.4 ± 3.7
Fam. Opheliidae		15.6		15.6						10.4	10.4				15.6	67.7	4.5 ± 6.8
Fam. Orbiniidae															93.8	93.8	
Fam. Paraonidae									78.1						15.6	93.8	6.3 ± 20.3
Fam. Paralacydoniidae						31.3				10.4					15.6	57.3	3.8 ± 8.9
Fam. Sabellariidae																15.6	
Fam. Spionidae			62.5						62.5						125.0	250.0	16.7 ± 37.1
Fam. Syllidae			46.9			31.3			46.9			15.6				140.6	9.4 ± 17.5
Subtotal (ind./m^2)	**15.6**	**93.8**	**796.9**	**281.3**	**15.6**	**218.8**		**15.6**	**625.0**	**20.8**	**41.7**	**203.1**	**72.9**	**145.8**	**718.8**	**3265.6**	**217.7 ±272.3**
Npo of Taxa = 19																	
Phylum: Arthropoda (Crustacea)																	
Infra Class Cirripedia		62.5														62.5	
Sub Class Copepoda		125.0	15.6			31.3			140.6		20.8	46.9			250.0	630.2	42.0 ± 73.3
Order Amphipoda	281.3	8937.5	15.6	15.6		453.1	41.7	109.4	2203.1	93.8	10.4	1390.6		125.0	2375.0	16052.1	1070.1 ± 2321.5
Order Cumacea		343.8				109.4			109.4	10.4		78.1			46.9	697.9	46.5 ± 91.8
Infra Order Anomura																	
Fam. Diogenidae		31.3								10.4						41.7	2.8 ± 8.3
Fam. Ocypodidae		109.4	640.6			62.5			218.8			31.3			375.0	1437.5	95.8 ± 184.8
Brachyura zoea	46.9					15.6			15.6			15.6		10.4		104.2	6.9 ± 12.9
Fam. Luciferidae		31.3														31.3	
Order Isopoda		31.3				31.3			15.6			125.0	20.8		15.6	239.6	16.0 ± 32.4
Order Mysida						15.6						15.6				31.3	2.1 ± 5.5
Order Stomatopoda														10.4		10.4	
Order Tanaidacea	109.4	796.9		15.6		218.8			93.8			203.1		31.3	46.9	1515.6	101.0 ± 206.2
Class Ostracoda		78.1				15.6		62.5	15.6	31.3	20.8	15.6	20.8		15.6	276.0	18.4 ± 23.5
Subtotal (ind./m2)	**437.5**	**10546.9**	**671.9**	**31.3**		**953.1**	**41.7**	**171.9**	**2812.5**	**145.8**	**52.1**	**1921.9**	**41.7**	**177.1**	**3125.0**	**21130.2**	**1408.6 ± 2731.8**
No of Taxa = 14																	
Phylum: Chordata																	
Fish eggs			78.1													78.1	
Phylum: Cnidaria																	
Order Pennatulacea		15.6														15.6	
Phylum: Echinodermata																	
*Ophiacti*s sp.		46.9				78.1										125.0	8.3 ± 22.8
Ophiocoma sp.						31.3						31.3	10.4		15.6	88.5	5.9 ± 11.3
Subtotal (ind./m^2)		**46.9**				**109.4**						**31.3**	**10.4**		**15.6**	**213.5**	**14.2 ± 29.8**
No of Taxa = 2																	
Phylum: Foraminifera																	
Asterorotalia pulchella	15.6	31.3								20.8			31.3			99.0	6.6 ± 11.9
Globorotali a sp.										41.7						41.7	
Pseudorotalia schroeteriana	31.3	140.6	218.8		437.5		20.8		62.5	468.8	343.8	15.6	958.3	62.5		2760.4	184.0 ± 269.5
Unidentified foraminifera	15.6									83.3			20.8	0.0		119.8	8.0 ± 21.8
Subtotal (ind./m^2)	**62.5**	**171.9**	**218.8**		**437.5**		**20.8**		**62.5**	**614.6**	**343.8**	**15.6**	**1010.4**	**62.5**		**3020.8**	**201.4 ± 291.5**
No of Taxa = 4																	
Phylum: Mollusca																	
Fam. Corbulidae		15.6	500.0						453.1			31.3		10.4	750.0	1760.4	117.4 ± 240.9
Fam. Cyrenidae								15.6				31.3				46.9	3.1 ± 8.8
Fam. Donacidae				15.6		31.3		15.6	31.3		31.3	62.5		20.8		208.3	13.9 ± 18.6
Fam. Mactridae			15.6						46.9						15.6	78.1	5.2 ± 12.8
Fam. Mytilidae														10.4		10.4	
*Modiolu*s sp.						15.6										15.6	
Fam. Nuculidae		15.6							15.6							31.3	2.1 ± 5.5
Pholas orientalis												1515.6				1515.6	

Table B continued

Taxa	Sampling Stations															Total	Mean
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S5A		
Fam. Semelidae									15.6						46.9	62.5	4.2 ± 12.5
Fam. Solenidae															15.6	15.6	
Fam. Tellinidae		15.6	15.6			78.1			15.6						15.6	140.6	9.4 ± 20.3
Ergaea walshi									15.6							15.6	
Fam. Cylichnidae															46.9	46.9	
Fam. Nassariidae		46.9										31.3				78.1	5.2 ± 14.1
Fam. Pyramidellidae		15.6	62.5									15.6				93.8	6.3 ± 16.5
Fam. Tornidae		15.6	109.4									15.6				140.6	9.4 ± 28.2
Subtotal (ind./m^2)		**125.0**	**703.1**	**15.6**		**125.0**		**31.3**	**593.8**		**31.3**	**1703.1**		**41.7**	**890.6**	**4260.4**	**284.0 ± 490.3**
No of Taxa = 16																	
Phylum: Sipuncula																	
Fam. Phascolionidae								31.3	15.6			31.3		10.4	31.3	119.8	8.0 ± 12.9
Fam. Phascolosomatidae									15.6							15.6	
Subtotal (ind./m^2)		**234.4**	**890.6**	**15.6**		**203.1**		**62.5**	**687.5**		**31.3**	**3312.5**		**52.1**	**1046.9**	**6536.5**	**435.8 ± 867.9**
No of Taxa = 2																	
Total Density (ind./m^2)	**515.6**	**11234.4**	**3359.4**	**343.8**	**453.1**	**1609.4**	**62.5**	**281.3**	**4781.3**	**781.3**	**500.0**	**7187.5**	**1135.4**	**479.2**	**5796.9**		
Mean Density (ind/m^2)	**64.5 ± 152.3**	**1404.2 ± 3695**	**419.9 ± 381.2**	**43.0 ± 97**	**56.6 ± 154**	**201.2 ± 316.5**	**7.8 ± 15.5**	**35.2 ± 59.5**	**597.7 ± 946.6**	**97.7 ± 214.8**	**62.5 ± 115.5**	**898.4 ± 1262.2**	**141.9 ± 351.9**	**59.9 ± 67.9**	**724.6 ± 1067.1**	**38520.8**	**2568.1 ± 3298.7**
Taxa Richness	**7**	**25**	**20**	**7**	**2**	**21**	**2**	**6**	**28**	**10**	**7**	**25**	**8**	**13**	**26**	**58**	

Table C Diversity indices of the macrobenthos sampled from the sampling stations of the Klang waters in the vicinity of the project site (shaded represents highest value)

Indices	Sampling Stations															Mean	Overall
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S5A		
Margalefs, D	0.96	2.57	2.43	1.03	0.16	2.75	0.24	0.9	3.24	1.35	0.97	2.9	0.99	1.97	2.95	**1.694 ± 1.03**	**5.49**
Shannon-Weiner, H'	1.36	0.9	2.31	1.11	0.15	2.43	0.63	1.48	1.97	1.41	1.03	1.79	0.7	2.11	1.92	**1.42 ± 0.66**	**2.22**
Pielou, J	0.7	0.28	0.79	0.57	0.21	0.79	0.91	0.83	0.59	0.61	0.53	0.55	0.34	0.82	0.59	**0.60 ± 0.20**	**0.54**
Taxa Richness	7	25	20	7	2	21	2	6	28	10	7	25	8	13	26		**58**

Table D Abundance and diversity indices of macrobenthos sampled by Tavakoly Sany *et al* . (2015)

Seasons	Abundance (ind/m^2)	Diversity (H')
Nov 2011	899.53	2.55
Feb 2012	908.17	2.84
May 2012	919.38	2.86
Aug 2012	1228.57	2.9

Table E Macrobenthos taxa sampled from mudflats on the west coast of Peninsular Malaysia (source: Lai *et al*., 2020)

Mollusca	Crustacea	Actinopterygii	Others
Bivalvia	*Acetes* sp.	*Arius* sp.	*Carcinoscorpius rotundicauda*
Barbatia foliata	*Charybdis affinis*	*Cynoglossus bilineatus*	*Brevitrygon walga*
Corbulidae A	*Charybdis feriata*	*Cynoglossus cynoglossus*	Anemone A
Meretrix meretrix	*Clibanarius infraspinatus*	*Cynoglossus lingua*	Anemone B
Mytilidae	*Diogenes lophochir*	*Cynoglossus punticeps*	Ophiuroidea A
Ostreidae A	*Diogenes moosai**	*Escualosa thoracata*	Sea cucumber A
Pelecyora sp. *(P.* cf. *gouldii)*	Galenidae A	*Harpadon nehereus*	*Diopatra* sp.
Placuna placenta	Isopoda	*Hemiramphus far*	*Acrochordus granulatus*
Solen sp.	Macrophthalmidae	*Johnius belangerii*	
Tegillarca granosa	*Metapenaeus affinis*	*Johnius carouna*	
Tellinidae A	*Metapenaeus brevicornis*	*Otolithes ruber*	
Tellinidae B	*Metapenaeus* sp.	*Planiliza subviridis*	
	Mierspenaeopsis hardwickii	Sciaenidae juvenile	
Cephalopoda	*Mierspenaeopsis sculptilis*	Stolephorus baganensis	
Sepia sp.	*Miyakella nepa*	*Thryssa kammalensis*	
	Myomenippe hardwickii	*Trichiurus lepturus*	
Gastropoda	*Neodorippe callida*	*Trypauchen trimarginatus*	
Cryptospira ventricosa	*Palaemon styliferus*	*Trypauchen vagina*	
Indothais lacera	*Parapenaeopsis stylifera*		
ndothais malayensis	*Penaeus indicus*		
Murex occa	*Penaeus merguiensis*		
Nassarius bellulus	*Philyra* sp.		
Nassarius jacksonianus	*Portunus pelagicus*		
Nassarius cf. *olivaceus*	*Xenophthalmus pinnotheroides*		
Natica sp.	Unidentified Brachyura		
Notocochlis tigrina	Unidentified shrimp		
Desmaulus extinctorium			
Scalptia scalariformis			
Turricula javana			
Volegalea cochlidium			
Scaphopoda			**Total Number of Taxa = 79**
Dentaliidae A			
Dentaliidae B			

Table F Density and diversity indices of macrobenthos sampled by Lai *et al*. (2020) compared to the current study

Camparative Measures	Bagan Nahkoda Omar	Bagan Sg Buloh	Kuala Sangga Besar	Current Study
Density (ind/m^2)	18.5 ± 18.5	16.3 ± 27.6	15.2 ± 43.8	2568.1 ± 3298.7
Shannon-Weiner, H'	1.5 ± 0.3	1.3 ± 0.5	1.2 ± 0.5	1.42 ± 0.66
Pielou, J	0.5 ± 0.1	0.5 ± 0.2	0.6 ± 0.3	0.60 ± 0.20
Taxa Richness	55	56	42	58

Table G Zooplankton taxa sampled from the coastal waters of Klang in the vicinity of the project site (shaded represents abundant taxa)

Phylum	Class	Order	Family	Taxa	Station						Total (ind/m^3)	Mean (ind/m^3)
					S1	S4	S8	S10	S12	S13		
Arthropoda	Hexanauplia			Copepod nauplius	127	64	127		382	64	764	127 ± 133
		Calanoida	Acartiidae	*Acartia* sp.	510			340	255	64	1169	195 ± 208
			Calanidae	*Canthocalanus pauper*		127	127				254	42 ± 66
			Centropagidae	*Centropages* sp.	127			42			169	28 ± 51
			Paracalanidae	*Bestiolina similis*	637	1911	764	764	2420	318	6814	1136 ± 830
				Parvocalanus crassirostris	2166	3312	1019	382	7134	1592	15605	2601 ± 2437
				Paracalanus aculeatus	1274	1783	255		1019	127	4458	743 ± 722
			Euchaetidae	*Euchaeta concinna*		255					255	
			Pontellidae	*Labidocera* sp.		64		85		64	213	36 ± 40
			Pseudodiaptomidae	*Pseudodiaptomus bowmani*	637	127			127		891	149 ± 247
			Eucalanidae	*Subeucalanus subcrassus*	1529	446	382	85		637	3079	513 ± 551
			Tortanidae	*Totanus forcipatus*		127		425	127		679	113 ± 165
		Cyclopoida	Oithonidae	*Oithona attenuata*	255	1720	2166	934	764	828	6667	1111 ± 700
				Oithona brevicornis				42			42	7 ± 17
				Oithona simplex	127	127		85	1146	191	1676	279 ± 429
			Oncaeidae	*Oncaea clevei*			127			318	445	74 ± 130
			Corycaeidae	*Corycaeus andrewsi*	892		1146	382		1019	3439	573 ± 514
		Harpacticoida	Peltidiidae	*Clytemnestra scutellata*	127						127	
			Tachidiidae	*Euterpina acutifrons*	1146	510	255	85	1274	446	3716	619 ± 483
				Harpaticoida sp.				42	127		169	28 ± 51
			Miraciidae	*Macrosetella gracilis*		64					64	
			Ectinosomatidae	*Microsetella norvegica*	127		127				254	42 ± 66
				Hexanauplia Subtotal (ind/m^3)	***9681***	***10637***	***6495***	***3693***	***14775***	***5668***	***50949***	***8492 ± 4012***
	Maxillopoda			Cirripede larva (cyprid/nauplii)	1911	127		42		64	2144	357 ± 763
	Malacostraca	Decapoda	Sergestidae	*Acetes* protozoea	127						127	
			Alphaeidae	Alphaeidae zoea	127						127	
				Brachyuran zoea	382	255				127	764	127 ± 161
			Penaeidae	*Penaeus* protozoea			127				127	
		Isopoda		Isopoda	127	64					191	32 ± 53
				Malacostraca Subtotal (ind/m^3)	***763***	***319***	***127***			***127***	***1336***	***223 ± 289***
	Ostracoda	Myodocopida	Cypridinidae	*Cypridina* sp.		127					127	
				Arthropoda Subtotal (ind/m^3)	***12355***	***11210***	***6622***	***3735***	***14775***	***5859***	***54556***	***9093 ± 4305***
Bryozoa				Bryozoa larvae	127					64	191	32 ± 53
Annelida	Polychaeta			Polychaete larvae			637		382		1019	170 ± 275
Echinodermata	Ophiuroidea	Ophiurida		Ophiupluteus larvae	255	127	127		764	64	1337	223 ± 278
Chaetognatha	Sagittoidea	Aphragmophora	Sagittidae	Sagittidae sp.	382		382	85	255	64	1168	195 ± 168
Chordata	Appendicularia	Copelata	Oikopleuridae	*Oikopleura* sp.		191	255	255	510	255	1466	244 ± 163
Mollusca	Gastropoda			Gastropoda	127	64		340			531	89 ± 133
	Bivalvia			Bivalve		64		85		64	213	36 ± 40
				Mollusca Subtotal (ind/m^3)	***127***	***128***		***425***		***64***	***744***	***124 ± 158***
Cnidaria	Hydrozoa	Siphonophorae		Siphonophora	255				127	127	509	85 ± 104
		Leptothecata	Campanulariidae	*Obelia* sp.	127				127		254	42 ± 66
				Hydrozoa	255		127				382	64 ± 107
				Cnidaria Subtotal (ind/m^3)	***637***		***127***		***254***	***127***	***1145***	***191 ± 238***
				Unidentified egg		191	127	85	510		913	152 ± 190
				Total (ind/m^3)	**13885**	**11847**	**8280**	**4586**	**17452**	**6497**	**62539**	**1563 ± 2826**
				Mean (ind/m^3)	**347 ± 541**	**296 ± 680**	**207 ± 422**	**115 ± 212**	**436 ± 1191**	**162 ± 328**		
				Taxa Richness	**26**	**23**	**18**	**19**	**18**	**20**	**40**	

Table H Diversity indices of the zooplankton sampled from the sampling stations of the Klang waters in the vicinity of the project site (shaded represents highest value)

Indices	S1	S4	S8	S10	S12	S13	Overall
Margalefs, D	2.62	2.34	1.88	2.13	1.74	2.16	3.53
Shannon-Weiner, H'	2.77	2.28	2.41	2.49	2.12	2.43	2.78
Pielou, J	0.85	0.72	0.83	0.84	0.73	0.81	0.75
Taxa Richness	26	23	18	19	18	20	40

Table I Phytoplankton taxa sampled from the coastal waters of Klang in the vicinity of the project site (shaded represents abundant taxa)

Taxa					Station						Total	Mean
Phylum	Class	Order	Family	Genus/Species	S1	S4	S8	S10	S12	S13		
Ciliophora	Spirotrichea	Tintinnida		Unidentified tintinnida	180	133	80		63		456	76 ± 72
				Unidentified ciliates	180		240	204			624	104 ± 116
				Subtotal (cells/L)	***360***	***133***	***320***	***204***	***63***	***0***	***1,080***	***180 ± 142***
Cyanobacteria				Unidentified cyanobacteria	540						540	90 ± 220
Euglenozoa	Euglenoidea	Euglenales	Euglenaceae	*Euglena* sp.						44	44	7 ± 18
Myzozoa	Dinophyceae	Dinophysiales	Dinophysiaceae	*Dinophysis* sp.	60	33					93	16 ± 25
		Gonyaulacales	Ceratiaceae	*Ceratium* sp.	60		40	24		44	168	28 ± 25
		Noctilucales	Noctilucaceae	*Noctiluca* sp.			60	36		44	140	23 ± 27
		Peridiniales	Peridiniaceae	*Peridinium* sp.	120	67	300	132		44	663	111 ± 105
				Subtotal (cells/L)	***240***	***100***	***400***	***192***	***0***	***132***	***1,064***	***177 ± 137***
Ochrophyta	Bacillariophyceae	Bacillariales	Bacillariaceae	*Nitzschia longissima*	520	1,600	1,000	252	1,953	220	5,545	924 ± 726
				Nitzschia sp.	200	500	300	168	1,701	132	3,001	500 ± 603
				Pseudo-nitzschia sp.		133					133	22 ± 54
		Biddulphiales	Biddulphiaceae	*Biddulphia* sp.	60	333	80	48	441	198	1,160	193 ± 163
		Chaetocerotales	Chaetocerotaceae	*Bacteriastrum* sp.		100	20	36	63		219	37 ± 39
		Chaetocerotanae	Chaetocerotaceae	*Chaetoceros* sp.	580	533	480	312		330	2,235	373 ± 212
		Corethrales	Corethraceae	*Corethron* sp.						22	22	4 ± 9
		Coscinodiscales	Coscinodiscaceae	*Asteromphalus* sp.					63		63	11 ± 26
				Coscinodiscus sp.	200	500	380	132	1,260	242	2,714	452 ± 417
		Flagilariales	Flagilariaceae	*Asterionella* sp.		67	40		126		233	39 ± 51
		Hemiaulales	Hemiaulaceae	*Eucampia* sp.			60				60	10 ± 24
				Hemiaulus sp.	20	67	140	12		22	261	44 ± 52
		Leptocylindrales	Leptocylindraceae	*Leptocylindrus* sp.	40		180	12	252	44	528	88 ± 103
		Lithodesmiales	Lithodesmiaceae	*Ditylum* sp.	60	500	260	48	378	176	1,422	237 ± 179
		Naviculales	Amphipleuraceae	*Amphiprora* sp.	20	33			126		179	30 ± 49
				Amphora sp.	20				126	44	190	32 ± 49
			Naviculaceae	*Navicula* sp.	360	267	140	48	378	110	1,303	217 ± 138
			Pinnulariaceae	*Pinnularia* sp.	20			12	63	88	183	31 ± 37
			Pleurosigmataceae	*Pleurosigma* sp.	100	200	40	60	504	66	970	162 ± 177
		Rhizosoleniales	Rhizosoleniaceae	*Guinardia* sp.	20						20	3 ± 8
				Rhizosolenia sp.	140	33	280	60	441	44	998	166 ± 133
		Surirellales	Surirellaceae	*Surirella* sp.	20	67					87	15 ± 27
		Thalassionematales	Thalassionemataceae	*Thalassionema* sp.	20	467	400	24	441		1,352	225 ± 232
				Thalassiothrix sp.	80	333	120	72	378	198	1,181	197 ± 132
		Thalassiosirales	Lauderiaceae	*Lauderia* sp.			140	24			164	27 ± 56
			Skeletonemaceae	*Skeletonema* sp.	8300	163,567	100,200	17,160	287,280	55,176	631683	105,281 ± 106045
			Stephanodiscaceae	*Cyclotella* sp.	20	100	20	36	504	132	812	135 ± 186
				Subtotal (cells/L)	***10800***	***169400***	***104280***	***18516***	***296478***	***57244***	***656,718***	***109,453 ± 108928***
	Dictyochophyceae	Dictyochales	Dictyochaceae	*Dictyocha* sp.	0	33	20	24	0	66	143	24 ± 25
				Total density (cell/L)	**11,940**	**169,667**	**105,020**	**18,936**	**296,541**	**57,486**	**659,589**	**3,054 ± 3019**
				Mean Density (cell/L)	**332 ± 1375**	**4713 ± 27234**	**2917 ± 16678**	**526 ± 2853**	**8237 ± 47838**	**1597 ± 9185**		
				Taxa Richness	**26**	**23**	**25**	**27**	**20**	**22**		

Table J Diversity indices of phytoplankton sampled from the sampling stations of the Klang waters in the vicinity of the project site (shaded represents highest value)

Indices	S1	S4	S8	S10	S12	S13	Overall
Margalefs, D	2.66	1.82	2.07	2.23	1.5	1.91	3.01
Shannon-Weiner,	1.42	0.24	0.31	0.56	0.21	0.28	0.29
Pielou, J	0.43	0.07	0.09	0.17	0.07	0.09	0.08
Taxa Richness	26	23	25	27	20	22	36

Table K1 Fishermens jetty in the Klang and Kuala Langat fishing districts (source: Selangor State Fisheries Department)

Fishermens Jetty (Klang)	Fishermens Jetty (Kuala Langat)
Pulau Ketam	Pulau Carey
Sungai Lima	Teluk Panglima Garang
Sungai Pinang	Kg. bandar
Sungai Chandong	Permatang Pasir
Jeti Orang Asli	Kelanang
Teluk Nipah	Sijangkang
Sungai Kembong	Kanchong Laut
Pandamaran	Batu Laut
Jeti Perajurit	Tanjung Sepat
Kampung Nelayan	Tongkah
Sungai Udang Telok Gong	Bedford
Sungai Udang Tampang	Kundang
Pendamar	Tumbok
Jeti Limbungan	
Sungai Sireh	
Sungai Udang Pelabuhan Klang	
Kampung Delek	
Sayang D' Sayang Rantau Panjang	
Jalan Genting Rantau Panjang	
Sungai Keramat	
Sungai Daun	
Sementa	
Sungai Kapar	
Tok Muda	

Table K2 Fish landing jetties of Lembaga Kemajuan Ikan Malaysia (LKIM) and fishermen registered with the fisheries associations (source: Lembaga Kemajuan Ikan Malaysia)

Jetty Name	Location
Jeti LKIM Sungai Lima – A	Sungai Lima, Pulau Ketam
Jeti LKIM Sungai Lima – B	Sungai Lima, Pulau Ketam
Jeti Nelayan Kg. Telok Gong	Kg. Nelayan Telok Gong, Pelabuhan Klang
Pengkalan Nelayan Kg. Teluk Nipah	Jalan Jeti, Pulau Indah Klang
Pengkalan Nelayan Sungai Kurau	Mukim Jugra, Pulau Carey
Pengkalan Nelayan Sungai Judah	Mukim Jugra, Banting

Fisheries Society	Number of Fishermen
Persatuan Nelayan Kawasan Pelabuhan Klan	961
Persatuan Nelayan Kawasan Kuala Langat	428
Total	**1389**

Table L Yearly fish landing by artisanal gear type for the state of Selangor (values are in metric tonnes) (source: Department of Fisheries Malaysia)

Year	Fishing Gear Type									Total Artisanal Landings
	Drift/Gill Nets (Pukat Hanyut)	Stationary Traps (Belat)	Portable Traps (Bubu)	Hook & Lines (Pancing)	Bagnets (Pukat Bakul)	Barrier Nets (Pukat Rentang)	Push/Scoop Nets (Pukat Surung)	Shellfish Collection	Miscellaneous (Rampaian)	
2008	11,743	721	109	3681	4035	1415	710	334	8	22756
2009	11450	150	141	2042	3784	1415	694	611	27	20314
2010	13854	219	72	1477	3459	2885	1411	635	7	24019
2011	12875	159	83	1037	2318	1557	587	442	4	19062
2012	16898	163	104	1139	1257	2001	796	905	5	23268
2013	20122	201	98	1042	1156	1644	329	680	20	25292
2014	19189	211	104	1138	1367	1885	663	484	3	25044
2015	35822	80	92	1552	1448	942	720	412	12	41080
2016	36496	66	42	1810	1346	1018	715	437	61	41991
2017	31445	338	33	2272	1013	451	979	200	157	36888
2018	38941	384	25	3719	1177	1786	1082	130	267	47511
Total	**248835**	**2692**	**903**	**20909**	**22360**	**16999**	**8686**	**5270**	**571**	**327225**
Mean	**22621 ± 10847**	**245 ± 184.5**	**82 ± 35.9**	**1901 ± 979.1**	**2033 ± 1165.8**	**1545 ± 637.1**	**790 ± 283.3**	**479 ± 221.8**	**52 ± 84.5**	**29748 ± 10068.1**
% Artisanal Landings By Gear Type	**76.04**	**0.82**	**0.28**	**6.39**	**6.83**	**5.19**	**2.65**	**1.61**	**0.17**	
% Total Yearly Landings	**19.49**	**0.21**	**0.07**	**1.64**	**1.75**	**1.33**	**0.68**	**0.41**	**0.04**	

Table M Zone A fish landing from Lembaga Kemajuan Ikan Malaysia landing sites (source: Lembaga Kemajuan Ikan Malaysia)

Year	Fishing Area			
	Pulau Indah	Pulau Carey	Pulau Ketam	Telok Gong
	Fish Catch Declaration Sites			
	Pelabuhan Klang	Simpang Telok/Sijangkang	Pulau Ketam	Pandamaran
2013	226,881	99,721	13,995,326	715,057
2014	155,996	94,903	15,831,041	631,809
2015	161,999.14	71,842.20	12,403,903.99	574,765.38
2016	49,439.09	41,908.10	4,819,706.95	352,498.09
2017	122,221.73	110,416.65	5,436,776.29	456,964.94
2018	109,269.89	117,719.65	5,440,016.45	337,651.47
2019	81,374.43	76,521.65	4,596,068.21	318,707.74
Total (Kg)	**524,304.28**	**418,408.25**	**32,696,471.89**	**2,040,587.62**
% Total Landings	**1.46**	**1.17**	**91.6**	**5.7**

Table N Fish landings based on gear type from Klang and Kuala Langat Fisheries District (source: State Fisheries Department) (values are in metric tonnes) (na – not

Artisanal Fish Landings by Gear Type - Klang District									
Year	**Bag Nets (Bakul)**	**Barrier Net (Pukat Rentang)**	**Drift Net (Pukat Hanyut)**	**Hook & Line (Pancing)**	**Bubu (Traps)**	**Push Net (Surong/Sungkor)**	**Miscellaneous (Rampaian)**	**Total**	**% of Selangor Artisanal Fish Landings**
2016	1199.47	790.3	5260.95	917.09				8167.8	**19**
2017	907.41	348.67	4970.24	808.84	-	-	-	7035.16	**19**
2018	1094.6	1690.29	8287.12	2376.82	-	-	125.4	13574.23	**29**
2019	680.82	745.66	8394.57	2233.79	-	-	137.3	12192.14	**26**
Total Landings	**3882.3**	**3574.92**	**26912.88**	**6336.54**			**262.7**	**40969.3**	
% of Total Landings	**9.5**	**8.6**	**66**	**15.4**			**0.6**		

Artisanal Fish Landings by Gear Type - Kuala Langat District									
Year	**Bag Nets (Bakul)**	**Barrier Net (Pukat Rentang/Belat)**	**Drift Net (Pukat Hanyut)**	**Hook & Line (Pancing)**	**Bubu (Traps)**	**Push Net (Surong/Sungkor)**	**Miscellaneous (Rampaian)**	**Total**	**% of Selangor Artisanal Fish Landings**
2014	-	420.89	1945.97	416.42	628.76	525	-	3937.04	**16**
2015	-	330.7	1824.33	320.86	575.14	316	-	3367.03	**8**
2016		na	na	na	na	na	na	na	**na**
2017	-	19.5	2202.97	436.44	29.4	2.58	126.25	2817.14	**8**
2018	-	8.27	3092.93	401.45	20.93	7.02	121.04	3651.64	**8**
Total Landings	**-**	**779.36**	**9066.2**	**1575.17**	**1254.23**	**850.6**	**247.29**	**13772.9**	
% of Total Landings		**5.7**	**66**	**11.4**	**9.1**	**6.7**	**1.8**		

Table N1 Fish landings by fish group from Klang and Kuala Langat Fisheries District (source: State Fisheries

Landings	Klang						
	2014	2015	2016	2017	2018	Total	%
Demersal Fish	2038	2873	3765	2943	6595	18258.3	44.3
Pelagic Fish	1225	1566	1574	1999	3010	9396.8	22.8
Prawns (Udang)	1523	989	1761	884	2575	7750.8	18.8
Crabs (Ketam)	247	332	246	464	587	1880.5	4.5
Mixed Fish (Ikan Campur)	134	41	23	11	15	224.5	0.5
Trash Fish (Ikan Baja)	567	472	453	315	372	2184.3	5.3
Jelly Fish (Ubur-Ubur)	271	352	338	257	242	1463.5	3.5
Total	**6005**	**6625**	**8160**	**6883**	**13396**	**41158.7**	

Landings	Kuala Langat			
	2017	2018	Total	%
Demersal Fish	1087.5	1101.3	2188.8	29.3
Pelagic Fish	941.4	2469.9	3411.3	45.7
Prawns (Udang)	300.7	276.5	577.2	7.7
Crabs (Ketam)	345	239.1	584.1	7.8
Squid (Sotong)	5.1	21.8	26.9	0.4
Mixed Fish (Ikan Campur)	220.7	6.38	227.08	3.0
Trash Fish (Ikan Baja)	313.2	142.1	455.3	6.1
Total	**3213.6**	**4527.1**	**7470.7**	

Table N2A Commercial landings by Fish Families at Kuala Langat (source: State Fisheries Department) (shaded represents abundant)

Fish Family	Local Name	Fish Landings (metric tonnes)		
		2017	2018	% Total
Ariidae	duri/puluta	116.6	104.3	3.25
Carangidae	talang/cinc	20.7	215.2	3.46
Carcharinidae	yu		0.02	0.00
Chirocentridae	parang-	265.3	1160.9	20.95
Clupeidae	kebasi/sel	101.1	113.7	3.15
Cynoglossidae	lidah	18.5	1.4	0.29
Dasyatidae/Gymnuridae	pari/ketuk	64.3	197.2	3.84
Drepanidae	daun	37.2	82.1	1.75
Haemulidae	gerut-	50.2	19.1	1.02
Latidae	siakap	45.1	23.6	1.01
Lutjanidae	tanda/mer	124.6	107.8	3.41
Mugilidae	belanak/loban/kedera	38.0		0.56
Mullidae	biji nangka	1.9	30.1	0.47
Muraenesocidae	malong	8.7	28.0	0.54
Plotosidae	semilang	23.7		0.35
Polynemidae	senangin/	255.0	152.4	5.98
Pristigasteriidae	puput/beliak mata	30.1	197.3	3.34
Psettodidae/Paralichthyidae	sebelah	5.0	11.8	0.25
Rachycentridae	aruan tasek	3.4	11.3	0.22
Sciaenidae	gelama/tengkerong	183.2	131.5	4.62
Scombridae	tenggiri	302.8	548.1	12.50
Serranidae	kerapu	38.4	9.8	0.71
Sillaginidae	puntong damar/bulus bulus	113.1	143.9	3.77
Sphyraenidae	alu-alu/kacang-kacang	3.0	12.3	0.23
Stromateidae	bawal	190.9	275.7	6.85
Penaeidae	udang	300.7	276.5	8.48
Portunidae	ketam renjong/ketam laut	345.1	239.2	8.58
Loliginidae/Sepiidae	sotong	5.1	21.8	0.39
Mixed Fish		220.7	6.4	
Trash Fish		313.2	142.1	

% does not include mixed fish & trash fish

Table N2B Commercial landings by Fish Families at Klang (source: State Fisheries Department) (shaded represents abundance)

Fish Family	Local Name	Fish Landing (metric tonnes)					
		2014	2015	2016	2017	2018	% Total
Ariidae	duri/pulutan/otek/mayong	484.2	618.6	728.1	1680.3	1687.3	12.21
Belonidae	todak	0.0			0.5	55.5	0.13
Carangidae	talang/cincaru/talang	10.9	0.1		62.5	276.2	0.82
Carcharhinidae	yu				0.2	1.0	0.00
Chirocentridae	parang-parang	26.5	36.3	40.9	253.6	316.9	1.58
Clupeidae	kebasi/selangat	21.3	11.6	33.2	25.5	122.5	0.50
Cynogolossidae	lidah	40.6	51.3	154.6	56.9	200.7	1.18
Dasyatidae/Gymnuridae	pari/ketuka/lalat/rimau	637.9	927.3	1316.6	848.0	1683.5	12.71
Drepanidae	daun baharu	7.3	12.8	10.5	14.9	58.5	0.24
Engraulidae	bulu ayam				0.0		0.00
Haemulidae	gerut-gerut/tebal pipi	0.7		0.1	16.1	62.8	0.19
Latidae	siakap	6.2	7.5	26.1	19.3	40.1	0.23
Limulidae	belangkas				10.2		0.02
Lutjanidae	tanda/merah/jenahak	17.3	41.2	24.5	53.9	245.4	0.90
Megalopidae	bulan-bulan	0.3			0.3	6.3	0.02
Mugilidae	belanak/kedera	318.0	532.8	437.2	143.2	246.1	3.94
Muraenesocidae	malong		17.2		14.8	88.9	0.28
Penaeidae	udang	2680.5	667.0	1446.7	623.5	2304.5	18.13
Platycephalidae	baji-baji	14.1	11.9	26.0	25.0	35.7	0.26
Plotosidae	semilang	210.8	325.1	195.0	118.4	302.4	2.70
Polynemidae	senangin/kurau/senohong	462.2	687.8	499.6	596.2	1379.8	8.51
Portunidae	ketam laut/renjong/batu	492.9	663.3	245.6	463.6	587.4	5.76
Psettodidae/Paralichthyidae	sebelah	7.4	13.6	3.0	2.1	1.5	0.06
Rachycentridae	aruan tasek				0.2	52.0	0.12
Sciaenidae	tembereh/selampai/gelama/tenggerong	360.9	483.4	749.9	382.7	630.3	6.12
Scombridae	tenggiri	629.5	707.3	753.2	845.1	704.9	8.55
Sergestidae	udang baring	172.3	322.4	314.5	261.0	270.8	3.15
Serranidae	kerapu	7.3	14.6	13.0	32.1	18.3	0.20
Sillagnidae	puntong damar/bulus-bulus	0.5			7.2	12.7	0.05
Sphyraenidae	alu-alu/kacang-kacang	3.3	3.2	2.1	4.1	36.9	0.12
Stromatidae	bawal putih/hitam/tambak/selatan	448.1	567.1	325.5	672.7	1338.2	7.87
Jelly Fish	ubur-ubur	271.2	352.3	338.2	257.3	242.2	3.43
Trash Fish		568.8	471.5	452.9	315.2	371.6	
Mixed Fish		134.2	40.6	23.4	10.9	15.4	

% does not include mixed fish & trash fish

Table O1 Zone A fish landing at Simpang Telok/Sijangkang (source: Lembaga Kemajuan Ikan Malaysia (shaded represents abundance) (values are in Kg)

Fish Type	Year					Total	% Total
	2013	2014	2015	2016	2017		
Ariidae	16825.5	19803.3	12438.5	3983.2	12222.6	65273.1	15.8
Belonidae	371.3	321.6		131	560.7	1384.6	0.3
Cerithedia obtusa	427		234	257		918	0.2
Chirocentrus dorab	444.2	364.2	235.8	201.6	265.1	1510.9	0.4
Clupeidae	21345.2	24637.6	20175.2	10001.9	27442.1	103602	25.1
Dasyatidae	5924.1	2442.8	1998.1	725.1	1098.4	12188.5	2.9
Eleutheronema tetradactylum	2639.4	2126	2027.3	1093.4	2147.9	10034	2.4
Lates calcarifer	702.8	624.8	595.1	221.3	665.5	2809.5	0.7
Macrobracium sp.	523					523	0.1
Megalops cordyla		390	224.8			614.8	0.1
Mugilidae	30093	30784.8	22273.2	9036.4	16086.1	108273.5	26.2
Muraenesox sp.		173.4				173.4	0.0
Pampus argenteus	1347.1	1251.3	800.4	640.8	1329.3	5368.9	1.3
Penaeidae	8467.94	4975.2	3612.9	2717.3	1793.6	21566.94	5.2
Plotosus canius	935.4	756	644	434.5	619.5	3389.4	0.8
Portunidae	1277.8	1671	1424.8	835.6	1191.2	6400.4	1.5
Sciaenidae	4328.2	2120.7	1901.2	1066.1	1541	10957.2	2.7
Scomberoides sp.		172.9			306.1	479	0.1
Scomberomorus commerson	3721.5	1244.9	1133.7	394.2	376.5	6870.8	1.7
Sphyraena sp.					184.7	184.7	0.0
Synodontidae			430	9952.5	40522	50904.5	12.3
Total	**96,959.17**	**93327.8**	**69867.5**	**41165.9**	**108749.3**		

Table O2 Zone A fish landing at Pulau Ketam (source: Lembaga Kemajuan Ikan Malaysia (shaded represents abundance) (values are in Kg)

Fish Type	Year					Total	% Total
	2013	2014	2015	2016	2017		
Pampus argenteus	48018.6	39875.2		5490.0	2664.4	96048.2	0.2
Acetes sp.	6670387.0	7327425.1	322382.0	1594120.0	3179606.0	19093920.1	35.6
Mugilidae			115123.3	14422.0		129545.3	0.2
Megalops cordyla	497676.1	464488.4	458789.6	62732.0	138778.2	1622464.3	3.0
Ariidae	1644709.3	1594004.4	1053379.2	282138.9	360284.1	4934515.8	9.2
Sciaenidae	674909.4	1037411.2	766303.2	471782.1	1099423.9	4049829.8	7.6
Trash Fish	852517.9	826466.7	853350.9	189690.9	147474.0	2869500.3	5.4
Mixed Fish	932322.2	1408777.0	1211795.6	281885.4	586160.7	4420940.9	8.3
Salted Fish	778735.9	1344716.7	62738.0			2186190.6	4.1
Rastrelliger kanagurta	800813.9	942238.3	801248.3	213409.8	52625.0	2810335.3	5.2
Portunidae	43212.8				3499.0	46711.8	0.1
Other Fish			6009530.3	794855.8	181947.0	6986333.1	13.0
Harpodon nehereus	185905.1	91851.8	72673.2	12922.0	13044.0	376396.1	0.7
Dasyatidae	99153.9	76175.7	67116.9	13669.8	7676.7	263793.0	0.5
Carangidae	43794.3	159915.9	420214.0	32042.0		655966.2	1.2
Clupeidae	369457.6	427236.6	400615.0	1002196.0	112500.4	2312005.6	4.3
Eleutheronema tetradactylum	38031.4	36581.1				74612.5	0.1
Scomberoides sp.	135837.1	157282.3	116114.3	22647.8	18292.3	450173.8	0.8
Scomberomorus sp.					10794.8	10794.8	0.0
Penaeidae			30300.0	5050.0	3000.0	38350.0	0.1
Carcharhinidae	49783.8	57638.3	28100.0		2715.0	138237.1	0.3
Total	**13,490,191.76**	**15,389,398.01**	**12,175,458.93**	**4,773,018.10**	**5,418,802.11**		

Table O3 Zone A fish landing at Pelabuhan Klang (source: Lembaga Kemajuan Ikan Malaysia (shaded represents abundance) (Values are in Kg)

Fish Type	Year					Total	% Total
	2013	2014	2015	2016	2017		
Acetes sp.	61212	30991	16775			108978.0	16.5
Anadara granosa	2375	15990			1604	19969.0	3.0
Ariidae	45860.8	32560.55	50649.59	16099.6	38998.2	184168.7	27.9
Clupeidae	15793.95	9481.84	9856.7	4376.5	7663.1	47172.1	7.1
Dasyatidae	17657.48	10376.24	21113.24	4748.1	13600.35	67495.4	10.2
Lates calcarifer	2995.4					2995.4	0.5
Lutjanus argentimaculatus	2699.8					2699.8	0.4
Megalaspis cordyla				559	862.4	1421.4	0.2
Mixed Fish	9329.2	1586.9		500.3	1800.8	13217.2	2.0
Mugilidae	7052.77	4413.98	5158.15	1906.85	3132.7	21664.5	3.3
Muraenesox cinereus	3453.02	3253.63	4706.4	1243.2	1655.1	14311.4	2.2
Pampus argenteus	6640.25	5473.78	5874.25	2649.5	6051.2	26689.0	4.0
Parastromateus niger	2679.05	1580.45	7710.7	795.75	2098	14864.0	2.3
Penaeidae	5341.3	1109.53	1109.53	1109.53	1109.53	9779.4	1.5
Platycepalus sp.		2605.3	2067.4		1706.4	6379.1	1.0
Plotosus canius	7735.16	6210.41	8337.57	2683.54	5426.48	30393.2	4.6
Polynemidae	8035.17	4898.02	7249.25	3097.05	10379.7	33659.2	5.1
Portunidae				711.2	1034.4	1745.6	0.3
Sciaenidae	10600.49	10000.57	11916.38	3763.9	11806.45	48087.8	7.3
Scomberoides sp.		976.8		1215.5		2192.3	0.3
Scomberomorus commerson			924.7	418.6	1139	2482.3	0.4
Total	**209460.94**	**140399.47**	**150356.96**	**447,68.59**	**108,958.28**		

Table O4 Zone A fish landing at Pandamaran (source: Lembaga Kemajuan Ikan Malaysia (shaded represents abundance) (Values are in Kg)

Fish Type	Year					Total	% Total
	2013	2014	2015	2016	2017		
Ariidae	189405	200978	189090	121429	145466	846366.5	33.4
Acetes sp.	66949	4559	5196	3243	8908	88855.7	3.5
Anodontostoma chacunda	78616	95570	108007	67457	84011	433660.6	17.1
Dasyatidae	42514	49040	39261	21060	22391	174266.2	6.9
Eleutheronema tetradactylum	21368	22698	18262	12716	21824	96868.0	3.8
Harpodon nehereus	7381					7381.0	0.3
Lates calcarifer		6846	4933	3742	6136	21657.3	0.9
Mmuraenesox sp.	9070	8170	9050	4671	5312	36272.1	1.4
Mugilidae	35849	37383	41088	20883	27474	162677.5	6.4
Other Fish	33564					33564.1	1.3
Pampus argenteus	33679	41240	29240	19859	34899	158917.1	6.3
Penaeidae	19395	23546	14506	7851	6729	72027.4	2.8
Platycephalus sp.	7794					7794.0	0.3
Plotosus canius	15139	16182	12460	8630	8604	61015.2	2.4
Portunidae		5040	4710		3033	12782.5	0.5
Rasrelliger kanagurta	13809					13809.0	0.5
Salted Fish	15775					15775.0	0.6
Sciaenidae	62607	61207	47893	30884	43984	246576.2	9.7
Scomberoides sp,		4945		2226		7171.0	0.3
Scylla serrata			3163	1929	2730	7821.9	0.3
Trash Fish		5850	11573	3197	4466	25086.3	1.0
Total	**652,914.41**	**583,253.49**	**538,431.32**	**329,777.49**	**425,967.84**		

Table OA Fish, prawns and crabs sampled from fishing jetties at Pulau Indah

Family	Fish Taxa	Local Name
Ariidae	*Hexanematichthys sagor*	bedukang/pedukang
	Osteogeneousus militaris	duri misai
	Arius maculatus	duri putih
	Plicofollis argyropleuron	jahan
Carangidae	*Scomberoides tala*	talang
	Carangoides malabaricus	demudok
	Alepes djedaba	selar
	Megalops cordyla	cincaru
Carcharhinidae	*Carcharhinus* sp.	yu bodoh
Clupeidae	*Anodontostoma chacunda*	selangat
	Sardinella gibbosa	sardin/tamban
Dasyatidae	*Brevitrygon imbricata*	pari/ketuka
	Brevitrygon walga	pari
	Hemitrygon sinensis	pari
	Neotrygon kuhlii	pari
	Telatrygon zugei	pari/ketuka
Drepanidae	*Drepane punctata*	daun baharu
Elopidae	*Elops machnata*	banang
Engraulidae	*Thryssa* sp.	bulu ayam
Gymnuridae	*Gymnura poecilura*	pari helang
Haemulidae	*Pomadasys argenteus*	tebal pipi
	Plectorhinchus gibbosus	kaci
Latidae	*Lates calcarifer*	siakap
Leiognathidae	*Leiognathus nuchalis*	kekek
Lutjanidae	*Lutjanus johnii*	jenahak
	Lutjanus russellii	tanda
	Lutjanus argentimaculatus	merah
Megalopidae	*Megalops cyprinoides*	bulan bulan
Mugulidae	*Liza malinoptera*	belanak
Muraenesocidae	*Muraenesox cinereus*	malong
Platycephalidae	*Platycephalus indicus*	baji baji
Plotosidae	*Plotosus canius*	semilang
Polynemidae	*Eleutheronema tetradactylum*	senangin
Sciaenidae	*Johnius* sp. 1	gelama
	Johnius sp. 2	gelama
	Johnius sp. 3	gelama
	Protonibea diacanthus	ibu gelama
Scombridae	*Ratrelliger kanagurta*	kembong
	Rastrelliger brachysoma	pelaling
Serranidae	*Epinephelus bleekeri*	kerapu
Stromatidae	*Papmpus chinensis*	bawal tambak
	Pampus argenteus	bawal putih
	Parastromateus niger	bawal hitam
Toxotidae	*Toxotes jaculatrix*	sumpit
Portunidae	*Portunus pelagicus*	ketam bunga/ketam renjong
	Charybdis feraiata	ketam laut/ketam salib
Penaeidae	*Fenneropenaeus merguiensis*	udang putih/kertas
	Fenneropenaeus indicus	udang putih
	Parapenaeopsis sp.	kulit keras/minyak jalur
	Metapenaeus sp.	susu/kuning/pasir
Family = 26	**Taxa = 51**	

Table P Fish taxa recorded from the coastal waters of Selangor (source: Chong *et al*., 2012; Lee *et al*., 2016; Teoh *et al*., 2017) (*low commercial value but consumed; **commercially exploited)

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Ambassidae	*Ambassis gymnocephalus*	X	X	X	X	X	X	X
	Ambassis ambassis	X						
	Ambassis kopsii	X						
Anguillidae	*Anguila nebulosa nebulosa*	X						
Aplocheilidae	*Aplocheilus panchax*	X						
Apogonidae	*Ostorhinchus fasciatus*	X						
	Jaydia ellioti	X						
	Yarica hyalosoma	X						
Ariidae*	*Arius arius*						X	X
	Arius maculatus	X	X		X	X	X	X
	Arius microcephalus						X	
	Arius oetik						X	X
	Arius venosus	X	X		X	X	X	X
	Batracocephalus mino	X						
	Cryptarius truncatus	X	X				X	X
	Hexanematichthys sagor	X	X				X	X
	Ketengus typus	X	X					
	Nemapteryx caelata	X	X			X	X	X
	Nemapteryx nenga						X	X
	Osteogeneiosus militaris	X	X	X	X		X	X
	Plicofollis argyropleuron	X			X		X	X
	Arius sp. A					X		
	Arius sp. B					X		
Atherinidae	*Atherinomorus duodecimalis*	X						
	Atherinomorus lacunosus	X						
Bagridae*	*Mystus gulio*	X						
Balistidae*	*Abalistes stellaris*	X						
Batrachoididae	*Allenbatrachus grunniens*	X			X			X
Belonidae*	*Ablennes hians*	X						
	Strongylura leiura	X						
	Strongylura strongylura	X					X	X
	Tylosurus crocodilus	X						X
Callionymidae	*Callionymus sagitta*	X						
	Callionymus schaapi	X						
Carangidae**	*Alectis indica*	X						
	Alepes djedaba	X						
	Alepes melanoptera	X						
	Atropus atropos	X						
	Carangoides armatus	X						
	Carangoides malabaricus	X					X	
	Caranx melampygus	X						
	Caranx ignobilis	X						
	Megalops cordyla	X						
	Parastromateus niger	X				X		
	Scomberoides commersonnianus	X		X			X	X
	Scomberoides tala							X
	Scomberoides tol							X
	Selaroides leptolepis	X				X		
	Trachinotus blochii						X	X

Table P continued

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Carcharinidae*	*Rhizoprionodon acutus*	X						
Centropomidae**	*Lates calcarifer*	X						
Chirocentridae**	*Chirocentrus nudus*						X	
	Chirocentrus dorab	X						
Cichlidae*	*Oreochromis mossambicus*	X					X	X
Clupeidae*	*Anodontostoma chacunda*	X	X	X				
	Escualosa thoracata	X	X	X				
	Hilsa keele	X					X	X
	Herklotsichthys punctatus	X						
	Ilisha megaloptera					X		
	Ilisha melastoma		X	X	X			
	Opisthopterus tardoore						X	X
	Sardinella fimbriata	X						
	Sardinella melanura	X						
	Sardinella gibbosa	X						
	Tenualosa toli	X						
Cynoglossidae**	*Cynoglossus arel*							X
	Cynoglossus bilineatus	X		X			X	X
	Cynoglossus cynoglossus						X	X
	Cynoglossus lingua	X	X	X	X	X	X	X
	Cynoglossus macrolepidotus	X						
	Cynoglossus puncticeps	X					X	X
	Cynoglossus sp.		X	X	X			
	Cynoglossidae sp.					X		
Dasyatidae**	*Brevitrygon imbricata*	X						
	Dasyatis bebbetti							X
	Telatrygon zugei	X	X	X			X	X
	Himantura marginata	X						
	Maculabatis pastinacoides						X	X
	Brevitrygon walga	X	X	X	X	X	X	X
	Himantura uarnak	X						
	Neotrygon kuhlii	X			X	X		X
	Tyeniura lymma	X					X	
Drepanidae**	*Drepane longimana*	X	X	X	X		X	X
	Drepane punctata	X			X		X	X
Eleotridae	*Butis butis*	X	X					
	Butis koilamatodon	X					X	
	Unidentified Eleotridae		X					
Elopidae**	*Elops machnata*	X						
Engraulidae*/**	*Coilia dussumieri*	X		X	X	X	X	X
	Coilia macrognathos	X		X				
	Setipinna taty	X	X	X	X	X	X	X
	Stolephorus baganensis	X					X	X
	Stolephorus indicus	X						
	Stolephorus tri	X			X		X	X
	Thryssa dussumieri	X						
	Thryssa hamiltonii	X	X		X		X	X
	Thryssa kammalensis	X	X				X	X
	Thryssa mystax	X	X		X			X
	Thryssa setirostris	X						

Table P continued

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Ephhipidae*	*Ephippus orbis*	X						
	Platax teira	X					X	X
Gerreidae*	*Gerres abbreviatus*						X	X
	Gerres erythrourus	X		X	X			
	Geres filamentosus	X						
Gobiidae	*Acentrogobius canius*	X						
	Aulopareia atripinnatus	X						
	Boleopthalmus boddarti	X						X
	Glossogobius giurus	X	X					
	Gobiopsis macrostoma	X						
	Odotamblyopus rubicundus						X	X
	Ophiocara porocephala	X						
	Opthicthys rhytidodermatodus	X						
	Oxuderes dentatus	X						X
	Parachaeturichthys polynema	X						
	Paratrypauchen microcephalus	X						
	Periopthalmodon scholsseri	X						
	Pseudapocryptes elongatus	X						
	Stigmatogobius sadanundio	X						
	Taenoides nigromarginatus						X	X
	Trypauchen vagina		X	X				
Gymnuridae*	*Gymnura poecilura*	X		X	X	X		
Haemulidae**	*Plectorhinchus gibbosus*						X	
	Pomadasys argenteus	X						
	Pomadasys kaakan	X					X	X
	Pomadasys maculatus	X					X	
Harpodontidae**	*Harpodon nehereus*	X						
Hemiramphidae	*Hemiramphus far*						X	X
	Hemirhampus quoyi(=gaimardi)	X						
	Zenarchopterus buffonis	X						
	Zenarchopterus caudovittatus	X						
	Zenarchopterus dispar	X						
Hemiscylliidae	*Chiloscyllium hasselti*						X	
	Chiloscyllium indicum	X			X	X		
	Chiloscyllium plagiosum						X	X
Kurtidae	*Kurtus indicus*	X					X	X
Labridae	*Halichoeres bicolor*	X						
Latidae	*Lates calcarifer*						X	X
Leiognathidae*	*Gazza minuta*	X						
	Photopectoralis bindus	X						
	Leiognathus brevirostris	X	X	X	X	X		
	Karalla daura	X						
	Equulites elongatus	X						
	Aurigequula fasciata	X						
	Equulites lineolatus	X						
	Eublekeeria splendens	X						
	Secutor insidiator						X	X
	Secutor ruconius	X			X	X	X	X
Lobotidae	*Lobotes surinamensis*						X	X

Table P continued

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Lutjanidae**	*Lutjanus argentimaculatus*	X						
	Lutjanus johnii	X			X			
	Lutjanus malabaricus	X			X			
	Lutjanus sanguineus	X						
Monocanthidae	*Paramonocanthus choirocephalus*	X						
	Paramonocanthus pussilus	X						
	Stephanolepis auratus	X						
Monodactylidae*	*Monodatylus argenteus*	X						
Mugilidae*/**	*Liza malinoptera*	X					X	X
	Liza subviridis	X	X				X	X
	Liza vaigiensis						X	X
	Paramugil parmatus						X	
	Osteomugil cunnesius	X						
Mullidae*	*Upeneus sulphureus*	X	X	X	X	X	X	X
	Upeneus tragula	X						
Muraenessocidae**	*Muraenesox bagio*	X		X		X		
	Congresox talabonoides							X
Muraenidae	*Gymnothorax tile*	X						
	Gymnothorax thrysoidea	X						
	Uroptergius concolor	X						
Myliobatidae**	*Aetomylaeus nichofii*	X						
Narcinidae	*Narcine timlei*					X		
Nemipteridae**	*Nemipterus hexodon*	X						
Narkidae	*Narke dipterygia*					X		
Orectolobidae	*Stegostoma fasciatum*	X						
Paralichthyidae**	*Pseudorhombus arsius*	X						
	Pseudorhombus javanicus	X						
	Pseudorhombus malayanus	X						
Platycephalidae*	Grammoplites scaber	X						
	Plartycephalus indicus	X						
	Rogadius asper	X			X		X	X
	Sorsogona tuberculata	X						
Plotosidae**	*Plotosus canius*	X	X		X			
	Plotosus lineatus	X					X	
Polynemidae**	*Eleutheronema tetradactylum*	X	X	X			X	X
	Leptomelanosoma indicum	X					X	X
	Polydactylus plebeius	X						
	Polynemus paradiseus						X	X
	Polydactylus sextarius				X			X
Pristigasteridae*	*Ilisha elongata*	X						X
	Ilisaha filigera	X						
	Ilisha kampeni	X						
	Ilisha melanoptera	X						
	Ilisha megaloptera	X						
	Ilisha macrogaster							X
	Ilisha melastoma	X					X	X
	Opisthopterus tardoore	X						
Psettodidae**	*Psettodes erumei*	X						
Scatophagidae*	*Scatophagus argus*	X	X	X	X		X	X

Table P continued

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Sciaenidae*/**	*Aspericorvina jubata*	X	X				X	X
	Dendrophysa russelii	X	X				X	X
	Johnius amblycephalus	X						
	Johnius belangerii	X	X	X	X	X	X	X
	Johnius borneensis	X	X				X	X
	Johnius carouna	X	X	X	X	X	X	X
	Johnius carutta	X						
	Johnius coitor	X						
	Johnius trachycephalus	X						X
	Johnius weberi	X	X					
	Nibea soldado	X	X				X	X
	Otolithes ruber	X					X	X
	Otolithoides biauritis	X					X	X
	Panna microdon	X	X	X			X	X
	Pennahia anea	X	X		X	X	X	X
	Pennahia argentata	X						
	Protonibea diacanthus	X					X	
	Sciaenidae sp.				X			
Scombridae**	*Rastrelliger brachysoma*						X	
	Rastrelliger kanagurta	X						
	Scomboromorus commerson							X
	Scomboromorus guttatus	X						
Scorpaenidae	*Trachicephalus uranoscopus*	X						
	Vespicula trachinoides	X						
Scyliorhinidae	*Atelomycterus marmoratus*	X						
Serranidae**	*Epinephelus* sp.							X
	Epinephelus longispinis	X						
Siganidae**	*Siganus canaliculatus*	X				X	X	X
	Siganus javus	X						
	Siganus vermiculatus						X	
Sillaginidae**	*Sillago chondropus*	X						
	Sillago sihama	X			X		X	X
Soleidae**	*Solea ovata*	X						
	Synaptura commersonii	X						
	Zebrais quagga	X						
Sphyraenidae**	*Sphyraena barracuda*	X		X				
	Sphyraena jello	X						
	Sphyraena putnamae							X
Stromateidae**	*Pampus argenteus*	X	X	X	X		X	X
	Pampus chinensis	X			X	X	X	X
Syngnathidae	*Doryichthys boaja*							X
Synodontidae**	*Harpadon nehereus*		X	X			X	X
	Saurida tumbil	X						
	Saurida undosquamis	X						
Terapontidae*	*Terapon jarbua*	X					X	X
	Terapon theraps	X	X	X	X	X	X	X

Table P continued

Family	Species	Chong et al. (2012)	Teoh et al. (2017)				Lee et al. (2016)	
		Selangor Mangroves & Coastal Waters	Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Bagan Pasir Mudflats	Sungai Buloh Mudflats
Tetraodontidae	*Arothron leopardus*	X						
	Chelonodon patoca	X		X				
	Lagocephalus lunaris	X						X
	Takifugu oblongus	X		X			X	X
	Tetraodon fluviatilis	X	X	X	X		X	X
	Dichotomyctere nigroviridis	X						
Toxotidae	*Toxotes chatareus*	X	X					
	Toxotes jaculatrix	X					X	X
	Toxotes microlepis						X	X
Triacanthidae	*Pseudotriacanthus stringilifer*	X						
	Triacanthus biculeatus	X						
	Triacanthus nieuhofii						X	X
	Tripodichthys blochii	X			X			
Trichiuridae*	*Lepturacanthus savala*	X	X			X	X	X
	Trichiurus lepturus	X	X	X	X		X	X
No of Families = 72	**Taxa Richness =258**	**208**	**46**	**34**	**41**	**30**	**91**	**98**

Table Q Invertebrates of the Selangor coastal waters (source: Chong *et al*., 2012 & Teoh *et al*., 2017) (*low commercial value but consumed; **commercially exploited)

Family	Species	Teoh *et al*. (2017)				Chong *et al*. (2012)
		Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Selangor Mangroves & Coastal Waters
Alpheidae*	*Alpheus sp.*					X
	Synalpheus sp.					X
Arcidae	*Anadara nodifera*	X				
Calappidae	*Matuta planiceps*					X
Diogenidae	*Clibanarius infraspinatus*		X	X		
	Diogenes avarus	X				
	Clibanarius sp.			X	X	
	Diogenes sp. A	X	X	X		
	Diogenes sp. B		X			
Dorripidae	Unidentified Dorippidae	X			X	
	Dorripoides facchino					X
	Neodorippe callida					X
	Heikea japonica					X
Epialtidae	*Phalangipus longipes*	X			X	
	Hyastenus diacanthus	X		X	X	
	Doclea rissoni			X	X	
	Enoplometopus pransor			X		
Eriphiidae	*Myomenippe hardwickii*					X
Euryalidae	*Euryale* sp.			X		
Hippolytidae	*Mimocaris* sp.					X
Holothuriidae	Acaudinai molpadioides					X
Leucosiidae	*Philyra* sp.		X			
Limulidae	*Carcinoscorpius rotundicauda*	X				X
	Tachypleus gigas	X			X	X
Loliginidae	*Uroteuthis duvaucelii*	X		X	X	
Luidiidae	*Luidia* sp.	X				
	Luidia penangensis					X
Majidae	*Doclea ovis*					X
	Doclea rissoni					X
	Hyastenus diacanthus					X
Matutidae	*Matuta planipes*			X	X	
Melongenidae	*Pugilina cochlidium*	X				
Muricidae	*Thais* sp.			X		
Mytilidae	*Perna viridis*			X		
Nassariidae	*Nassarius dorsatus*	X				
	Nassarius jacksonianus	X				
	Nassarius olivaceus	X				
	Nassarius sp.	X				
Naticidae	*Natica* sp.	X				
Palaemonidae**	*Exopalaemon styliferus*	X				
	Macrobrachium equidens	X	X			
	Macrobrachium rosenbergii					X
	Paleomon styliferus					X
Pectinidae	*Volachlamys singaporina*		X			
Penaeidae**	*Alcockpenaeopsis hungerfordii*			X		
	Metapenaeus affinis	X	X	X	X	
	Metapenaeus brevicornis	X	X	X	X	X
	Metapenaeus ensis					X
	Metapenaeus lysianassa			X		X
	Metapenaeus stridulans					X
	Metapenaeus tenuipes				X	
	Parapenaeopsis coromandelica			X		X
	Parapenaeopsis gracillima				X	X
	Parapenaeopsis hardwickii	X		X	X	X
	Parapenaeopsis hungerfordii					X

Table Q continued

Family	Species	Teoh *et al*. (2017)				Chong *et al*. (2012)
		Sungai Langat	Selat Lumut	Klang Islands	Pulau Carey South	Selangor Mangroves & Coastal Waters
Penaeidae**	*Parapenaeopsis maxillipedo*					X
	Parapenaeopsis sculptilis	X	X	X	X	X
	Parapenaeopsis tenella					X
	Penaeus indicus	X		X	X	X
	Penaeus japonicus					X
	Penaeus merguiensis	X	X	X	X	X
	Penaeus monodon					X
	Penaeus penicillatus					X
	Penaeus semisucatus					X
	Solenocera subnuda					X
	Trachypenaeus fulvus					X
Portunidae*/**	*Charybdis affinis*	X	X	X	X	X
	Charybdis anisodon					X
	Charybdis callianassa					X
	Charybdis feriata					X
	Charybdis japonica			X		X
	Charybdis natator					X
	Charybdis variegata					X
	Portunus pelagicus			X		
	Scylla serrata					X
	Scylla paramamosain					X
	Thalamita crenata					X
Sepiidae**	*Sepiella inermis*			X	X	
	Sepia sp.			X		
Sergestidae**	*Acetes* sp.	X			X	
	Acetes erytheraeus					X
	Acetes indicus					X
Spatangidae	*Lovenia elongata*					X
Squillidae**	*Claridopsis scorpio*					X
	Harposquilla harpax					X
	Harpiosquilla raphidea			X		X
	Oratosquilla interrupta					X
	Oratosquillina perpensa	X	X	X	X	X
	Oratosquilla oratoria					X
Temnopleuridae	*Salmacis dussumieri.*		X	X	X	X
	Unidentified anthozoan				X	
	Unidentified caridean			X	X	
	Unidentified echinoderm A			X	X	
	Unidentified echinoderm B			X		
	Unidentified echinoderm C			X		
	Unidentified gastropoda	X				
	Unidentified octopoda				X	
	Unidentified ophiuroidea			X		
Xanthidae	*Parapanope singaporensis*					X
No of Families = 31	**Taxa Richness = 89**	**28**	**13**	**33**	**26**	**57**

Table Q1 Density and biomass of fish and invertebrates from the Klang waters via trawls (source: Teoh *et al* ., 2017)

Sampling Stations	Fish		
	Density (ind/ha)	Biomass (no/ha)	Number of Taxa
Selat Lumut	1,077 ± 518	14.2 ± 3.4	34
Pulau Tengah	787	18.4	17
Selat Kering	1158	31.5	13
Selat Che Mat Zin	302	23.9	27
Pulau Pintu Gedong	373	6.2	18
South Carey Island	2,743 ± 2,797	26.0 ± 28.2	30
Sungai Langat	3,655 ± 2,826	56.8 ± 51.8	47
Sampling Stations	**Invertebrates**		
	Density (ind/ha)	Biomass (no/ha)	Number of Taxa
Selat Lumut	1,298 ± 1,788	13.6 ± 18.4	13
Pulau Tengah	347	4	11
Selat Kering	1,646	22.3	18
Selat Che Mat Zin	67	3.4	11
Pulau Pintu Gedong	545	5.3	18
South Carey Island	2,320 ± 2,874	10.9 ± 9.3	26
Sungai Langat	1,687 ± 1,379	6.0 ± 2.9	28

Table QA Standard lengh (SL) of fishes from 3 sampling locations in the coastal waters of Klang (see Fig. A2 for sampling locations)

Fish Species	Pulau Pintu Gedong			South of Selat Lumut Mouth			Kg. Sg. Pinang Jetty, Selat Lumut			Mean SL/Max SL
	n	SL (cm)	Range	n	SL (cm)	Range	n	SL (cm)	Range	
Anodontostoma chacunda							1	13.0		0.65
Carangoides malabaricus				1	29.0					0.48
Drepane punctata	1	13.0					4	10.5 ± 1.0	10 - 12	0.26
Eleutheronema tetradactylum	15	55 ± 6.1	44 - 69	10	45.5 ± 5.2	33 - 49	6	22.2. ± 5.4	12.5 - 28	0.35
Hexanematichthys sagor				4	38.4 ± 4.7	33 - 43	5	23.1 ± 1.1	22 - 25	
Johnius belangerii				1	16.0		1	13.5		0.53
Johnius carouna							5	12.1 ± 1.5	10 - 13.5	
Lates calcarifer				3	39.1 ± 0.9	38.2 - 40				0.20
Leiognathus nuchalis							1	7.0		
Lutjanus johnii	1	29.0		2	26 ± 1.4	25 - 27				0.41
Megalops cyprinoides				2	34.5 ± 0.7	34 - 35				0.23
Muraenesox cinereus				1	95.0					
Osteogeneousus militaris							4	25.9 ± 4.5	19.2 - 28.5	
Pampus argenteus				2	10.5 ± 0.7	10 - 11	1	15.0		0.25
Papmpus chinensis							2	11.9 ± 2.8	10 - 13.9	0.35
Platycephalus indicus				3	37 ± 2.0	35 - 39				0.39
Pomadasys argenteus	3	38.6 ± 5.5	35 - 45	3	28 ± 2.6	25 - 30				0.45
Protonebia anea				2	13.2 ± 2.6	11.3 - 15				
Scomberoides tala				1	32.5					0.52
Telatrygon zugei							4	20 ± 2.8	16 - 22	0.29

Table Q2 Recreational fishes caught in the coastal waters and the channles of the Klang Islands

Fish Taxa	Weight Range (kg)
Dasyatidae (pari)	
Drepane punctata (daun baharu)	
Eleutheranoma tetradactylum (senangin)	1 - 1.2
Epinephelus fuscoguttatus (kerapu naga)	6.5
Himantura uarnak (pari harimau/rimau)	5
Lates carcarifer (siakap)	1.7 - 4.5
Lujanus argentimaculatus (merah)	1.2 - 3.1
Lutjanus johnii (tanda/jenahak)	0.6 - 5.2
Pampus/Parastromateus (bawal)	
Polydactylus plebius (kurau)	2.1 - 2.3
Pomadasys argenteus (tebal pipi)	0.5 - 0.8
Portunus pelagicus (ketam renjong)	
Psettodidae/Paralichthyidae (sebelah)	
Scylla serrata (ketam bakau)	
Telatrygon zuge i (ketuka)	

Table R Bivalves and gastropods collected from the mangroves and mudflats of the Klang Islands (source: Wong & Teh, 2019)

Class	Family	Local Name	Species
Bivalvia	Arcidae	Kerang Bulu	*Anadara globosa*
		Kerang	*Tegillarca granosa*
	Cyrenidae	Lokan	*Geloina expansa*
		Tongot/Lokan	
	Donacidae	Cemeh	*Donax faba*
		Kijing/Kijing	
	Glauconomidae	Bakau/Siput Biji Nangka	*Glauconome virens*
	Lucinidae	Lokan Tanah	*Austriella corrugata*
	Mactridae	Ibu Pahat	*Mactra grandis*
	Ostreidae	Tiram/Teritip	*Crassostrea* sp.
		Teritip/Titip	*Saccostrea* sp.
	Pharidae	Cemeh bakau/Lala Pahat	*Orbicularia orbiculata*
			Neociliqua winteriana
	Pholadidae	Mentarang	*Pholas orientalis*
	Pinnidae	Siput Biong/Siput B	*Atrina* sp.
	Placunidae	Siput Cermin/Siput CD	*Placuna placenta*
	Solenidae	Pepahat/Pahat	*Sole* n sp.1
		Katip/Katep	*Solen* sp.2
	Tellinidae	Siput Matahari Lala/Lala	*Tellina* sp.
	Veneridae	Kuning/Cemeh/Kepah Coreng	*Marcia recens*
		Kepah/Kepah Gading	*Meretrix lyrata*
		Kepah	*Meretrix* sp.
		Lala Kuning	*Protapes gallus*
Gastropoda	Ellobidae	Siput Kantel	*Ellobium aurismidae*
		Siput Diat	*Ellobium aurisjudae*
	Melongenidae	Unam	*Volegalea cochlidium*
	Muricidae	Siput Batu	*Chicoreus capucinus*
		Siput Jengking	*Murex trapa*
		Siput Kedeit	*Reishia* sp. 1
		Siput Gidek	*Reishia* sp. 2
	Naticidae	Siput Bulan/Siput B	*Paratectonatica tigrina*
	Neritidae	Siput Timba/Siput T	*Nerita* sp.
	Potamididae	Siput Hisap/Siput S	*Cerithidea obtusa*
		Siput Pahit	*Pirenella alata*
	Volutidae	Siput Bihong	*Cymbiola nobilis*
2 Classes	**21 Families**		**32 Taxa**

Table S Aquaculture (cage culture) operators from the Klang Islands (source: State Fisheries Department)

NO	OWNER	AREA (hectare)
1	KS AQUACULTURE	4.20
2	MIE AGRO FARM SDN BHD	2.00
3	OCEAN KINGDOM SDN BHD	1.50
4	CHUA SWEE CHOON	1.27
5	EVERBLUE AQUACULTURE SDN BHD	1.20
6	JAYA QUAFARM SDN BHD	1.10
7	DEE SIN FISH FARM	1.00
8	DEE SIN AQUACULTURE	1.00
9	HTL AQUACULTURE	0.80
10	ZAMRI BIN BUANG	0.70
11	CHIA GEK SIANG	0.66
12	IKMAJU SDN BHD	0.62
13	SIANG HENG FISH FARM SDN BHD	0.60
14	ISRF SDN BHD	0.55
15	TONGJIN FISH FARM	0.54
16	TAN JIAK KOK	0.51
17	LIAN YU AQUACULTURE SDN BHD	0.51
18	TAN JIAK KEAN	0.50
19	ROSYAFF FISH FARM SDN BHD	0.50
20	SUNLY FISH FARM	0.47
21	CHUA KANG KEO	0.45
22	HO HING AQUACULTURE	0.43
23	TAN TAI GUAN	0.42
24	SIN LIAN HUAT FISH FARM	0.41
25	UNITED MARINE AQUACULTURE SDN BHD	0.40
26	MEGAFISH AQUACULTURE SDN BHD	0.40
27	LI HENG FISH DEALER	0.30
28	CHUA LEONG FUN	0.30
29	KA GET SENG@KOW GET SENG	0.20
30	HIKMAH RAUDAH SDN BHD	0.20
31	SIN HAI PENG AQUACULTURE SDN BHD	0.20
32	OASIS LONG DIANN MARINE BIO TECH SDN BHD	0.10
33	CHIA SEAH HUAT	0.09
34	YEO KOK LENG	0.04
	Total	**24.10**

Table S1 Aquaculture production (metric tonnes -mt) from Kuala Langat and Klang districts

Year	Kuala Langat (mt)	Klang (mt)
2015	1691.2	-
2016	850.9	-
2017	1626.9	494.8
2018	1369.8	511.7
2019	-	609.7

Table S2 Harmful Algal Blooms (HABs) repored from Malaysian waters

Harmful algal blooms

	HARMFUL MICROALGAE	LOCATION	IMPACT
2001	*Alexandrium minutum*	Tumpat, Kelantan	Shellfish contamination six hospitalised, one death
2002	*Prorocentrum minimum*	Johor Baru, Johor	Water discolouration
2003-2004	*Cochlodinium polykrikoides*	Kota Kinabalu, Sabah	Fish kills
2005	*Cochlodinium polykrikoides*	Kota Kinabalu, Sabah	Water discolouration
2006	*Cochlodinium polykrikoides*	Kuching, Sarawak, Kota Kinabalu, Sabah	Fish kills
2007	*Neoceratium furca*	Pangkor, Lumut, Penang	Water discolouration
2009	*Pyrodinium bahamense*	Kota Kinabalu and surrounding areas	Shellfish contamination
2013	*Pyrodinium bahamense*	West coast, Sabah	Shellfish contamination, 3 deaths, over 40 hospitalised

Table T Mangrove tree taxa from the Klang Islands and Pulau Carey

Tree Family	Tree Taxa
Avicenniaceae	*Avicennia alba* *Avicennia lanata* *Avicennia marina* *Avicennia officinalis*
Rhizophoraceae	*Bruguiera cylindrica* *Bruguiera gymnorrhiza* *Bruguiera hainesii* *Bruguiera parviflora* *Bruguiera sexangula* *Ceriops decandra* *Ceriops tagal* *Kandelia candel* *Rhizophora apiculata* *Rhizophora mucronata*
Sonneratiaceae	*Sonneratia alba* *Sonneratia griffithii* *Sonneratia caseolaris*
Rubiaceae	*Sychpiphora hyrophyllaceae*
Meliaceae	*Xylocarpus granatum* *Xylocarpus mollucensis* *Excoecaria agallocha*

Table U Mangrove gastropods sampled from mangroves at the south of Westports

Family	Species	Density (no/m^2)	Biomass (g/m^2)
Assiminiedae	*Sphaerassiminea miniata*	0.70 ± 34.15	0.16 ± 6.51
Ellobiidae	*Cassidula aurisfelis*	0.62 ± 18.71	2.24 ± 63.81
	Cassidula nucleus	0.19 ± 6.78	0.46 ± 6.78
Naticidae	*Neritina cornucopia*	0.13 ± 4.82	0.22 ± 10.32
	Neritina violacea	0.37 ± 5.31	0.47 ± 9.72
Potamididae	*Cerithidea obtusa*	0.77 ± 8.77	1.64 ± 8.77
	Pirenella cingulata	0.28 ± 8.60	0.14 ± 4.62
	Telescopium telescopium	0.31 ± 5.67	10.07 ± 166.93
	Density (no/m^2)	3.4 ± 1.78	
	Biomass (no/m^2)		15.41 ± 9.48

Table V Mangrove gastropod taxa from the Klang Islands (source: Singh & Norasekin, 2016)

		Sampling Sites		
Gastropod Family	**Gastropod Taxa**	**Pulau Klang**	**Pulau Ketam**	**Pulau Che Mat Zin**
Assimineidae	*Sphaerassiminea miniata*	+	+	+
Ellobiidae	*Cassidula aurisfelis*	+	+	+
	Cassidula nucleus	+	+	+
	Cassidula sp.	+		
	Ellobium aurisjudae	+	+	+
	Laemodonta punctigera		+	
	Laemodonta siamensis	+		
	Laemodonta sp.	+		+
	Melampus sp. 1	+	+	
	Melampus sp. 2	+		
	Phythia plicata	+	+	
	Phythia trigona	+		
Littorinidae	*Littoraria conica*	+	+	+
	Littoraria melanostoma		+	+
	Littoraria scabra	+		+
Muricidae	*Chicoreus capucinus*	+	+	+
Nassariidae	*Nassarius jacksonianus*	+		
	Nassarius olivaceus	+		+
Naticidae	Naticidae sp.	+		
	Nerita lineata	+	+	+
	Neritina cornucorpia	+	+	
	Neritina violacea	+	+	
Pachychilidae	*Melanoides* sp.	+		
Potamididae	*Cerithidea cingulata*	+	+	
	Cerithidea obtusa	+	+	+
	Telescopium mauritsi	+	+	+
	Telescopium telescopium	+		

Table W Mangrove taxa, density and diversity sampled from various locations in Peninsular Malaysia

[source: [a]Singh & Noreshekin (2017); [b]Singh (2013); [c]Singh & Wan Mohamad Nabil (2019); [d]Nur Anis *et al*. (2015); [e]Ajmal & Singh (2018); [f]Singh & Norashekin (2016)]

Location	Number of Taxa	Density (no/m^2)	ınnor	Pielou, J
P. Indah	8	3.4	1.9	0.93
[a]P Klang	25	3.36	2.3	0.72
[a]P Ketam	16	1.65	1.9	0.69
[a]P Che Mat Zin	13	0.86	1.2	0.47
[b]Tanjung Tuan	40	9.6	2.5	0.68
[b]P Besar	39	12.9	1.6	0.45
[b]P Merambong	21	4.3	2	0.66
[c]Melaka	16	0.92 - 3.66	3.2	0.84
[c]N. Sembilan	33	0.45 - 1.91	3.2	0.84
[d]Lukut	37	1.53 - 6.94	2.2	0.6
[e]Kuala Selangor	19	0.85	2.3	0.77
[f]Pristine Mangrov	27	1.75	2.3	0.69
[f]Semi Disturbed M	41	15.34	2	0.55
[f]Disturbed	29	11.55	1.5	0.63
[f]Rejuvenating	18	24.76	1.9	0.51

Table X Meiofauna of the mangrove shore of Selangor coast (source: Sasekumar, 1994)

Stations	Avicennia		Rhizophora		Bruguiera	
	A	B	A	B	A	B
Fauna						
Nematodes	885.1±226.5	79.9%	543.6±175.5	93.1%	347.2±151.2	85.3%
Harpacticoids	147.2±45.7	13.3	27.4±12.3	4.7	43.3±38.3	10.6
Oligochaetes	11.6±7.0	1.0	8.0±4.8	1.4	15.4±11.0	3.8
Kinorhynch	56.6±26.1	5.1	2.4±2.2	0.4	-	-
Others	8.8±5.8	0.8	1.9±1.3	0.3	1.1±0.5	0.3
Total	1109.3±27		583.3±186		407.0±188	

Table Y Mangrove crabs (Brachyura: Grapsoidea) known from the coastal mangroves of Selangor (source: Ribero *et al.,* 2019)

Family	Crab Taxa
Sesarmidae	*Clistocoeloma merguiense* *Episesarma* sp. *Episesarma versicolor* *Fasciarma fasciatum* *Nanosesarma andersonii* *Nanosesarma minutum* *Nanosesarma nunongi* *Nanosesarma pontianacense* *Neosarmatium smithi* *Parasesarma eumolpe* *Parasesarma lanchesteri* *Parasesarma onychophorum* *Parasesarma plicatum* *Sarmatium germaini* *Selatium brockii* *Sesarmoides kraussi*
Grapsidae	*Metopograpsus latifrons*
Varunidae	*Metaplax crenulata* *Metaplax elegans*

Table YA Bird taxa of the Klang Magrove Reserve (source: Norhayati *et al*., 2009)

Family	Species	Common Name	Habitat	Status
Accipitridae	*Elanus caerulus*	Black-shouldered Kite	OA	R
	Milvus migrans	Black Kite	OA	M
	Haliastur indus	Brahminy Kite	MG	R
Alcedinidae	*Alcedo atthis*	Common Kingfisher	MG/IS	R/M
	Ceyx erithacus	Oriental Dwarf Kingfisher	L	R/M
	Halcyon smyrnensis	Whited-throated Kingfisher	OA	R
	Halcyon pileata	Black capped Kingfisher	OA/MG	M
	Todiramphus chloris	White-collared Kingfisher		
Aredeidae	*Ardea cinerea*	Grey Heron	MG	R
	Ardea purpurea	Purple Heron	IS	R/M
	Butorides striatus	Little Heron	IS/MG	R/M
	Bubulcus ibis	Cattle Egret	OA/MG	M
	Egretta garzetta	Little Egret	IS/MG	M
	Ixobrychus sinensis	Yellow Bittern	IS	R/M
	Dupetor flavicollis	Black Bittern	IS	M
Campephagidae	*Lalage nigra*	Pied Triller	OA	R
Charadriidae	*Vanellus Indus*	Red-wattled Lapwing	OA	R
	Charadrius hiaticula	Little Ringed Plover	OA	
Ciconiidae	*Leptoptilos javanicus*	Lesser Adjuntant	MG/IS	R
Columbidae	*Streptopelia chinensis*	Spotted Dove	OA	R
	Geopelia striata	Peaceful Dove	OA	R
	Treron curvirostra	Thick-billed Pigeon	MG/L/LMF	R
Corvidae	*Corvus splendens*	House Crow	OA	
	Corvus macrorhynchos	Large-billed Crow	OA/L/LMF	R
Dicaeidae	*Prionochilus maculates*	Yellow-breasted Flowerpecker	L/LMF	R
Estrildidae	*Lonchura punctulata*	Scally-breasted Munia	OA	R
	Lonchura malacca	Chestnut-Munia	OA	R
	Lonchura maja	White-headed Munia	OA	R
Hirundinidae	*Hirundo rustica*	Barn Swallow	OA	R
	Hirundo tahitica	Pacific Swallow	OA	R
Laniidae	*Lanius cristatus*	Brown Shrike	OA	M
	Hydroprogne caspia	Caspian Tern		M
	Sterna hirundo	Common Tern		M
	Larus brunnicephalus	Brown-headed Gull		M
Meropidae	*Merops philippinus*	Blue-Tailed Bee Eater	OA	R
Motacillidae	*Motacilla flava*	Yellow Wagtail	OA	M
	Anthus novaeseelandiae	Richards pipit	OA	R

Note: OA = Open Area; MG = Mangrove; IS = Inland Forest Swamp; L = Lowland; LMF = Lowland Mountain Forest; R = Resident; M =Migrant

Table YB Waders, gulls and terns recorded from the Kapar Power Plant (Bakewell, 2009)

Waders		Gulls & Terns	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Actitis hypoleucos	Common Sandpiper	*Chlidonias leucopterus*	White-winged Tern
Arenaria interpres	Ruddy Turnstone	*Gelochelidon nilotica*	Gull-billed Tern
Calidris acuminata	Sharp-tailed Sandpiper	*Hydroprogne caspia*	Caspian Tern
Calidris alba	Sanderling	*Larus ridibundus*	Black-headed Gull
Calidris alpina	Dunlin Calidris alpina	*Sterna albifrons*	Little Tern
Calidris canutus	Red Knot	*Sterna hirundo*	Common Tern
Calidris ferruginea	Curlew Sandpiper		
Calidris minuta	Little Stint Calidris minuta		
Calidris ruficollis	Red-necked Stint		
Calidris tenuirostris	Great Knot		
Charadrius (alexandrinus) dealbatus	White-faced Plover		
Charadrius alexandrinus	Kentish Plover		
Charadrius dubius	Little Ringed Plover		
Charadrius leschenaultii	Greater Sand-Plover		
Charadrius mongolus	Lesser Sand-Plover		
Eurynorhynchus pygmaeus	Spoon-billed Sandpiper		
Limicola falcinellus	Broad-billed Sandpiper		
Limnodromus semipalmatus	Asian Dowitcher		
Limosa lapponica	Bar-tailed Godwit		
Limosa limosa	Black-tailed Godwit		
Numenius arquata	Eurasian Curlew		
Numenius phaeopus	Whimbrel		
Pluvialis fulva	Pacific Golden Plover		
Pluvialis squatarola	Grey Plover		
Tringa guttifer	Nordmann's Greenshank		
Tringa nebularia	Common Greenshank		
Tringa stagnatilis	Marsh Sandpiper		
Tringa totanus	Common Redshank		
Xenus cinereus	Terek Sandpiper		

Table YC Mammals of the Klang Mangrove Reserve (source: Norhayati *et al* . 2009)

Family	Species	Common Name	WCA 2010	IUCN Red List
Cercopithecidae	*Macaca fascicularis*	long-tailed macaque	P	Lr/Nt
	Trachypithecus obscurus	Dusky leaf monkey	TP	Lr/Nt
Muridae	*Rattus tiomanicus*	Malayan field rat		
Mustelidae	*Amblonyx cinera*	Oriental small-clawed otter	TP	Lr/Nt
Pteropodidae	*Macroglossus minimus*	Long-tongued nectar bat		Lr/Lc
Sciuridae	*Collosciurus notatus*	Plaintain squirrel		
Suidae	*Sus scrofa*	Wild pig		Nt
Viverridae	*Paradoxurus hermaphroditus*	Common palm civet	P	Lr/Nt
Note: WCA 2010 = Wildlife Conservation Act 2010; TP = Totally Protected; P = Protected; Lr = Low Risk; Lc = Least Concern; NT = Not Threatened				

Table YD Commercial fish families that utilise mangroves to complete their life cycle [adapted from Ronnback (1999)]

Megalopidae (tarpons)	Gerridae (mojarras)
Chanidae (milkfish)	Haemulidae (rubberlips, grunts)
Clupeidae (herrings, sardines, pilchards)	Sparidae (breams)
Engraulidae (anchovies)	Polynemidae (threadfins)
Ariidae (sea catfishes)	Scianidae (drums, croakers)
Plotosidae (eel catfishes)	Mullidae (goat fishes)
Mugilidae (mullets)	Cichlidae (cichlids)
Centropomidae/Latidae (barramundi, snooks)	Gobiidae (gobies)
Serranidae (groupers, sea basses)	Scatophagidae (scatties)
Sillaganidae (sillagos)	Siganidae (rabbit fishes)
Carangidae (king fishes)	Sphyraeinidae (barracudas)
Leiognathidae (soapies)	Stromateidae (ruffs)
Lutjanidae (snappers)	Cynoglossidae (tonguefishes)

Table Z Products and ecosystem services from mangroves (source: Ronnback, 1999)

Fuel	**Construction**
Firewood	Timber for scaffolds and heavy construction
Charcoal	Beams, poles, flooring, panelling, etc.
Alcohol	Boat building
	Dock piling
Fishing	Thatch, matting
Poles for fish traps	
Fish attracting shelters	**Other products**
Fishing floats	Fish, shellfish and mangrove roots for aquarium trade
	Medicines from bark, leaves, fruits and seeds
Food and beverages	Fodder for cattle, goats and camels
Fish poison	Fertilisers
Tannins for net and line preservation	Lime
Fish	Paper
Crustaceans	Raw material for handicraft
Molluscs	Cigarette wrappers
Other fauna	
Vegetables from propagules, fruit and leaves	**Ecosystem services**
Sweetmeats from propagules	Protection against floods, hurricanes and tidal waves
Condiments from bark	Control of shoreline and riverbank erosion
Sugar	Biophysical support to other coastal ecosystems
Honey	Provision of nursery, breeding and feeding grounds
Cooking oil	Maintenance of biodiversity and genetic resources
Tea substitutes	Storage and recycling of organic matter, nutrients and pollutants
Household items	Export of organic matter and nutrients
Alcohol	Biological regulation of ecosystem processes and functions
Vinegar	Biological maintenance of resilience
Fermented drinks	Production of oxygen
Furniture	Sink for carbon dioxide
Glue	Water catchment and groundwater recharge
Wax	Topsoil formation, maintenance of fertility
Household utensils	Influence on local and global climate
Incense	Habitat for indigenous people
Matchsticks	Sustaining the livelihood of coastal communities
Textiles, leather	Heritage values
Fur, skins	Cultural, spiritual and religious values
Synthetic fibres (e.g. rayon)	Artistic inspiration
Dye for cloth	Educational and scientific information
Tannins for leather preservation	Recreation and tourism

ANNEX A

Macrobenthos sampling utilising a Van Veen Grab

Plankton sampling utilising a plankton net

ANNEX B1

Alepes djedaba (selar)

Anodontostoma chacunda (selangat)

Arius maculatus (duri)

Brevitrygon imbricata (ketuka)

Drepane punctata (daun baharu)

Epinephelus bleekeri (kerapu)

ANNEX B2

Gymnura poecilura (pari helang)

Liza sp. (belanak)

Johnius sp. (gelama)

Lutjanus sp. (tanda & merah)

Lates calcarifer (siakap)

Megalops cordyla (cincaru)

ANNEX B3

Neotrygon kuhlii (pari lalat)

Pampus argenteus (bawal putih)

Parastromateus niger (bawal hitam)

Plotosus canius (semilang)

Protonibea diacanthus (ibu gelama - top; daun baharu - bottom)

Restrelliger kanagurta (kembong)

ANNEX B4

Sardinella gibbosa (tamban)

Toxotes jaculatrix (sumpit)

Carangoides malabaricus (demudok)

Dasyatis sinensis (pari)

Megalops cyprinoides (bulan)

ANNEX B5

Muraenesox cinerues (malong)

Osteogeneosus militaris (duri misai tebal)

Eleutheronema tetradactylum (senangin)

Pomadasys argenteus (tebal pipi)

Telatrygon zugei (pari/ketuka)

ANNEX B6

Fishes of high values landed by fishermen : *Eleutheronema tetradactylum* (senangin), *Plectorhinchus gibbosus* (kaci), *Pomadasys argenteus* (tebal pipi), *Drepane punctata* (daun baharu - juvenile), *Lutjanus johnii* (jenahak - juvenile)

Pampus chinensis (bawal tambak)

ANNEX C

Scylla serrata (ketam bakau)

Charybdis feriata (ketam salib/laut)

Portunus pelagicus (ketam renjong)

ANNEX D

Eleutheronema tetradactylum (senangin)

Himantura uarnak (pari rimau/harimau)

Polydactylus plebeus (kurau)

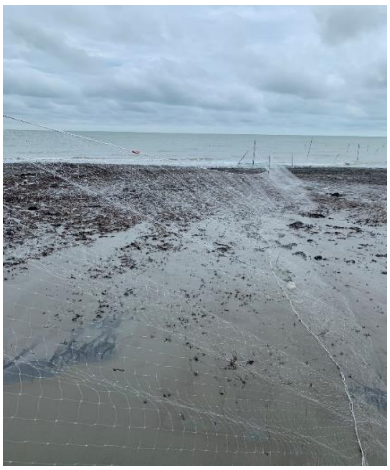
Pomadasys argenteus (tebal pipi) & *Lutjanus johnii* (jenahak)

Lutjanus argentimaculatus (merah)

Lutjanus johnii (jenahak)

ANNEX E

Traps used by locals to catch fish at Pantai Tg. Piai



Gill nets used as barrier nets by locals at Pantai Tg. Piai

Locals collecting fish from nets at Pantai Tg. Piai

Anodontostoma chacunda (selangat) caught in nets by locals at Pantai Tg. Piai

Scomberoides tala (talang) caught in nets by locals at Pantai Tg. Piai

Local resident collecting fish from nets at Pantai Tg. Piai (for personal consumption)

Rod fishing at Pantai Tg. Piai by locals

Families enjoying the beach at Pantai Tg. Piai

ANNEX F

Tegillarca granosa (kerang)

Gelonia expansa (lokan)

Meretrix lyrata (kepan/kepan gading)

Cerithedia obtusa (siput hisap/siput sedut)

ANNEX G - GPS locations for Aquaculture cage culture at Klang Islands

1	KS AQUACULTURE	
	N 03 00' 53.03" E 101 16' 32.83"	N 03 01' 16.56" E 101 16' 40.60"
	N 03 00' 55.68" E 101 16' 33.71"	N 03 01' 17.38" E 101 16' 38.51"
	N 03 00; 57.08" E 101 16' 32.42"	N 02 59' 58.91" E 101 16' 29.40"
	N 03 00' 58.04" E 101 16' 30.52"	N 02 59' 55.68" E 101 16' 27.25"
	N 03 00' 59.44" E 101 16' 27.07"	N 02 59' 54.23" E 101 16' 28.18"
	N 03 00' 56.15" E 101 16' 25.61"	N 02 59' 53.52" E 101 16' 29.70"
	N 03 00' 54.70" E 101 16' 26.93"	N 02 59' 52.60" E 101 16' 31.24"
	N 03 00' 53.81" E 101 16' 28.99"	N 02 59' 55.56" E 101 16' 33.20"
	N 03 01' 19.40" E 101 16' 16.20"	N 02 59' 57.11" E 101 16' 32.19"
	N 03 01' 22.20" E 101 16' 53.00"	N 02 59' 58.05" E 101 16' 30.39"
	N 03 00' 53.81" E 101 16' 28.99"	N 03 00' 90.90" E 101 16' 36.40"
	N 03 01' 13.55" E 101 16' 36.77"	N 03 00' 86.40" E 101 16' 47.50"
	N 03 01' 12.90" E 101 16' 38.29"	N 03 00' 53.81" E 101 16' 28.99"
	N 03 01' 12.44" E 101 16' 39.96"	N 02 59' 92.70" E 101 16' 46.30"
	N 03 01' 12.04" E 101 16' 41.96"	N 02 59' 96.60" E 101 16' 39.50"
	N 02 59' 08.64" E 101 16' 08.10"	N 02 59' 44.04" E 101 16' 24.77"
	N 02 59' 11.11" E 101 16' 09.65"	N 03 00' 46.96" E 101 16' 28.65"
	N 02 59' 14.69" E 101 16' 05.69"	N 03 00' 42.32" E 101 16' 26.11"
	N 02 59' 11.64" E 101 16' 03.88"	N 03 00' 38.30" E 101 16' 31.25"
	N 03 01' 15.11" E 101 16' 43.03"	N 03 00' 42.68" E 101 16' 33.90"
	N 03 01' 16.39" E 101 16' 42.13"	
2	JAYA QUAFARM SDN BHD	
	N 02 59' 41.18" E 101 16' 22.70"	N 02 59' 38.07" E 101 16' 26.02"
	N 02 59' 41.62" E 101 16' 24.17"	N 02 59' 41.14" E 101 16' 27.84"
	N 02 59' 41.95" E 101 16' 23.61"	N 02 59' 44.04" E 101 16' 27.84"
3	DEE SIN FISH FARM	
	N 02 59' 38.00" E 101 15' 27.39"	N 02 59' 44.09" E 101 15' 23.19"
	N 02 59' 40.44" E 101 15' 26.13"	N 02 59' 42.18" E 101 15' 20.25"
	N 02 59' 35.78" E 101 15' 24.51"	N 02 59' 38.59" E 101 15' 21.52"
	N 02 59' 40.44" E 101 15' 22.05"	
	CHUA SWEE CHOON	
4	N 03 01' 21.20" E 101 16' 36.63"	N 03 01' 25.62" E 101 16' 37.38"
	N 03 01' 23.05" E 101 16' 33.71"	N 03 01' 25.03" E 101 16' 36.58"
	N 03 01' 18.84" E 101 16' 32.16"	N 03 01' 20.66" E 101 16' 38.30"
	N 03 01' 18.20" E 101 16' 35.14"	
5	TONGJIN FISH FARM	
	N 03 00' 00.42" E 101 15' 82.14"	N 02 59' 54.68" E 101 15' 41.24"
	N 02 59' 57.63" E 101 15' 39.16"	N 02 59' 56.94" E 101 15' 43.67"
6	SUNLY FISH FARM	
	N 03 01' 16.77" E 101 16' 43.50"	N 03 01' 18.03" E 101 16' 48.00"
	N 03 01' 14.98" E 101 16' 47.18"	N 03 01' 20.35" E 101 16' 44.44"
7	TAN TAI GUAN	
	N 03 00' 51.70" E 101 16' 22.66"	N 03 00' 47.13" E 101 16' 23.19"
	N 03 00' 48.43" E 101 16' 21.58"	N 03 00' 50.10" E 101 16' 24.12"
8	TAN JIAK KOK	
	N 03 00' 41.17" E 101 16' 20.68"	N 03 00' 36.51" E 101 16' 20.55"
	N 03 00' 38.14" E 101 16' 18.80"	N 03 00' 39.39" E 101 16' 22.19"
9	HTL AQUACULTURE	
	N 02 59' 19.63" E 101 16' 14.80"	N 02 59' 24.06" E 101 16' 14.85"
	N 02 59' 22.12" E 101 16' 16.43"	N 02 59' 21.07" E 101 16' 12.99"
10	HO HING AQUACULTURE	
	N 03 01' 13.55" E 101 16' 31.30"	N 03 01' 01.34" E 101 16' 32.76"
	N 03 01' 10.85" E 101 16' 30.74"	N 03 01' 12.56" E 101 16' 33.33"
11	LIAN YU AQUACULTURE SDN BHD	
	N 03 01' 07.13" E 101 16' 28.39"	N 03 01' 29.44" E 101 16' 29.44"
	N 03 01' 02.80" E 101 16' 27.40"	N 03 01' 05.38" E 101 16' 30.04"
12	LI HENG FISH DEALER	
	N 03 01' 20.66" E 101 16' 38.30"	N 03 01' 20.30" E 101 16' 39.87"
	N 03 01' 24.50" E 101 16' 40.11"	N 03 01' 23.94" E 101 16' 40.95"
13	KA GET SENG@KOW GET SENG	
	N 03 00' 51.68" E 101 14' 21.38"	N 03 00' 49.68" E 101 14' 19.13"
	N 03 00' 51.09" E 101 14' 19.13"	N 03 00' 50.32" E 101 14' 21.46"
14	CHIA GEK SIANG	
	N 02 59' 08.95" E 101 14' 40.84"	N 02 59' 08.45" E 101 14' 36.52"
	N 02 59' 10.52" E 101 14' 38.99"	N 02 59' 25.78" E 101 14' 37.07"
15	IKMAJU SDN BHD	
	N 02 57' 24.82" E 101 15' 38.29"	N 03 00' 29.73" E 101 16' 17.36"
	N 02 57' 21.42" E 101 15' 39.41"	N 03 00' 24.61" E 101 16' 22.68"
	N 02 57' 21.48" E 101 15' 42.41"	N 03 00' 25.67" E 101 16' 14.47"
	N 02 57' 25.25" E 101 15' 41.39"	N 03 00' 20.80" E 101 16' 16.81"
16	CHUA KANG KEO	
	N 03 01' 15.66" E 101 16' 45.45"	N 03 01' 20.35" E 101 16' 44.44"
	N 03 01' 18.03" E 101 16' 48.00"	N 03 01' 19.33" E 101 16' 46.70"
17	HIKMAH RAUDAH SDN BHD	
	N 03 03' 31.70" E 101 22' 05.40"	N 03 03' 32.00" E 101 22' 02.30"
	N 03 03' 33.00" E 101 22' 02.70"	N 03 03' 38.30" E 101 16' 31.25"
18	SIN LIAN HUAT FISH FARM	
	N 03 00' 07.17" E 101 15' 49.14"	N 03 00' 02.91" E 101 15' 47.84"
	N 03 00' 04.62" E 101 15' 46.83"	N 03 00' 05.41" E 101 15' 49.40"
19	ZAMRI BIN BUANG	
	N 02 57' 37.15" E 101 15' 30.68"	N 02 57' 35.03" E 101 15' 31.67"
	N 02 57' 35.02" E 101 15' 31.24"	N 02 57' 36.14" E 101 15' 31.80"
20	ISRF SDN BHD	
	N 03 00' 14.69" E 101 16' 04.67"	N 03 00' 08.56" E 101 16' 04.31"
	N 03 00' 11.66" E 101 16' 02.06"	N 03 00' 11.58" E 101 16' 06.89"
21	UNITED MARINE AQUACULTURE SDN BHD	
	N 03 00' 25.57" E 101 16' 09.92"	N 03 00' 20.09" E 101 16' 08.15"
	N 03 00' 21.81" E 101 16' 07.27"	N 03 00' 24.03" E 101 16' 10.71"
22	OASIS LONG DIANN MARINE BIO TECH SDN BHD	
	N 02 59' 30.24" E 101 15' 09.57"	N 02 59' 25.67" E 101 15' 06.00"
	N 02 59' 27.22" E 101 15' 05.85"	N 02 59' 29.10" E 101 15' 09.75"
23	TAN JIAK KEAN	
	N 03 00' 42.41" E 101 16' 19.90"	N 03 00' 39.79" E 101 16' 17.18"
	N 03 00' 42.92" E 101 16'18.94"	N 03 00' 38.13" E 101 16' 17.53"
24	DEE SIN AQUACULTURE	
	N 02 59' 47.74" E 101 15' 44.10"	N 02 59' 43.00" E 101 15' 40.53"
	N 02 59' 44.51" E 101 15' 40.15"	N 02 59' 46.21" E 101 15' 44.24"
25	MIE AGRO FARM SDN BHD	
	N 03 00' 10" E 101 16' 02.18"	N 03 00' 10" E 101 16' 02.33"
26	MEGAFISH AQUACULTURE SDN BHD	
	N 03 01' 05.59" E 101 16' 43.85"	N 03 00' 58.79" E 101 16' 42.00"
27	EVERBLUE AQUACULTURE SDN BHD	
	N 02 59' 21.66" E 101 15' 01.90"	N 02 59' 20.01" E 101 15' 06.58"
28	CHIA SEAH HUAT	
	N 03 01' 00.87" E 101 16' 22.37"	N 03 01' 02.81" E 101 16' 22.67"
29	ROSYAFF FISH FARM SDN BHD	
	N 02 59' 23.85" E 101 14' 57.17"	N 02 59' 21.71" E 101 14' 56.72"
30	CHUA LEONG FUN	
	N 03 00' 58.41" E 101 15' 00.41"	N 03 00' 58.71" E 101 15' 01.24"
31	YEO KOK LENG	
	N 03 01' 18.11" E 101 15' 46.21"	N 03 01 18.27" E 101 16' 47.06"
32	SIANG HENG FISH FARM SDN BHD	
	N 02 59' 52.19" E 101 15' 48.60"	N 02 59' 49.53" E 101 15' 45.50"
33	SIN HAI PENG AQUACULTURE SDN BHD	
	N 02 59' 31.35" E 101 16' 12.65"	N 02 59' 36.42" E 101 16' 13.21"
34	OCEAN KINGDOM SDN BHD	
	N 02 59' 13.90" E 101 14' 53.38"	N 02 59' 09.15" E 101 14' 46.75"

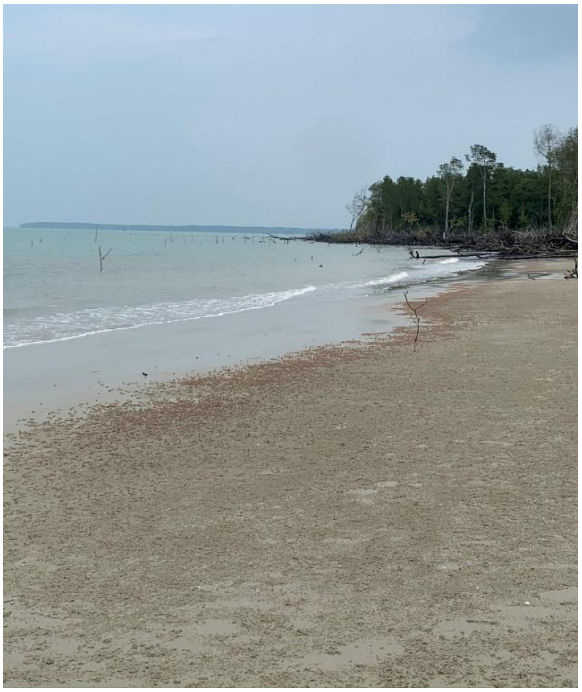
ANNEX H

Disturbed mangroves of Tanjung Piai (south of Westports)

Mmangrove erosion at Tanjung Piai beach (south of Westports)

The gentle slope of the Tanjung Piai beach (south of Westports)

ANNEX I



Soldier crab community (top pictures - in red) on the Tanjung Piai beach (south of Westports) and the crab viewed close (*Dotilla myctiroides*) (bottom)

ANNEX J Gastropd taxa sampled from the mangroves south of Westports

Cassidula auresfelis

Cassidula nucleus

Cerithedia obtusa

Neritina cornucopia

Neritina violacea

Pirenella cingulata

Telescopium telescopium

Sphaerassimenia minuta

ANNEX K

Crabs holes on the mangrove floor