

## ANNEX 5C FISHERIES SURVEY RESULTS

### 5C.1 Introduction

This *Annex* presents the results of the adult fish production survey, ichthyoplankton and fish post-larvae survey, and vessel survey conducted to better understand the fisheries resources and fishing operations within and in the vicinity of the Study Area. Field surveys at selected locations within and in the vicinity of the Study Area where potential impact could occur were conducted to update the latest fisheries baseline in these locations. The methodology for the surveys is described in detail in **Annex 5B**.

#### 5C.1.1 Survey Schedule

In accordance with the agreed methodology, fisheries surveys were carried out at three locations (Site A, Site B and Site C) within and in the vicinity of the Study Area (**Figure 5C.1**) from February 2021 to May 2021 to cover dry and wet seasons. The survey schedule is summarized in **Table 5C.1**. All surveys were conducted during daytime at each of the survey locations. During the course of the survey, sea conditions were mild to moderate and weather conditions were fine in general.

**Table 5C.1 Fisheries Baseline Surveys**

Survey	Frequency	Date	
		Dry Season	Wet Season
Adult Fish Production Survey	<ul style="list-style-type: none"> <li>■ Two times during dry season between February and March 2021</li> <li>■ Two times during wet season between April and May 2021</li> </ul>	26 Feb & 24 Mar 2021	16 Apr & 7 May 2021
Ichthyoplankton and Fish Post-larvae Survey	<ul style="list-style-type: none"> <li>■ Two times during dry season between February and March 2021</li> <li>■ Two times during wet season between April and May 2021</li> </ul>	16 & 27 Mar 2021	17 Apr & 8 May 2021
Vessel Survey	<ul style="list-style-type: none"> <li>■ Two times during dry season between February and March 2021 at the same time as the adult fish production surveys</li> <li>■ Two times during wet season between April and May 2021 at the same time as the adult fish production surveys</li> </ul>	26 Feb & 4 Mar 2021	16 Apr & 7 May 2021

### 5C.2 Adult Fish Production Survey

#### 5C.2.1 Overview

A total of about 11.68 kg (263 individuals) of fisheries resources were recorded from the three survey locations from the gill-netting and hand-lining surveys during the survey period from February to May 2021. Among all, about 9.03 kg (151 individuals) of 39 fish species from 23 families and about 2.66 kg (112 individuals) of 15 other fisheries species (i.e. crustaceans and cephalopod) from 7 families were recorded from the surveys. The adult fish production survey data (including fish and other fisheries species) in terms of abundance (no. of individuals), biomass (g) and diversity indices are summarised in **Table 5C.2**. The full list of species recorded during the surveys is presented in **Annex 5D**.

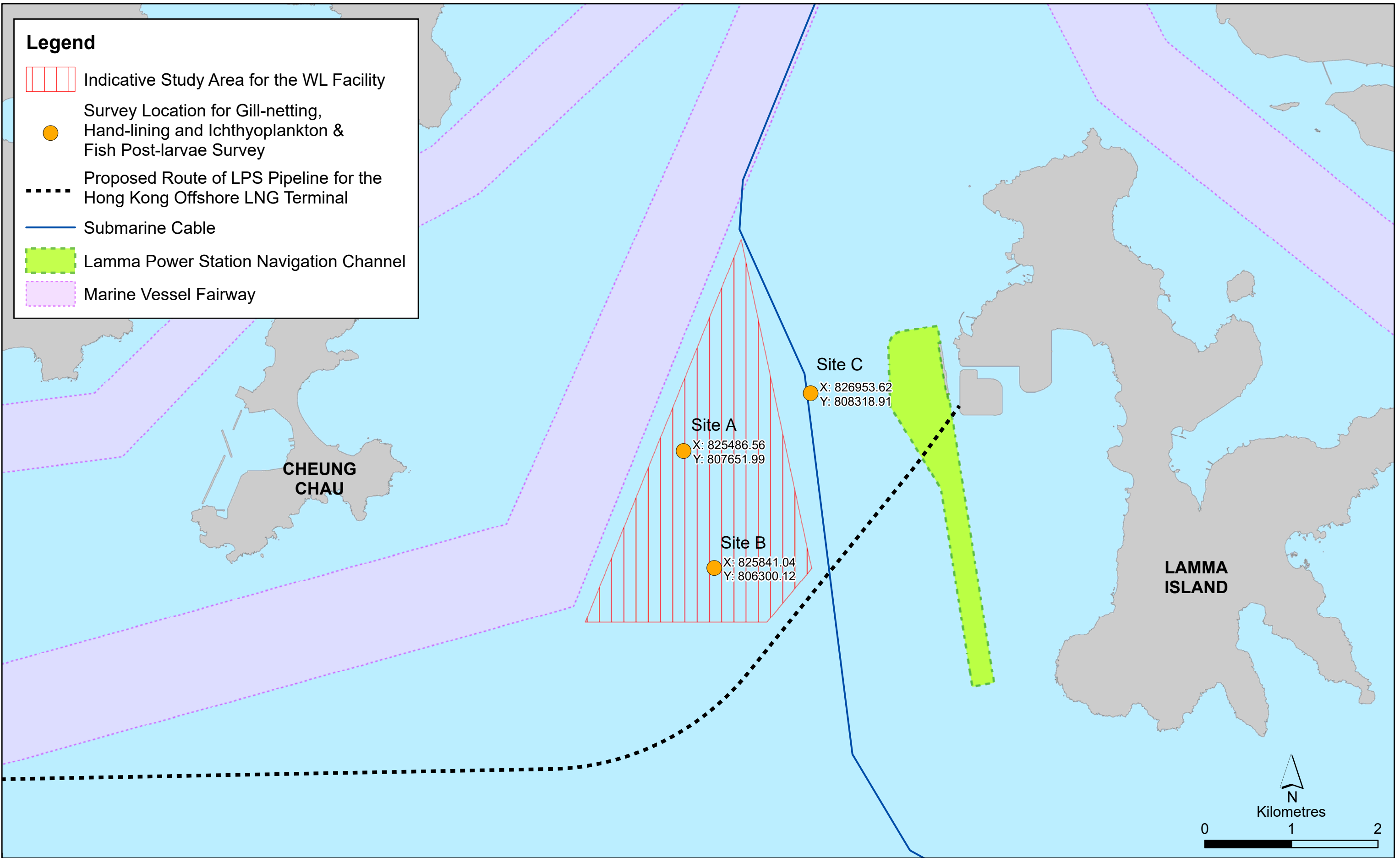


Figure 5C.1

Survey Locations for the Fisheries Surveys

**Table 5C.2 Summary of Adult Fish Production Survey (including Fish and other Fisheries Species) in the Dry and Wet Seasons. Mean values expressed as per survey**

Season	Dry Season			Wet Season		
Site	A	B	C	A	B	C
Total Abundance (Nos. of individuals)	48	84	56	31	26	18
Mean Abundance (Nos. of individuals)	24.0	42.0	28.0	15.5	13.0	9.0
Total Biomass (g)	1614.4	3958.3	1239.9	2824.8	1007.1	1036.2
Mean Biomass (g)	807.2	1979.2	620.0	1412.4	503.6	518.1
Species Richness (Total No. of Species)	19	33	19	21	10	12
Mean Species Richness (S)	9.5	17.5	10.0	12.0	6.0	7.5
Mean Species Diversity (H')	1.35	2.30	1.74	2.34	1.72	1.96
Mean Species Evenness (J')	0.92	0.93	0.84	0.95	0.96	0.97

### 5C.2.2 Species Composition

The species recorded within and in the vicinity of the Study Area generally consisted of fish with low commercial value (e.g. the croaker *Johnius belangerii*) and some fish and crustaceans of medium to high commercial value (e.g. mantis shrimps, prawns and crabs). The top ten recorded in the surveys species, in terms of abundance and biomass, are summarised in **Tables 5C.3** and **5C.4** respectively.

The most dominant fisheries species recorded in the survey by abundance was *Metapenaeus joyneri* (crustacean) of high commercial value, according to the Fish Marketing Organisation (FMO) <sup>(1)</sup> and other published references <sup>(2)</sup>. However this species only made up of 1.45% (0.30 kg) of the total fisheries biomass from the survey. The most dominant fish species by abundance was *Evynnis cardinalis* of medium commercial value and made up of 0.72% (0.15 kg) of the total fisheries biomass from the survey. Although some of the species of medium to high commercial value were recorded from the surveys, it should be noted that the biomass of these species were generally low when compared to the total catches of the survey. The most dominant species ranked by abundance / biomass contributed to 9-12% of the total abundance / biomass, indicating the fisheries resources of the survey areas were not dominated by any single species.

**Table 5C.3 Top Ten Dominant Species Ranked by Total Abundance from the Adult Fish Production Survey**

Group	Family	Species	Species Abundance (nos. of individual)	% of Total Abundance	Commercial Value (see Note below)
Crustacean	Penaeidae	<i>Metapenaeus joyneri</i>	32	12.17%	H
Crustacean	Squillidae	<i>Anchisquilla fasciata</i>	21	7.98%	H
Fish	Sparidae	<i>Evynnis cardinalis</i>	16	6.08%	M
Crustacean	Squillidae	<i>Harpiosquilla harpax</i>	14	5.32%	H
Fish	Paralichthyidae	<i>Pseudorhombus cinnamomeus</i>	14	5.32%	M
Fish	Sciaenidae	<i>Johnius belangerii</i>	13	4.94%	L
Fish	Engraulidae	<i>Thryssa dussumieri</i>	12	4.56%	L

(1) Fish Marketing Organization (FMO). Available at <https://www.fmo.org.hk>

(2) ERM (2018). Hong Kong Offshore LNG Terminal Environmental Impact Assessment (EIA) Report.

Group	Family	Species	Species Abundance (nos. of individual)	% of Total Abundance	Commercial Value (see Note below)
Crustacean	Portunidae	<i>Charybdis hellerii</i>	10	3.80%	-
Crustacean	Dorippidae	<i>Dorippoides facchino</i>	10	3.80%	-
Fish	Leiognathidae	<i>Leiognathus brevirostris</i>	8	3.04%	M

Notes:

For fish species: H= High (> 90 HK\$/kg); M = Medium (66 – 90 HK\$/kg); L = Low (< 66 HK\$/kg).

‘-’ indicates not commercially important species or no commercial value is evaluated by the FMO.

For crustacean and cephalopod species, commercial value made reference to approved EIA reports.

**Table 5C.4 Top Ten Dominant Species Ranked by Total Biomass from the Adult Fish Production Survey**

Group	Family	Species	Species Biomass (g)	% of Total Biomass	Commercial Value (see Note below)
Fish	Muraenidae	<i>Strophidon sathete</i>	1077.50	9.22%	L
Fish	Tetraodontidae	<i>Lagocephalus wheeleri</i>	933.30	7.99%	-
Fish	Sciaenidae	<i>Johnius belangerii</i>	910.60	7.80%	L
Fish	Nemipteridae	<i>Nemipterus japonicus</i>	681.30	5.83%	L
Fish	Sparidae	<i>Sparus aurata</i>	527.50	4.52%	L
Fish	Sciaenidae	<i>Pennahia argentata</i>	407.60	3.49%	M
Crustacean	Squillidae	<i>Anchisquilla fasciata</i>	406.60	3.48%	H
Crustacean	Squillidae	<i>Harpiosquilla harpax</i>	399.30	3.42%	H
Fish	Cynoglossidae	<i>Cynoglossus arel</i>	337.20	2.89%	H
Fish	Sillaginidae	<i>Sillago sihama</i>	333.40	2.85%	M

Notes:

For fish species: H= High (> 90 HK\$/kg); M = Medium (66 – 90 HK\$/kg); L = Low (< 66 HK\$/kg).

‘-’ indicates not commercially important species or no commercial value is evaluated by the FMO.

For crustacean and cephalopod species, commercial value made reference to approved EIA reports.

### 5C.2.3 Commercial Value

According to the Annual Report 2018/2019 of Fish Marketing Organization (FMO), the average wholesale prices of fresh marine fish ranged from 66.95 – 90.12 HK\$/kg with an average price of 74.80 HK\$/kg. The commercial value of adult fish resources recorded in the surveys was estimated based on FMO’s wholesale price of fresh marine fish and classified to three classes: High value (>90 HK\$/kg); Medium value (66-90 HK\$/kg); and Low value (<66 HK\$/kg). Species of which prices are not provided by the FMO, the commercial value were estimated with reference to previous EIA reports, submissions under EIAO and price of similar species. It should be noted that there are no published wholesale prices of crustaceans available for assessment of commercial value. Most edible species of mantis shrimps (e.g. *Harpiosquilla harpax*), prawns (e.g. *Penaeidae* spp.) and crabs (e.g. *Portunus* spp.) are generally regarded as having high commercial value <sup>(3)</sup>.

(3) ERM (2018). *Op. cit.*

Out of the 39 fish species recorded in the survey, 37 of them are classified as commercial fish species and more than half of them (23 out of 37 species) were of low commercial value (**Annex 5F**). For other fisheries species (crustaceans and cephalopod), 9 of the 15 species recorded in the survey are considered as commercial species, though the commercial species recorded are generally considered as of high value. Overall, although the dominant species consisted of fish and crustaceans with various commercial values (**Tables 5C.3** and **5C.4**), the catches were generally comprised of low to moderate commercial value fisheries species which accounted for about 75% of total biomass and 65% of total abundance.

### 5C.2.4 Spatial and Seasonal Variation

The mean species richness ( $S$ ), diversity ( $H'$ ) and evenness ( $J'$ ) of fisheries resources in the wet and dry seasons are presented in **Table 5C.2**. The abundance, biomass and species diversity varied amongst the three survey locations in the dry and wet seasons and they were higher at Site B and Site A in the dry and wet seasons, respectively. The mean biomass and abundance of fisheries resources was higher in the dry season than in the wet season. Belanger's croaker *Johnius belangerii* (12 individuals) was the most dominant fish species recorded in the dry season, while Cardinal seabream *Evynnis cardinalis* (11 individuals) was the most dominant fish species recorded in the wet season. The mean species diversity ( $H'$ ) within and in the vicinity of the Study Area are considered to be low and they were higher in wet season, while species evenness ( $J'$ ) in the wet and dry seasons were similar, indicating there was no dominating species recorded within and in the vicinity of the Study Area over the survey period.

## 5C.3 Ichthyoplankton and Fish Post-Larvae Survey

### 5C.3.1 Overview

There were 113 ichthyoplankton (i.e. eggs and larvae in planktonic phase and drift with the water currents) species from 34 families, 42 fish post-larvae (i.e. post-settlement stages when fish have attained a larger size, are no longer planktonic and are capable of swimming against currents) species from 20 families recorded from the three ichthyoplankton and fish post-larvae survey locations during the survey period. The species richness and density of ichthyoplankton and fish post-larvae are summarised in **Table 5C.5**. The full list of recorded species during surveys is presented in **Annex 5E**.

The mean densities of ichthyoplankton and fish post-larvae species are about 36.6 and 0.1 number/m<sup>3</sup>, respectively, which are comparable to other previous studies conducted in the Assessment Area (see **Section 5A2.4 of Annex 5A** for details). The level of ichthyoplankton and fish post-larvae resources of the Study Area varied over time (7.3-108.8 number/m<sup>3</sup> for ichthyoplankton; 0.02-0.23 number/m<sup>3</sup> for fish post-larvae) and was considered low in general.

**Table 5C.5 Summary of Fish Eggs, Fish Larvae and Fish Post-larvae over the Survey Period. Mean values expressed as per replicate**

Survey Date	16 Mar 2021			27 Mar 2021			17 Apr 2021			8 May 2021		
Site	A	B	C	A	B	C	A	B	C	A	B	C
<b>Fish Eggs</b>												
Family Richness (Total No. of Family)	16	10	13	14	14	12	15	15	14	10	12	12
Species Richness (Total No. of Species)	23	13	17	22	25	17	23	30	21	15	19	14
Mean Density (number / 1000 m <sup>3</sup> )	14883.90	6884.04	10967.86	14540.25	85640.78	18504.89	40806.48	77569.43	48218.35	17457.86	23957.80	13729.43
<b>Fish Larvae</b>												
Family Richness (Total No. of Family)	4	7	5	12	14	11	11	17	8	10	8	7
Species Richness (Total No. of Species)	4	9	5	14	23	13	19	38	11	11	15	10
Mean Density (number / 1000 m <sup>3</sup> )	396.29	372.38	215.96	992.97	1843.40	1320.43	5376.46	31261.81	2158.71	6062.35	8087.57	7392.83
<b>Fish Post-larvae</b>												
Total No. of Family	2	7	5	5	10	13	4	6	5	10	6	9
Total No. of Species	2	7	6	5	13	16	5	9	8	17	9	12
Mean Density (number / 1000 m <sup>3</sup> )	20.96	59.21	20.30	108.86	52.85	133.61	107.81	226.18	91.53	141.62	74.16	133.57

### 5C.3.2 Species Composition

The top ten dominant fish eggs, fish larvae and fish post-larvae species from surveys are summarized in **Tables 5C.6 to 5C.8**, respectively. The dominant fish eggs consisted of species with various commercial values, including *Nuचेquula nuchalis*, *Sillago sihama*, *Nibea albiflora*, *Diagramma pictum* and *Alepes kleinii*. The dominant fish larvae consisted of species with low to medium commercial values, including *Ambassis gymnocephalus*, *Sillago sihama*, *Nuचेquula nuchalis*, *Alepes kleinii* and *Apogonichthyoides cathetogramma*. The dominant fish post-larvae species consisted of species with low to medium commercial values, including *Ambassis gymnocephalus*, *Sardinella* sp., *Sardinella melanura*, *Inegocia japonica*, *Sillago sihama* and *Alepes kleinii*.

**Table 5C.6 Top Ten Dominant Fish Egg Species in all Survey Locations**

Family	Species	Commercial Value (see Note below)	Mean Density (No./ 1000 m <sup>3</sup> )	% of Total Density
Leiognathidae	<i>Nuचेquula nuchalis</i>	M	3937.15	12.7%
Sillaginidae	<i>Sillago sihama</i>	M	3755.50	12.1%
Sciaenidae	<i>Nibea albiflora</i>	H	3414.95	11.0%
Haemulidae	<i>Diagramma pictum</i>	H	2848.76	9.2%
Leiognathidae	<i>Photopectoralis bindus</i>	L	1934.44	6.2%
Sparidae	<i>Acanthopagrus pacificus</i>	H	1711.75	5.5%
Carangidae	<i>Alepes kleinii</i>	L	1563.51	5.0%
Gerreidae	<i>Gerres oyena</i>	L	1299.29	4.2%
Clupeidae	<i>Nematalosa japonica</i>	L	941.84	3.0%
Leiognathidae	<i>Leiognathus ruconius</i>	L	873.96	2.8%

Notes:

For fish species: H= High (> 90 HK\$/kg); M = Medium (66 – 90 HK\$/kg); L = Low (< 66 HK\$/kg).

‘-’ indicates not commercially important species or no commercial value is evaluated by the FMO.

For crustacean and cephalopod species, commercial value made reference to approved EIA reports.

**Table 5C.7 Top Ten Dominant Fish Larvae Species in all Survey Locations**

Family	Species	Commercial Value (see Note below)	Mean Density (No./ 1000 m <sup>3</sup> )	% of Total Density
Ambassidae	<i>Ambassis gymnocephalus</i>	L	1228.8	22.52%
Clupeidae	<i>Sardinella melanura</i>	L	978.0	17.92%
Blenniidae	<i>Omobranchus punctatus</i>	-	313.1	5.74%
Sparidae	<i>Acanthopagrus pacificus</i>	H	248.6	4.56%
Sillaginidae	<i>Sillago sihama</i>	M	235.1	4.31%
Pomacentridae	<i>Neopomacentrus cyanomos</i>	L	233.6	4.28%
Leiognathidae	<i>Nuचेquula nuchalis</i>	M	204.6	3.75%
Gobiidae	<i>Gobiidae</i> sp.	-	172.3	3.16%
Carangidae	<i>Alepes kleinii</i>	L	133.4	2.45%



Family	Species	Commercial Value (see Note below)	Mean Density (No./ 1000 m <sup>3</sup> )	% of Total Density
Apogonidae	<i>Apogonichthyoides cathetogramma</i>	L	116.3	2.13%

Notes:

For fish species: H= High (> 90 HK\$/kg); M = Medium (66 – 90 HK\$/kg); L = Low (< 66 HK\$/kg).

'-' indicates not commercially important species or no commercial value is evaluated by the FMO.

For crustacean and cephalopod species, commercial value made reference to approved EIA reports.

**Table 5C.8 Top Ten Dominant Fish Post-Larvae Species in all Survey Locations**

Family	Species	Commercial Value (see Note below)	Mean Density (No./ 1000 m <sup>3</sup> )	% of Total Density
Ambassidae	<i>Ambassis gymnocephalus</i>	L	16.85	17.3%
Clupeidae	<i>Sardinella</i> sp.	L	15.74	16.1%
Clupeidae	<i>Sardinella melanura</i>	L	14.89	15.3%
Platycephalidae	<i>Inegocia japonica</i>	L	12.59	12.9%
Callionymidae	<i>Callionymus curvicornis</i>	-	4.68	4.8%
Mugilidae	<i>Osteomugil cunnesius</i>	L	4.07	4.2%
Monacanthidae	<i>Monacanthus chinensis</i>	-	3.07	3.1%
Sillaginidae	<i>Sillago sihama</i>	M	2.83	2.9%
Carangidae	<i>Alepes kleinii</i>	L	2.33	2.4%
Carangidae	<i>Decapterus maruadsi</i>	L	2.12	2.2%

Notes:

For fish species: H= High (> 90 HK\$/kg); M = Medium (66 – 90 HK\$/kg); L = Low (< 66 HK\$/kg).

'-' indicates not commercially important species or no commercial value is evaluated by the FMO.

For crustacean and cephalopod species, commercial value made reference to approved EIA reports.

### 5C.3.3 Spatial and Seasonal Variation

Higher richness of ichthyoplankton species were recorded in the wet season than in the dry season (85 nos. of species in wet season and 69 species in dry season). Among the three survey locations, higher mean densities of ichthyoplankton (~47 nos. / m<sup>3</sup> in the dry season and ~70 nos. / m<sup>3</sup> in the wet season) were consistently recorded in Site B, dominated by *Sillago sihama* and *Nuclequula nuchalis* in the dry and wet seasons, respectively. The mean densities of ichthyoplankton were ~26 and ~47 no./m<sup>3</sup> in the dry and wet seasons, respectively.

For fish post-larvae resources, there was no substantial difference between the mean densities recorded from all survey locations in the dry and wet seasons. A total of 22 and 31 species were recorded in the dry and wet seasons, respectively. Higher mean densities of fish post-larvae were recorded in Site C (0.077 no./m<sup>3</sup>) during the dry season and in Site B (0.150 no./m<sup>3</sup>) during the wet season, respectively. The mean densities of fish post-larvae resources were 0.066 and 0.129 no./m<sup>3</sup> in the dry and wet seasons, respectively.

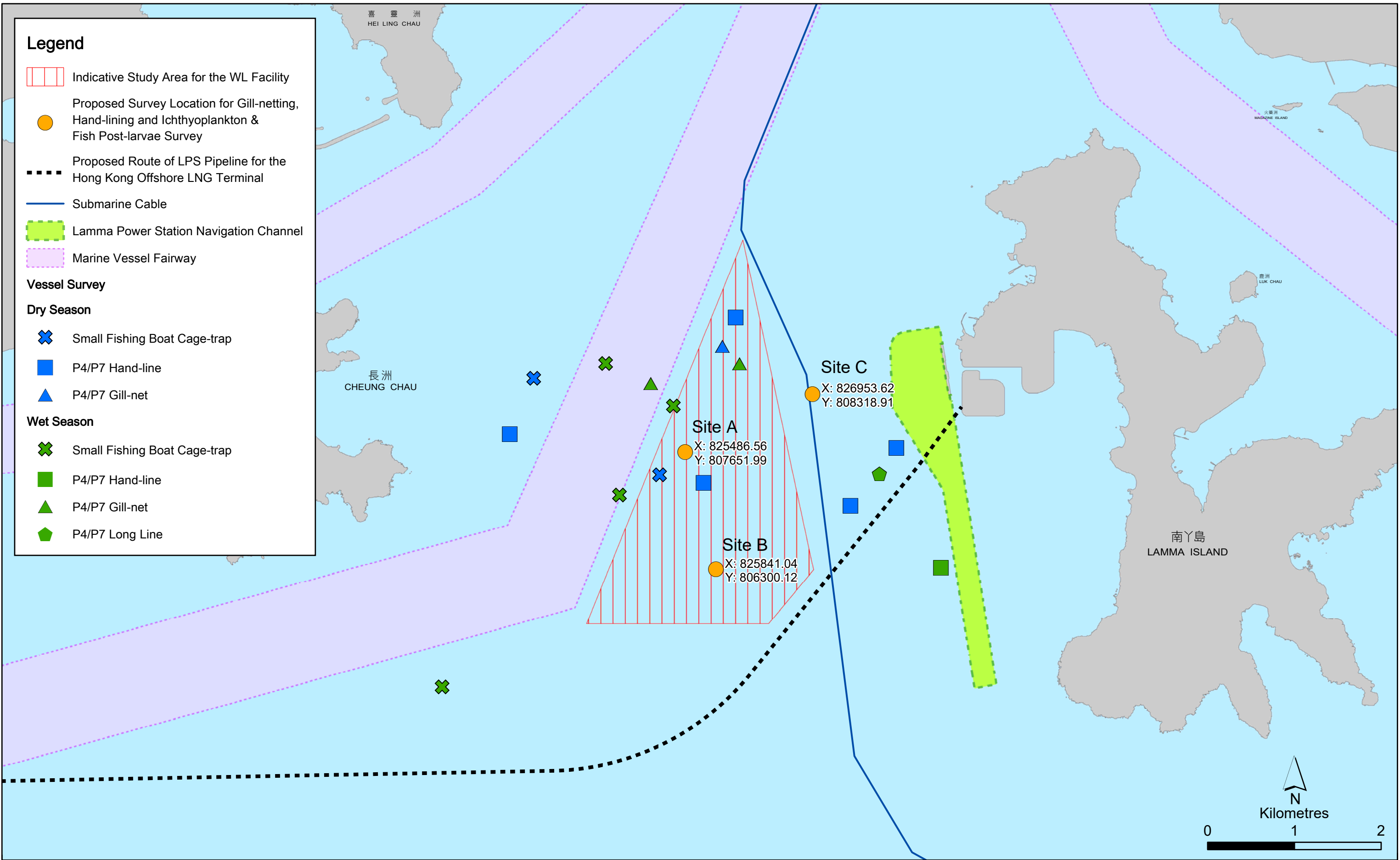


## 5C.4 Vessel Survey

A total of 16 vessels with fishing activities were recorded during the adult fish production surveys between February 2021 and May 2021. The locations of fishing vessels sighted during the surveys are presented in **Figure 5C.2** <sup>(4)</sup>. The level of fishing activities recorded during the survey was considered to be low, with an average of 4 vessels encountered per day. Similar levels of fishing activities were recorded between the dry and wet seasons (a total of 8 vessels were recorded in each of the dry and wet seasons). Fishing by hand-lining, gill-netting, long-lining and cage trapping were observed, with a majority of fishing undertaken by hand-lining using P4/7 vessels (also referred to as sampan) and cage-trapping using small fishing vessels.

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(4) The license number of most vessels observed was not clearly marked, and the vessels were usually distant from the observation point, thus the license number of the observed vessels was not recorded.



**Legend**

- Indicative Study Area for the WL Facility
- Proposed Survey Location for Gill-netting, Hand-lining and Ichthyoplankton & Fish Post-larvae Survey
- Proposed Route of LPS Pipeline for the Hong Kong Offshore LNG Terminal
- Submarine Cable
- Lamma Power Station Navigation Channel
- Marine Vessel Fairway
- Vessel Survey**
- Dry Season**
- × Small Fishing Boat Cage-trap
- P4/P7 Hand-line
- ▲ P4/P7 Gill-net
- Wet Season**
- × Small Fishing Boat Cage-trap
- P4/P7 Hand-line
- ▲ P4/P7 Gill-net
- ◀ P4/P7 Long Line

Figure 5C.2

Results of Vessel Surveys

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Date: 19/11/2021

**Environmental  
Resources  
Management**

