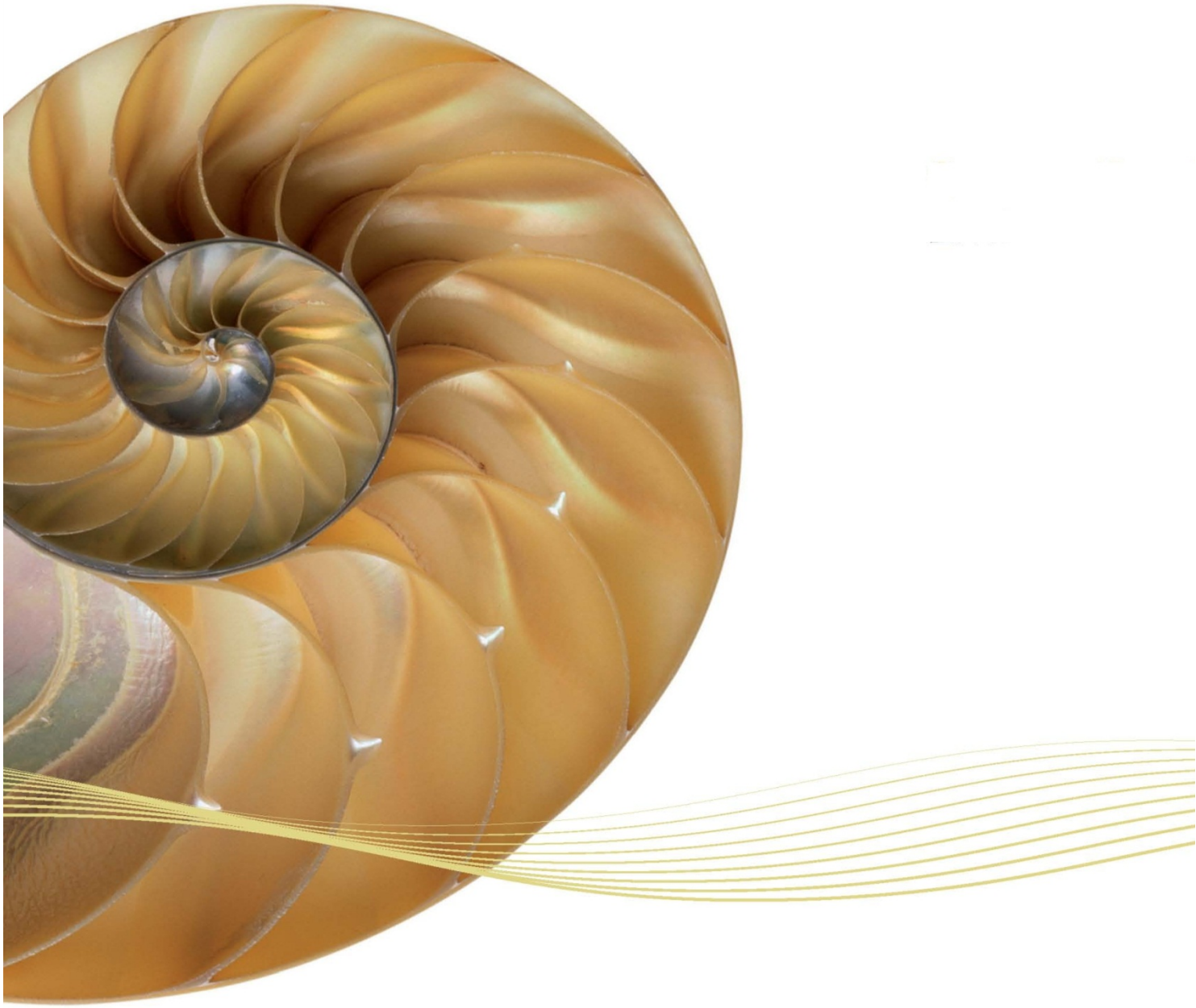

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Water Supplies Department

Provision of Consultancy Services for Updated Fisheries Survey for Tseung Kwan O Desalination Plant

Final Report

6 June 2017

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Provision of Consultancy Services for Updated Fisheries Survey for Tseung Kwan O Desalination Plant

Final Report

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Client: Water Supplies Department	Project No: 0321826
Summary: This document presents the *Final Report* for undertaking the Provision of Consultancy Services for Updated Fisheries Survey for Tseung Kwan O Desalination Plant.	Date: 6 June 2017 Approved and Prepared by: *Dr Jasmine Ng* *Partner* *Fisheries Specialist* Prepared by: *Mr Jovy Tam* *Fisheries Specialist*

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6	Report	JT/JN	JT	JN	06/06/17

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CONTENTS

1 INTRODUCTION

The **Water Supplies Department** (WSD) has commissioned **ERM-Hong Kong, Limited** (ERM) to undertake "**Consultancy Services for Updated Fisheries Survey for Tseung Kwan O Desalination Plant**" (the "Assignment"). The Assignment commenced on 20 October 2015.

1.1 BACKGROUND OF THE STUDY

In the Final Report of Fisheries Resources and Fishing Operations in Hong Kong waters conducted in 1998 for the Agriculture, Fisheries and Conservation Department (AFCD), Port Shelter and Southeastern waters were identified as the closest fish spawning grounds to the project site of the Tseung Kwan O (TKO) desalination plant. With reference to this report and other available information on fisheries resources and fishing operation, a fisheries impact assessment conducted as part of the Environmental Impact Assessment (EIA) Study (Application No. *EIA-229/2015*) revealed that there would be negligible impact to fisheries due to the construction and operation of the TKO desalination plant.

During the public inspection period (30 July 2015 to 28 August 2015) of the EIA Report, public comments received raised concerns on the lack of recent fisheries survey in the project site to support the conclusion that there would be negligible impact to potential spawning and nursery grounds near the proposed submarine structures caused by the operation of the TKO desalination plant. At the EIA Subcommittee Meeting held on 14 September 2015, Members raised the same question and requested the project proponent, WSD, to conduct an updated fisheries survey.

1.2 PURPOSE & OBJECTIVES OF UPDATED FISHERIES SURVEY

Pursuant to Condition 2.9 of the Environmental Permit (EP-503/2015) of the TKO desalination plant, the main objective of the Assignment is to conduct an updated fisheries survey in wet and dry seasons between December 2015 and August 2016 to verify if there is any fish spawning and nursery grounds in the vicinity of the planned location and alignment of the proposed seawater intake and submarine outfall of the TKO desalination plant. The updated fisheries survey would provide information to assist in the fine-tuning of the detailed design of these facilities as necessary with reference to EIA Ordinance-Technical Memorandum Annex 9 and Annex 17.

1.3 PURPOSE OF THIS REPORT

In accordance with Condition 2.9 of EP-503/2015, this *Report* is prepared to present:

- details of the updated fisheries survey on the survey methodology, duration and timing;

- findings of the updated fisheries survey on presence of any fish spawning and nursery ground in the vicinity of the planned locations and alignment of the seawater intake and submarine outfall; and

- recommendation on the need of fine-tuning the detailed design of the locations and alignment of the seawater intake and submarine outfall facilities.

1.4 STRUCTURE OF THIS REPORT

Following the introductory section, the remainder of this *Report* is arranged as follows:

- *Section 2: Methodology of Fisheries Survey* – presents the survey design and details the fisheries survey procedures;

- *Section 3: Survey Findings and Analysis* – presents results of adult fish, juvenile fish and ichthyoplankton surveys and subsequent data analysis;

- *Section 4: Review of Fisheries Impact Assessment* – reviews the findings in the approved EIA Report with reference to EIA Ordinance-Technical Memorandum Annex 9 and Annex 17 and the findings of the updated fisheries survey;

- *Section 5: Design Recommendations* – make recommendation on the design, construction and operation aspects of the desalination plant at Tseung Kwan O; and

- *Section 6: Conclusions* – summarize the findings of this Assignment.

2 METHODOLOGY OF FISHERIES SURVEY

2.1 INTRODUCTION

This section provides the details of the updated fisheries survey undertaken within the Study Area under this Assignment between December 2015 and August 2016 by qualified ecologist(s)/ fisheries specialist(s) (1) to examine:

- Fish species composition;
- Abundance: number of fish captured;
- Diversity of fish resources: species diversity and evenness;
- Size: range of total length;
- Biomass in weight;
- Values of catches of commercial species: catch per unit effort (CPUE) and yield per unit effort (YPUE); and,
- Any significant fish spawning and nursery grounds within the Project Area.

The effort for the fisheries survey is summarized in *Table 2.1* and detailed in the following sections.

Table 2.1 Summary of Updated Fisheries Survey

Survey	Survey Frequency	Sampling Location (1)	Method	Survey Schedule
Adult Fish Survey	2 times in dry season and 2 times in wet season	P1, P2, R1, R2	Gill Netting Cage Trapping	Dry season: 15 December 2015 & 12 January 2016 Wet Season: 13 July & 9 August 2016
Juvenile fish survey	2 times in dry season and 2 times in wet season	P1, P2, R1, R2	Purse-seining	Dry season: 16 December 2015 & 13 January 2016 Wet Season: 8 July & 11 August 2016

(1) The qualification and experience of the qualified ecologist(s)/ fisheries specialist(s) shall be at least five years of experience in fish surveys with a relevant degree in biology or equivalent.

Survey	Survey Frequency	Sampling Location (1)	Method	Survey Schedule
Ichthyoplankton Survey	2 times in dry season and 2 times in wet season	T1 to T4	Plankton-towing	Dry season: 18 December 2015 & 22 January 2016 Wet Season: 13 April & 11 May 2016

Notes:
(1) The sampling locations are illustrated on *Figure 2.1*.

2.2 *STUDY AREA*

With reference to the findings of the water quality impact assessment presented in the approved EIA Report (Register No. *AEIAR-192/2015*), the potential impacts on fisheries resources would be confined within close proximity of the submarine utilities of the desalination plant. Based on this, the Study Area for this Assignment is proposed to include the area in close proximity to the direct project footprint of the submarine utilities around Tseung Kwan O Area 137 (i.e. Project Area) and the identified spawning ground in the outer Joss House Bay between the waters of Tung Lung Chau and Fat Tong Mun (i.e. Reference Area) to investigate the spatial and seasonal variations of fisheries resources between the Project Area and Reference Area (*Figure 2.1*).

2.3 *ADULT FISH SURVEY*

2.3.1 *Sampling Locations*

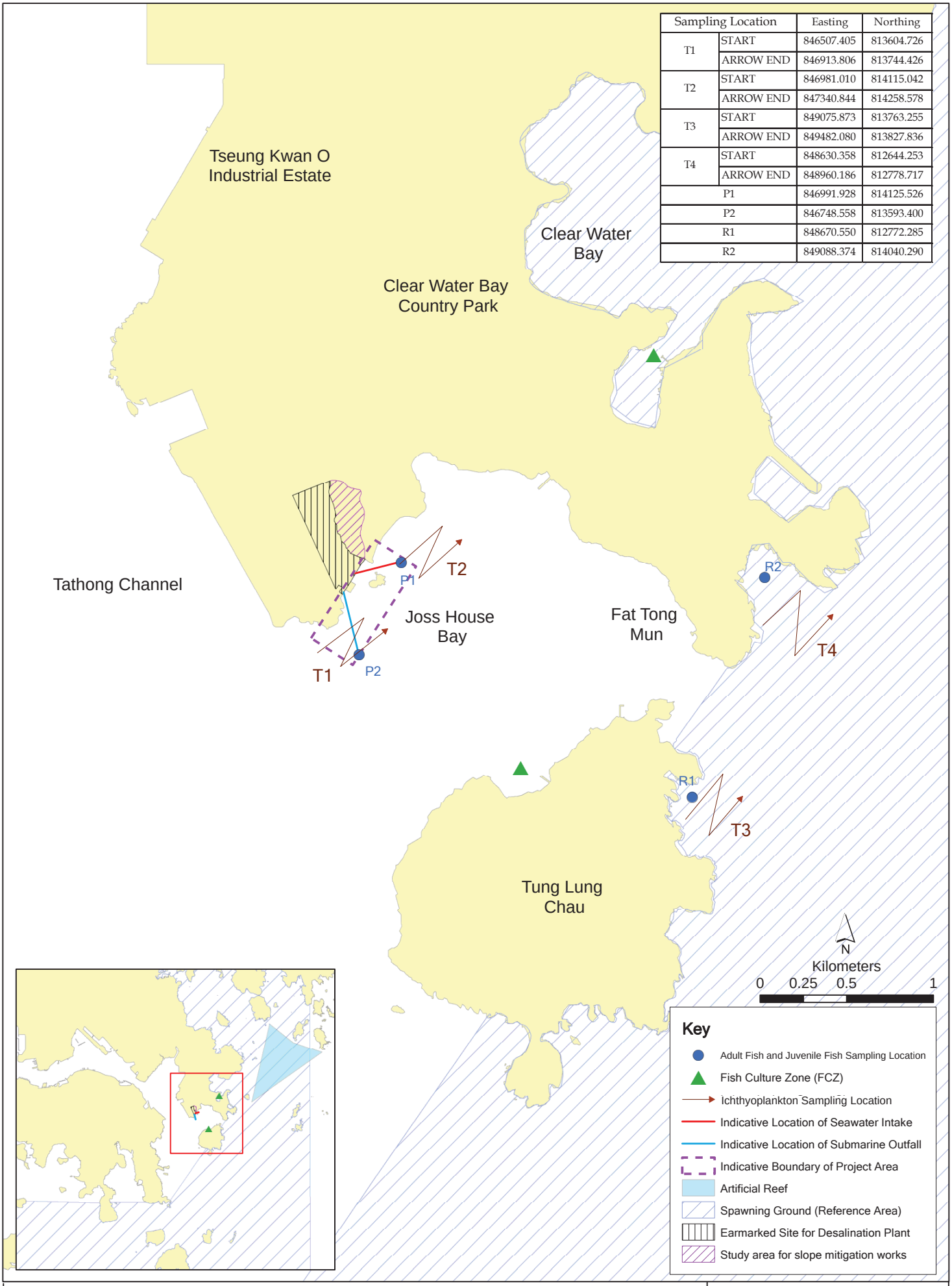
The adult fish survey was carried out at two (2) locations (P1 and P2) within the footprint of the proposed submarine utilities and two (2) reference stations (R1 and R2) within the identified spawning grounds of the Study Area (*Figure 2.1*).

2.3.2 *Survey Period*

Sampling was conducted for two (2) times in each of the wet and dry seasons (dry season: December – March; wet season: June - August). All surveys were conducted during daytime at each of the selected locations.

2.3.3 *Methodology*

Two fishing methods, gill netting and cage trapping, were used to sample pelagic and demersal adult fish resources at each sampling location. These methods are also commonly used by local fishermen in Hong Kong waters.



Sampling Location		Easting	Northing
T1	START	846507.405	813604.726
	ARROW END	846913.806	813744.426
T2	START	846981.010	814115.042
	ARROW END	847340.844	814258.578
T3	START	849075.873	813763.255
	ARROW END	849482.080	813827.836
T4	START	848630.358	812644.253
	ARROW END	848960.186	812778.717
	P1	846991.928	814125.526
	P2	846748.558	813593.400
	R1	848670.550	812772.285
	R2	849088.374	814040.290

Figure 2.1

Study Area of Updated Fisheries Survey

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Date: 11/12/2015

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Pelagic Fish Survey – Gill Netting

At each sampling location, a pair of trammel (gill) nets was deployed for one (1) hour at each sampling location. The nets were 1 m deep, 30 m in length and comprised of three (3) layers, with two 20 cm mesh stretches sandwiching a 5 cm mesh stretch. All fish species captured were washed and recorded immediately and were identified to species level as far as practicable. Each gill netting survey was analysed for species composition, abundance, size (total length, standard length and fork length as appropriate), biomass in weight and diversity of adult fish.

This sampling gear is selected for its ability to capture pelagic fish resources in a wide range of sizes and is commonly used in previous fisheries and EIA studies.

Demersal Fish Survey – Cage Trapping

Cage trapping is the preferred method for demersal fish sampling in comparison with hand lining and long lining. Cage trapping is a non-selective fishing method, which does not require a special technique with captured species retained in a better condition and thus can be readily released back to the sea, whilst species captured by long lining and hand lining are usually hurt by hooks. Furthermore, a review undertaken on the Port Survey 2006 suggested that the levels of long-ling and hand-lining in the Project Area and its vicinity are not particularly high in terms of fisheries production and vessel operation.

Two sets of four metal wire cage traps, each of ranged from 0.8 to 0.9 m^3 in volume and mesh size of 25 mm, were deployed for one (1) hour at each sampling location [(1) (2)]. Distance between the traps was about 10 m, and the distance between each set of traps was about 100 m [(3)]. Bread or other suitable fish bait was used as bait for cage trapping [(4)]. All species caught in the cage trapping survey were identified to species level as far as practical. Each cage trapping survey was analysed for species composition, abundance, size (total length, standard length and fork length as appropriate), biomass in weight and diversity of adult fish.

For all the above fishing methods, all sampling locations were recorded using global positioning system (GPS) and water depth was measured.

(1) FAO (2001) FAO Training Series: Fishing with Traps and Pots. Food and Agriculture Organization of the United Nations.

(2) Personal communication with local fishermen.

(3) *Ibid*.

(4) *Ibid*.

2.4 JUVENILE FISH SURVEY

2.4.1 Sampling Locations

Juvenile fish surveys were conducted at the same sampling locations as the adult fish survey (*Figure 2.1*).

2.4.2 Survey Period

Sampling was conducted during daytime at each selected sampling location for two (2) times in each of the wet and dry seasons (Dry season: December - March; Wet season: June - August).

2.4.3 Methodology – Purse-seining

A typical purse-seine fishing method was used to sample juvenile fish at each sampling location. This sampling gear is selected for its ability to capture pelagic fish resources in a wide range of sizes including post-larval stages and juvenile fish. The nets were 5 to 15 m deep (depending on the water depth), 50 m in length, and with 6 mm mesh size (maximum stretched). For each sampling event, both a mother boat and a P4 sampan deployed the seine net for approximately 30 to 45 minutes, with each boat holding one end of the net. The net was pulled towards the fish resources in the form of a semi-circle. Fish catches were concentrated and lifted onto the mother boat. All fishes captured were recorded and identified to species level as far as practicable.

The sampling location was recorded using GPS and water depth was measured.

2.5 ICHTHYOPLANKTON SURVEY

2.5.1 Sampling Locations

Ichthyoplankton survey was carried out at two (2) locations (T1 and T2) within the footprint of the proposed submarine utilities and two (2) reference stations (T3 and T4) within the identified spawning ground within the Study Area (*Figure 2.1*).

2.5.2 Survey Period

Sampling was conducted during daytime at each selected sampling location, two (2) times in each of the dry (December 2015 and January 2016) and wet (April – May 2016) seasons. The programme of the survey in the wet season was revised from July and August 2016 as originally proposed in the survey methodology to April and May 2016. The purpose was to allow completion of the fisheries survey before commencement of the marine ground investigation works which were planned to be conducted around the same time in the wet season while still capturing the baseline condition in the Study Area. The revised programme was proposed to and accepted by AFCD.

2.5.3 *Methodology – Plankton-towing*

Ichthyoplankton survey was conducted using plankton towing. A bongo plankton net of 50 cm mouth diameter and with 0.5 mm mesh size was deployed to collect ichthyoplankton. A flow meter was fitted at mouth of the net to record the volume of water filtered.

At each sampling location, three (3) replicate tows were conducted and each tow with a duration of at least 10 minutes. The net was deployed in a single oblique tow to a depth of 2 m off the seabed and towed at a speed of 1-2 knots. Subsequently the net was gradually winched up towards the water surface in order to sample the entire water column. The plankton were immediately fixed in 70% ethanol [1] [2] [3].

Standard and accepted techniques were used for sorting the ichthyoplankton in laboratory [4]. The ichthyoplankton were held in the fixative solution for a minimum of 24 hours to ensure adequate fixation of the organisms. Identification of fish larvae were made under dissecting stereomicroscopes according to the observed morphological characteristics such as body shape, cloacal location, pigmentation pattern, and other special structures. Individual larval fish without distinctive morphological features for taxonomic identification were examined with the aid of DNA sequencing if deemed necessary [5]. Fish larvae were identified to the lowest taxonomic level, where possible, using available identification keys and literatures [6], and counted as well as size range were also recorded.

2.6 *FIELD CONDITION & OBSERVATION*

During each survey, the field conditions and observations (e.g. weather conditions, water depth (m) and temperature (°C) etc.) were recorded at each sampling location.

2.7 *DATA ANALYSIS*

Spatial and seasonal variations of species abundance and total biomass are assessed. Seasonal (e.g. wet vs. dry) and spatial (Impact Area (IPA: P1 and P2; T1 and T2) vs. Reference Area (RFA: R1 and R2; T3 and T4)) differences in fish abundance were compared using descriptive statistics and/ or inferential

(1) Theilacker, G. H. (1980). Changes in body measurements of larval northern anchovy, Engraulis mordax, and other fishes due to handling and preservation. Fishery Bulletin 78: 685–692.

(2) Takizawa K, Fujita Y, Ogushi Y, Matsuno S (1994) Relative change in body length and weight in several fish larvae due to formalin fixation and preservation. Fisheries Science, 60(4): 355-359.

(3) Leis J.M. and Carson-Ewart B.M. (eds) (2004). The larvae of Indo-Pacific coastal fishes: a guide to identification (Fauna Malesiana Handbook 2, 2nd edition). Brill: Leiden. 850 pp.

(4) Situ Y (2007) Ichthyoplankton assemblages at Cape d'Aguilar: seasonal variability and family composition. MPhil thesis. University of Hong Kong. pp 199.

(5) Ko HL, Wang YT, Chiu TS, Lee MA, Leu MY, Chang KZ, Chen WY and Shao KT (2013) Evaluating the Accuracy of Morphological Identification of Larval Fishes by Applying DNA Barcoding. PLoS ONE 8(1): 1 – 7.

(6) Leis JM, Carson-Ewart BM (2004) The larvae of Indo-Pacific coastal fishes: a guide to identification. Brill, Leiden.

statistics (Microsoft Excel and/or Statistical Package for the Social Sciences (SPSS)), followed by multiple comparison procedures, as appropriate. Diversity of fish resources are presented as species richness, Shannon-Weiner diversity (*H'*) and Pielou's evenness (*J'*). Patterns of fish species composition were presented and subject to statistical analyses as above. Values of catches of commercial species for adult and juvenile fishes were presented in terms of CPUE (number of individuals per fishing time and number of nets or cages) and YPUE (weight of fish per survey time and number of nets or cages).

3 SURVEY FINDINGS & ANALYSIS

3.1 ADULT FISH SURVEY

For adult fish survey, a total 26,995 g of 723 individuals comprising 56 species from 33 families were recorded. The dominant species in terms of biomass and abundance were Spotted puffer (*Takifugu alboplumbeus)* and Threadfin porgy (*Evynnis cardinalis*), and these species are of low and moderate to high commercial value, respectively. Besides fish species, other invertebrate species, including cuttlefish, octopus, crab, shrimp and mantis shrimp, were also captured. Full list of adult fish species recorded is presented in *Annex A*.

In terms of fish species, a total 23,389 g of 698 individuals comprising 48 fish species from 28 families were recorded. The overall adult fish resources in the Study Area is summarized in *Table 3.1*. Location R2 recorded the highest adult fish resources in terms of biomass, abundance and number of fish species. The total length of collected fish species ranged between 4.5 to 31 cm, in which only three individuals of fish species, Greater lizardfish (*Saurida tumbil*), Silver sillago (*Sillago sihama*) and Indian goatfish (*Parupeneus indicus*), reached marketable size (≥ 25 cm [(1)]).

Table 3.1 Overall Fish Resources (Adult Fish) in the Study Area

Sampling Location	Mean No. of Species (± S.D.)	Mean Biomass (g) (± S.D.)	Mean No. of Individual (± S.D.)	Total No. of Species	Total Biomass (g)	Total No. of Individual	Dominant Species
P1	5.3 ± 1.7	1,014.3 ± 917.3	30.8 ± 18.8	17	4,057	123	*Siganus canaliculatus*
P2	8.0 ± 2.7	1,252 ± 1,286.9	57.3 ± 73.7	23	5,011	229	*Evynnis cardinalis*
R1	6.5 ± 1.3	1,134.0 ± 549.0	22.0 ± 10.3	20	4,536	88	*Takifugu alboplumbeus*
R2	11.3 ± 3.6	2,446.1 ± 882.9	64.5 ± 28.8	29	9,785	258	*Evynnis cardinalis*
Overall total	7.8 ± 3.2	1,461.8 ± 1,033.4	43.6 ± 41.0	48	23,389	698	*Takifugu alboplumbeus*, *Evynnis cardinalis*

For cage trapping, a total of 10,418 g of 383 individuals comprising 17 fish species from 11 families were recorded. Location P2 and R2 recorded the highest adult fish resources in terms of biomass, abundance and number of fish species. For gill netting, a total of 12,971 g of 315 individuals comprising of 40 fish species from 24 families were recorded. The results showed that gill netting is more productive for capturing adult fish in terms of biomass, abundance and number of species, except for P2 where cage trapping is more productive in terms of biomass. The adult fish resources captured by different gear types are summarized in *Table 3.2* below.

(1) Sadovy de Mitcheson Y & Colin PL (2011) Reef Fish Spawning Aggregations: Biology, Research and Management. Fish & Fisheries Series (35): 622pp.

Table 3.2 Overall Adult Fish Resources by Different Fishing Gears

Sampling Location	Cage Trapping			Gill netting		
	Mean No. of Species (± S.D.)	Mean Biomass (g) (± S.D.)	Mean No. of Individual (± S.D.)	Mean No. of Species (± S.D.)	Mean Biomass (g) (± S.D.)	Mean No. of Individual (± S.D.)
P1	2.5 ± 1.0	279.0 ± 145.6	13.8 ± 11.9	3.8 ± 1.0	735.3 ± 974.9	17.0 ± 16.7
P2	4.3 ± 2.1	741.0 ± 957.5	42.5 ± 63.1	5.8 ± 3.3	511.8 ± 394.3	14.8 ± 9.1
R1	1.8 ± 1.0	384.3 ± 439.3	9.5 ± 11.4	5.3 ± 1.5	749.8 ± 414.2	12.5 ± 7.1
R2	4.5 ± 3.3	1,200.3 ± 1,175.7	30.0 ± 25.7	7.3 ± 4.1	1245.9 ± 1125.4	34.5 ± 43.7

3.1.1 Commercial Value

With reference to the Fish Marketing Organisation's (FMO) wholesale prices of fresh marine fish, the average price for fresh marine fish in 2014 and 2015 ranged 50.28 – 60.84 HK$/kg with an average price of 54.89 HK$/kg. Commercial value of adult fish resources in this Study is thus estimated based on FMO's wholesale price and subsequently ranked into three classes in accordance with the EIA Study for Three-runway System (1): High (> 60 HK$/kg); Medium (50 – 60 HK$/kg); and Low (< 50 HK$/kg), in which the commercial value has also made reference to FMO.

Among the 48 fish species recorded, 43 of them are classified as commercial species, which accounted for about 75% of the total biomass and 83% of total abundance from the captured adult fish species. Of the 43 commercial species, the majority of commercial fish species captured are of low commercial value (43.8% of total abundance and 54.1% of total biomass). The highest abundance and biomass were recorded for Threadfin porgy (*Evynnis cardinalis*) and Rabbitfish (*Siganus canaliculatus*) (*Table 3.3*), accounting for < 50% of total biomass and abundance of captured adult fish resources. The Threadfin porgy (*Evynnis cardinalis*) and Rabbitfish (*Siganus canaliculatus*) are of medium to high and low commercial value, respectively. Although species of high commercial value (Chocolate hind *Cephalopholis boenak*) were recorded, they accounted for less than 3% of total biomass and total abundance of overall adult fish resources. Level of commercial value for the recorded species is presented in *Annex A* and the top ten species of commercial importance are summarized in *Table 3.3.* It is therefore considered that the overall commercial value of adult fish resources in the Study Area is low and low to moderate.

(1) Mott (2013) Expansion of Hong Kong Airport into Three-Runway System. Available at: http://www.epd.gov.hk/eia/register/report/eiareport/eia_2232014/html/Appendix%2014.3%20Annex%20B.pdf

Table 3.3 Top Ten Species of Commercially Important within the Study Area

Family	Species	Level of Commercial Value (a)	Biomass (g)	% of Total Biomass (Rank)	Abundance	% of Total Abundance (Rank)
Sparidae	*Evynnis cardinalis*	M-H	4,053	17.3 (1)	244	35.0 (1)
Siganidae	*Siganus canaliculatus*	L	2,612	11.2 (2)	69	9.9 (2)
Sciaenidae	*Dendrophysa russelii*	L	1,006	4.3 (3)	10	1.4 (10)
Gerreidae	*Gerres oblongus*	L	894	3.8 (4)	15	2.1 (7)
Monacanthidae	*Stephanolepis cirrhifer*	M	802	3.4 (5)	12	1.7 (8)
Pomacentridae	*Neopomacentrus cyanomos*	L	789	3.4 (6)	47	6.7 (3)
Serranidae	*Cephalopholis boenak*	H	622	2.7 (7)	8*	1.1 (-)*
Apogonidae	*Ostorhinchus fleurieu*	L	622	2.7 (8)	19	2.7 (5)
Carangidae	*Selaroides leptolepis*	L	488	2.1 (9)	9*	1.3 (-)*
Carangidae	*Decapterus maruadsi*	L	482	2.1 (10)	15	2.1 (6)
Leiognathidae	*Leiognathus brevirostris*	M	335*	1.4 (-)*	21	3.0 (4)
Leiognathidae	*Secutor insidiator*	L	166*	0.7 (-)*	11	1.6 (9)

Notes:
(a) H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg)
*Species which is not ranked as the top ten species under the corresponding parameters

3.1.2 Catch per Unit Effort

The following equation is adopted to calculate Catch per Unit Effort (CPUE):

$$\text{CPUE} = \frac{\text{No.of Individual}}{\text{Fishing time (hour)x (Number of Net and Cage)}} \text{, where}$$

Fishing time = 1 hour;
Number of net = 2; number of cage = 8.

The mean CPUE of each sampling location ranged between 2.20 and 6.45 no. per hour per net/cage (*Table 3.4*).

Table 3.4 Mean Catch per Unit Effort of Adult Fish Resources at each Sampling Location

Sampling Location	Mean CPUE (± S.D.) (no. per hour per net/cage)
P1	3.08 ± 1.43
P2	5.73 ± 7.04
R1	2.20 ± 1.04
R2	6.45 ± 2.88
Overall total	4.36 ± 3.94

3.1.3 *Yield per Unit Effort*

The following equation is adopted to calculate Yield per Unit Effort (YPUE):

$$YPUE = \frac{\text{Weight of Fish}}{\text{Fishing time (hour)x (Number of Net and Cage)}}$$, where

Fishing time = 1 hour;
Number of net = 2; number of cage = 8.

The average YPUE of each sampling location is ranged between 101.43 and 244.61 g per hour per net/ cage (*Table 3.5*).

Table 3.5 Mean Yield per Unit Effort of Adult Fish Resources at each of the Sampling Location

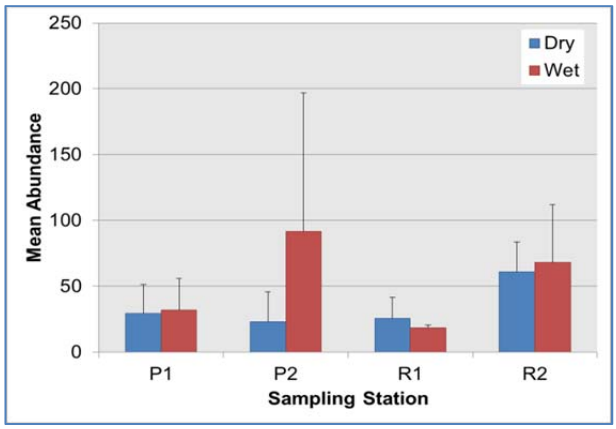
Sampling Location	**Mean YPUE (± S.D.)** (g per hour per net/cage)
P1	101.43 ± 90.68
P2	125.28 ± 122.78
R1	113.40 ± 55.30
R2	244.61 ± 88.29
Overall total	146.18 ± 101.74

3.1.4 *Spatio-seasonal Variation in Adult Fish Resources*

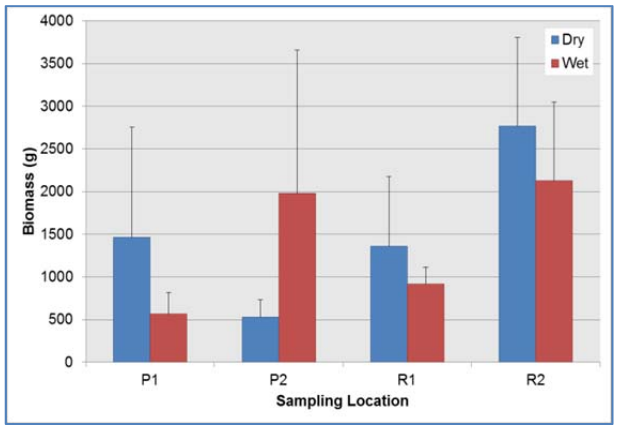
In the dry season, a total of 3,978 g of 105 individuals comprising 18 fish species from 13 families were recorded from IPA, whilst a total of 8,241 g of 173 individuals comprising 19 species from 16 families recorded at RFA. On the other hands, a total of 5,090 g of 247 individuals comprising 14 fish species from 11 families were recorded from IPA, whilst a total of 6,080 g of 173 individuals comprising 28 species from 20 families recorded at RFA during the wet season. The abundance and biomass of adult fish resources in wet season was higher than dry season (*Figure 3.1*); however, the observed difference is statistically insignificant (*Table 3.6*). Similarly, whilst the total biomass of adult fish species at RFA is higher than that in the IPA, the observed difference is again statistically insignificant. The abundance of adult fish is also comparable among the two areas.

Species richness, diversity and evenness of adult fish resources are illustrated in *Figure 3.1*. The overall species richness, *H'* and J in the Study Area are considered to be low. This indicates a relatively low diversity of adult fish resources (mean value of *H'* <1.5) in the Study Area as the number of adult fish species recorded is not particularly high (mean value of S <15) and the abundance of recorded species is rather unevenly distributed (mean value of *J* < 1) (i.e. adult fish community is dominated by several species only). The spatial and seasonal difference in species richness (S, number of species), Shannon-Weiner diversity (*H'*) and Pielou's eveness (*J*) was also examined. Statistical analyses showed an insignificant difference of all parameters among areas and season (*Table 3.6*).

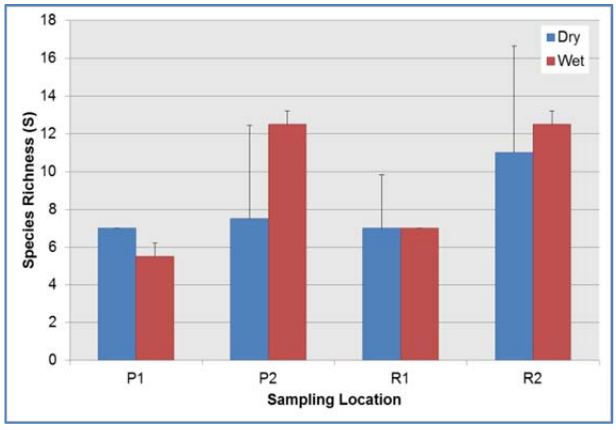
Figure 3.1 Spatial and Seasonal Variation in Adult Fish Resources in the Study Area



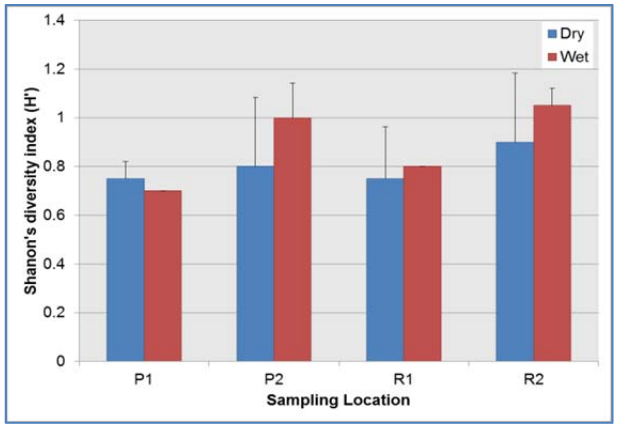
(a) Mean Abundance



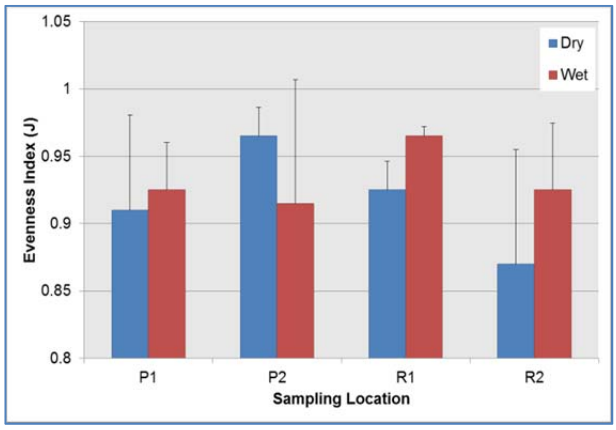
(b) Mean Biomass



(c) Mean Species Richness (S)



(d) Mean Shannon's Diversity Index (*H'*)



(e) Mean Evenness Index (*J*)

Table 3.6 ***Statistical Analyses of Spatio-seasonal Variation in Adult Fish Resources: (a) abundance, (b) biomass, (c) species richness (S), (d) Shannon's diversity index (H') and (e) Evenness index (J) between areas (reference vs impact), seasons (wet and dry), location nested within areas (Location(Area)) using three-factor, mixed model ANOVA. "+" indicates homogeneous of variance by Levene's Test of equal variance (p > 0.05). Significant differences are indicated by underline (p < 0.05)***

	Source	*df*	MS	*F*	*p*
a)	Abundance +				
	Area	1	2.250	0.001	0.979
	Season	1	1260.250	0.714	0.418
	Area * Season	1	1260.250	0.714	0.418
	Location(Area)	2	2508.500	1.421	0.286
	Residual	10			
b)	Biomass +				
	Area	1	1724297.266	0.969	0.429
	Season	1	68840.641	0.069	0.798
	Area * Season	1	669737.641	0.670	0.432
	Location(Area)	2	1778554.266	1.779	0.218
	Residual	10			
c)	Species richness (S)				
	Area	1	6.250	0.171	0.720
	Season	1	6.250	0.708	0.420
	Area * Season	1	1.000	0.113	0.743
	Location(Area)	2	36.625	4.150	0.049
	Residual	10			
d)	Diversity Index (*H'*) +				
	Area	1	0.016	0.221	0.684
	Season	1	0.031	1.129	0.313
	Area * Season	1	0.001	0.023	0.882
	Location(Area)	2	0.071	2.604	0.123
	Residual	10			
e)	Evenness Index (*J*)				
	Area	1	0.000	0.081	0.802
	Season	1	0.001	0.327	0.580
	Area * Season	1	0.004	1.535	0.244
	Location(Area)	2	0.003	1.004	0.401
	Residual	10			

3.1.5 Species Composition

In total 48 species of adult fish recorded, and there were differences in species composition between seasons (wet vs dry), and areas (Impact Area (IPA) vs Reference Area (RFA)) to a lesser extent. The top ten fish species recorded in the Study Area are listed in *Table 3.7* and *Table 3.8*, with percentages of total biomass and total abundance presented in descending order.

In the dry season, over 50% of the total biomass and total abundance at RFA (i.e.R1 and R2) was dominated by the Pufferfish *Takifugu alboplumbeus*. For IPA, the most abundant fish species were the Rabbitfish *Siganus canaliculatus*, Pufferfish *Takifugu alboplumbeus* and Regal damselfish *Neopomacentrus cyanomos*, together these species contributed >= 50% of the total biomass and

total abundance. These dominant species are of low to no commercial value. In wet season, over 70% of total abundance at IPA was contributed by Threadfin porgy *Evynnis cardinalis* and Rabbitfish *Siganus canaliculatus*. In terms of total biomass, over 50% of total biomass in IPA was contributed by Threadfin porgy *Evynnis cardinalis* and Goatee croaker *Dendrophysa russelii*. The dominant species recorded in IPA are of low and medium to high commercial value. In contrast, RFA was dominated by a wider range of fish species, of which about 50% of total abundance and total biomass were contributed by Yellowstripe scad *Selaroides leptolepis*, Bubblefin wrasse *Halichoeres nigrescens* and Threadsail filefish *Stephanolepis cirrhifer* at R1. For R2, over 50% of total abundance was contributed by Threadfin porgy *Evynnis cardinalis* and Japanese scad *Decapterus maruadsi*, and these species together with Round sardinella *Sardinella aurita* accounting for over 50% of total biomass. The dominant species recorded in RFA are of low and medium to high commercial value.

Table 3.7 Top Ten Species Recorded at the Four Sampling Locations (Abundance)

Location	Family	*Species*	Abundance	% of Total Abundance	Commercial Value [a]	Location	Family	*Species*	Abundance	% of Total Abundance	Commercial Value [a]
		Dry Season						Wet Season			
P1	Siganidae	*Siganus canaliculatus*	34	57.6	L	P1	Sparidae	*Evynnis cardinalis*	46	71.9	M-H
	Tetraodontidae	*Takifugu alboplumbeus*	7	11.9	X		Leiognathidae	*Leiognathus brevirostris*	5	7.8	M
	Pomacentridae	*Neopomacentrus cyanomos*	6	10.2	L		Siganidae	*Siganus canaliculatus*	5	7.8	L
	Gerreidae	*Gerres oblongus*	4	6.78	L		Leiognathidae	*Secutor insidiator*	4	6.3	L
	Labridae	*Stethojulis interrupta*	1	1.69	L		Sciaenidae	*Dendrophysa russelii*	2	3.1	L
	Sillaginidae	*Sillago sihama*	1	1.69	H		Paralichthyidae	*Pseudorhombus cinnamoneus*	2	3.1	M
	Pomacentridae	*Neopomacentrus bankieri*	1	1.69	L		-	-	-	-	-
	Serranidae	*Epinephelus awoara*	1	1.69	H		-	-	-	-	-
	Dactylopteridae	*Dactyloptena peterseni*	1	1.69	L		-	-	-	-	-
	Serranidae	*Cephalopholis boenak*	1	1.69	H		-	-	-	-	-
P2	Pomacentridae	*Neopomacentrus cyanomos*	16	34.8	L	P2	Sparidae	*Evynnis cardinalis*	132	72.1	M-H
	Leiognathidae	*Leiognathus brevirostris*	9	19.6	M		Siganidae	*Siganus canaliculatus*	15	8.2	L
	Siganidae	*Siganus canaliculatus*	7	15.2	L		Sciaenidae	*Dendrophysa russelii*	8	4.4	L
	Tetraodontidae	*Takifugu alboplumbeus*	4	8.7	X		Leiognathidae	*Leiognathus brevirostris*	6	3.3	M
	Labridae	*Stethojulis interrupta*	2	4.35	L		Leiognathidae	*Leiognathus equulus*	5	2.7	L
	Serranidae	*Cephalopholis boenak*	2	4.35	H		Leiognathidae	*Secutor insidiator*	4	2.2	L
	Pomacentridae	*Abudefduf vaigiensis*	2	4.35	L		Monacanthidae	*Stephanolepis cirrhifer*	4	2.2	M
	Apogonidae	*Ostorhinchus fleurieu*	1	2.17	L		Mullidae	*Upeneus japonicus*	3	1.6	L
	Monacanthidae	*Monacanthus chinensis*	1	2.17	M		Paralichthyidae	*Pseudorhombus cinnamoneus*	1	0.5	M
	Serranidae	*Diploprion bifasciatum*	1	2.17	L		Soleidae	*Aseraggodes kobensis*	1	0.5	L
R1	Tetraodontidae	*Takifugu alboplumbeus*	32	62.7	X	R1	Carangidae	*Selaroides leptolepis*	9	24.3	L
	Pomacentridae	*Neopomacentrus cyanomos*	5	9.8	L		Labridae	*Halichoeres nigrescens*	6	16.2	L
	Apogonidae	*Ostorhinchus fleurieu*	4	7.8	L		Monacanthidae	*Stephanolepis cirrhifer*	4	10.8	M

Location	Family	*Species*	Abundance	% of Total Abundance	Commercial Value [a]	Location	Family	*Species*	Abundance	% of Total Abundance	Commercial Value [a]
R1	Siganidae	*Siganus canaliculatus*	2	3.9	L	R1	Mullidae	*Upeneus japonicus*	3	8.1	L
	Gerreidae	*Gerres oblongus*	2	3.9	L		Mullidae	*Parupeneus biaculeatus*	3	8.1	M
	Synodontidae	*Trachinocephalus myops*	1	2.0	L		Apogonidae	*Apogon doederleini*	2	5.4	L
	Monacanthidae	*Stephanolepis cirrhifer*	1	2.0	M		Gerreidae	*Gerres sp.*	2	5.4	-
	Paralichthyidae	*Pseudorhombus cinnamoneus*	1	2.0	M		Monacanthidae	*Monacanthus chinensis*	2	5.4	M
	Mullidae	*Parupeneus biaculeatus*	1	2.0	M		Scorpaenidae	*Sebastiscus marmoratus*	2	5.4	H
	Cheilodactylidae	*Cheilodactylus zonatus*	1	2.0	H		Siganidae	*Siganus canaliculatus*	1	2.7	L
R2	Tetraodontidae	*Takifugu alboplumbeus*	70	57.4	X	R2	Sparidae	*Evynnis cardinalis*	66	48.5	M-H
	Apogonidae	*Ostorhinchus fleurieu*	14	11.5	L		Carangidae	*Decapterus maruadsi*	14	10.3	L
	Gerreidae	*Gerres oblongus*	9	7.4	L		Pomacentridae	*Neopomacentrus cyanomos*	13	9.6	L
	Pomacentridae	*Neopomacentrus cyanomos*	7	5.7	L		Sparidae	*Rhabdosargus sarba*	7	5.1	M
	Siganidae	*Siganus canaliculatus*	3	2.5	L		Clupeidae	*Sardinella aurita*	6	4.4	L
	Monacanthidae	*Stephanolepis cirrhifer*	3	2.5	M		Gerreidae	*Gerres* sp.	3	2.2	-
	Sillaginidae	*Sillago sihama*	3	2.5	H		Leiognathidae	*Secutor insidiator*	3	2.2	L
	Apogonidae	*Apogon doederleini*	3	2.5	L		Synodontidae	*Trachinocephalus myops*	3	2.2	L
	Synodontidae	*Trachinocephalus myops*	2	1.6	L		Labridae	*Halichoeres nigrescens*	2	1.5	L
	Serranidae	*Cephalopholis boenak*	2	1.6	H		Mullidae	*Upeneus japonicus*	2	1.5	L

Notes:

a. H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species or no commercial value is evaluated

Table 3.8 Top Ten Species Recorded at the Four Sampling Locations (Biomass)

Location	Family	*Species*	Biomass	% of Total Abundance	Commercial Value	Location	Family	*Species*	Abundance	% of Total Biomass	Commercial Value
		Dry Season						Wet Season			
P1	Siganidae	*Siganus canaliculatus*	1695	58.0	L	P1	Sparidae	*Evynnis cardinalis*	661	58.3	M-H
	Tetraodontidae	*Takifugu alboplumbeus*	439	15.0	X		Sciaenidae	*Dendrophysa russelii*	160	14.1	L
	Gerreidae	*Gerres oblongus*	264	9.0	L		Siganidae	*Siganus canaliculatus*	95	8.4	L
	Pomacentridae	*Neopomacentrus cyanomos*	161	5.5	L		Leiognathidae	*Leiognathus brevirostris*	93	8.2	M
	Sillaginidae	*Sillago sihama*	125	4.3	H		Paralichthyidae	*Pseudorhombus cinnamoneus*	74	6.5	M
	Sparidae	*Acanthopagrus schlegeli*	81	2.8	H		Leiognathidae	*Secutor insidiator*	50	4.4	L
	Serranidae	*Cephalopholis boenak*	49	1.7	H		-	-	-	-	-
	Dactylopteridae	*Dactyloptena peterseni*	37	1.3	L		-	-	-	-	-
	Apogonidae	*Apogonichthyoides pseudotaeniatus*	26	0.9	L		-	-	-	-	-
	Labridae	*Stethojulis interrupta*	25	0.9	L		Clupeidae	*Sardinella aurita*	0	0.0	L
P2	Tetraodontidae	*Takifugu alboplumbeus*	233	22.1	X	P2	Sparidae	*Evynnis cardinalis*	1953	49.4	M-H
	Siganidae	*Siganus canaliculatus*	207	19.6	L		Sciaenidae	*Dendrophysa russelii*	846	21.4	L
	Pomacentridae	*Neopomacentrus cyanomos*	136	12.9	L		Siganidae	*Siganus canaliculatus*	373	9.4	L
	Leiognathidae	*Leiognathus brevirostris*	106	10.1	M		Monacanthidae	*Stephanolepis cirrhifer*	218	5.5	M
	Serranidae	*Cephalopholis boenak*	101	9.6	H		Leiognathidae	*Leiognathus brevirostris*	107	2.7	M
	Labridae	*Stethojulis interrupta*	88	8.3	L		Leiognathidae	*Leiognathus equulus*	102	2.6	L
	Serranidae	*Diploprion bifasciatum*	50	4.7	L		Mullidae	*Upeneus japonicus*	94	2.4	L
	Cirrhitidae	*Cirrhitichthys aureus*	45	4.3	X		Clupeidae	*Konosirus punctatus*	78	2.0	L
	Pomacentridae	*Abudefduf vaigiensis*	40	3.8	L		Leiognathidae	*Secutor insidiator*	60	1.5	L
	Apogonidae	*Ostorhinchus fleurieu*	33	3.1	L		Sparidae	*Rhabdosargus sarba*	52	1.3	M
R1	Tetraodontidae	*Takifugu alboplumbeus*	1702	62.8	X	R1	Carangidae	*Selaroides leptolepis*	488	26.7	L
	Gerreidae	*Gerres oblongus*	180	6.6	L		Monacanthidae	*Stephanolepis cirrhifer*	250	13.7	M
	Mullidae	*Parupeneus biaculeatus*	159	5.9	M		Labridae	*Halichoeres nigrescens*	209	11.5	L
	Pomacentridae	*Neopomacentrus cyanomos*	136	5.0	L		Monacanthidae	*Monacanthus chinensis*	170	9.3	M
	Apogonidae	*Ostorhinchus fleurieu*	130	4.8	L		Mullidae	*Upeneus japonicus*	152	8.3	L
	Monacanthidae	*Stephanolepis cirrhifer*	108	4.0	M		Mullidae	*Parupeneus biaculeatus*	112	6.1	M
	Cheilodactylidae	*Cheilodactylus zonatus*	101	3.7	H		Gerreidae	*Gerres sp.*	103	5.6	-
	Siganidae	*Siganus canaliculatus*	75	2.8	L		Scorpaenidae	*Sebastiscus marmoratus*	70	3.8	H

Location	Family	*Species*	Biomass	% of Total Abundance	Commercial Value	Location	Family	*Species*	Abundance	% of Total Biomass	Commercial Value
R1	Paralichthyidae	*Pseudorhombus cinnamoneus*	53	2.0	M	R1	Sparidae	*Pagrus major*	70	3.8	M
	Chaetodontidae	*Chaetodon auripes*	47	1.7	L		Serranidae	*Cephalopholis boenak*	62	3.4	H
R2	Tetraodontidae	*Takifugu alboplumbeus*	3255	58.9	X	R2	Sparidae	*Evynnis cardinalis*	1439	33.8	M-H
	Apogonidae	*Ostorhinchus fleurieu*	459	8.3	L		Clupeidae	*Sardinella aurita*	476	11.2	L
	Gerreidae	*Gerres oblongus*	450	8.1	L		Carangidae	*Decapterus maruadsi*	442	10.4	L
	Serranidae	*Cephalopholis boenak*	237	4.3	H		Sparidae	*Rhabdosargus sarba*	426	10.0	M
	Monacanthidae	*Stephanolepis cirrhifer*	226	4.1	M		Synodontidae	*Trachinocephalus myops*	243	5.7	L
	Synodontidae	*Saurida tumbil*	210	3.8	L		Mullidae	*Parupeneus indicus*	223	5.2	M
	Pomacentridae	*Neopomacentrus cyanomos*	165	3.0	L		Pomacentridae	*Neopomacentrus cyanomos*	191	4.5	L
	Apogonidae	*Apogon doederleini*	91	1.6	L		Serranidae	*Cephalopholis boenak*	173	4.1	H
	Sillaginidae	*Sillago sihama*	85	1.5	H		Monacanthidae	*Monacanthus chinensis*	77	1.8	M
	Scorpaenidae	*Sebastiscus marmoratus*	81	1.5	H		Mullidae	*Upeneus japonicus*	74	1.7	L

Notes:

a. H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species or no commercial value is evaluated

3.2 *JUVENILE FISH SURVEY*

For juvenile fish survey, a total 519 g of 1,523 individuals comprising eight species from six families were recorded. The dominant species in terms of biomass and abundance was Engraulidae sp.. A bivalve species, Green lipped mussel *Perna veridis*, was recorded during the survey.

Among the four sampling locations, P1 and R2 reported relatively higher juvenile fish resources in terms of abundance, biomass and number of species, whilst R1 exhibited the lowest level of juvenile fish resources. The overall juvenile fish resources in the Study Area is summarized in *Table 3.9*.

Table 3.9 Overall Juvenile Fish Resources in the Study Area

Sampling Location	Average No. of Species (± S.D.)	Average Biomass (g) (± S.D.)	Average No. of Individual (± S.D.)	Total No. of Species	Total Biomass (g)	Total No. of Individual
P1	1.0 ± 0.8	5.0 ± 3.9	63.0 ± 93.8	3	20	252
P2	1.8 ± 1.3	16.8 ± 22.6	23.3 ± 35.8	6	67	92
R1	0.3 ± 0.5	0.3 ± 0.5	1.0 ± 2.0	1	1	4
R2	1.5 ± 1.3	107.5 ± 209.0	293.5 ± 486.6	4	430	1,174
Overall total	1.1 ± 1.1	32.4 ± 104.3	95.1 ± 252.7	8	518	1,522

3.2.1 *Commercial Value*

The commercial value of juvenile fish is also estimated using the similar approach for adult fish resources as described in *Section 3.1.1.* Among the eight recorded juvenile fish species in the Study Area, only three of them could be identified to species level and their commercial value is thus evaluated. All of them are considered of low commercial value. Level of commercial value for the recorded species is presented in *Annex B*.

The juvenile fish species with low commercial value accounted for 65% of the total biomass and only 2% of total abundance from juvenile fish survey. The highest abundance and biomass were recorded for Hardenberg's anchovy (*Stolephorus insularis*) and Hardyhead silverside (*Atherinomorus lacunosus*), respectively.

3.2.2 *Catch per Unit Effort*

The following equation is adopted to calculate Catch per Unit Effort (CPUE):

$$\text{CPUE} = \frac{\text{No.of Individual}}{\text{Fishing time (hour)x Number of Seine Net}}, \text{ where}$$

Fishing time = 10 minutes = 0.1667 hours;
Numbers of seine nets = 1.

The average CPUE of each sampling location is ranged between 6.00 and 1,760.65 no. hour $^{-1}$ seine net $^{-1}$ (*Table 3.10*).

Table 3.10 ***Mean Catch per Unit Effort of Juvenile Fish Resources at each Sampling Location***

Sampling Location	**Mean CPUE (± S.D.)** (no. hour $^{-1}$ seine net^{-1})
P1	377.92 ± 562.50
P2	137.97 ± 211.75
R1	6.00 ± 12.00
R2	1,760.65 ± 2,918.84
Overall total	570.64 ± 1,516.14

3.2.3 Yield per Unit Effort

The following equation is adopted to calculate Yield per Unit Effort (YPUE):

$$YPUE = \frac{\text{Weight of Fish}}{\text{Fishing time (hour)x Numbers of Seine Net}}$$, where

Fishing time = 10 minutes = 0.1667 hours;
Numbers of seine net = 1.

The average YPUE of each sampling location is ranged between 1.50 and 644.87 g hour $^{-1}$ seine net^{-1} (*Table 3.11*).

Table 3.11 ***Mean Yield per Unit Effort of Juvenile Fish Resources at each of the Sampling Location***

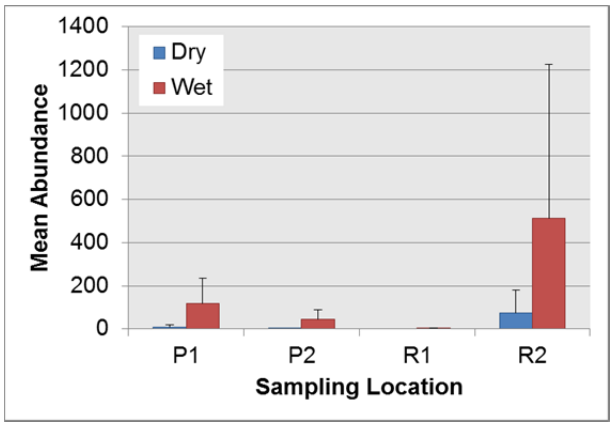
Sampling Location	**Mean YPUE (± S.D.)** (g hour $^{-1}$ seine net^{-1})
P1	29.99 ± 23.49
P2	100.48 ± 135.68
R1	1.50 ± 3.00
R2	644.87 ± 1,253.87
Overall total	194.21 ± 625.96

3.2.4 Spatio-seasonal Variation in Juvenile Fish Resources

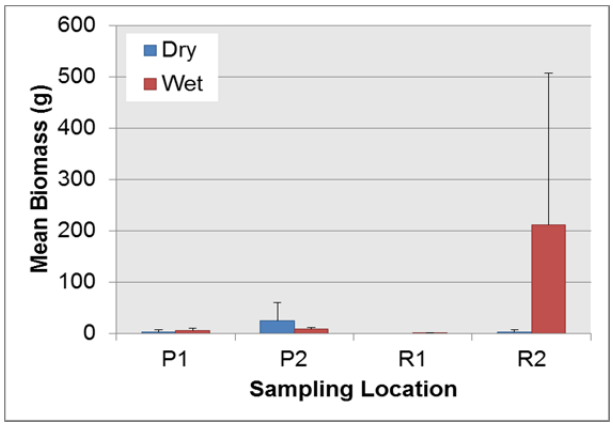
Species richness, diversity and evenness of juvenile fish resources are illustrated in *Figure 3.2*. An increase in the species richness was observed in wet season across the four sampling locations with results of ANOVA showing a significant seasonal difference in species richness (*Table 3.12*). However the overall species richness is still rather low in the Study Area. Among the four sampling locations, a relatively lower species richness, diversity and evenness was observed at R1 and P1, whilst the highest was observed at R2, although the observed difference is statistically insignificant. The overall species richness, *H'* and J in the Study Area are considered to be very low. This indicates a very low diversity of adult fish resources (mean value of *H'* <0.2) in the Study Area as the number of adult fish species recorded is very low (mean value of S <3) and the abundance of recorded species is rather unevenly distributed (mean value of *J* < 0.6) (i.e. juvenile fish community is dominated by few species). The juvenile fish resources in the

Study Area is considered to be of very low diversity and production level in comparison with the other fisheries surveys under this Assignment (see *Sections 3.1 & 3.3*).

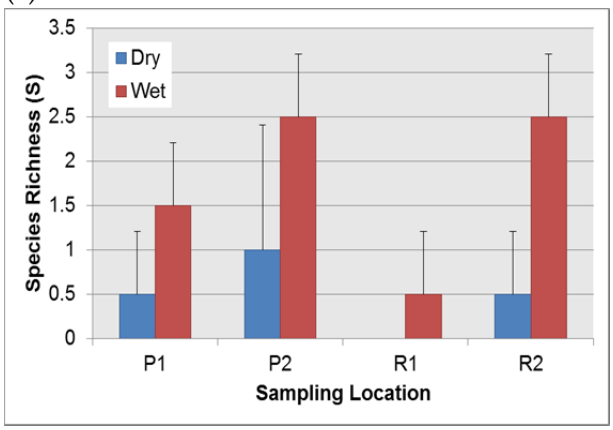
Figure 3.2 Spatio-seasonal Variation in Juvenile Fish Resources in the Study Area



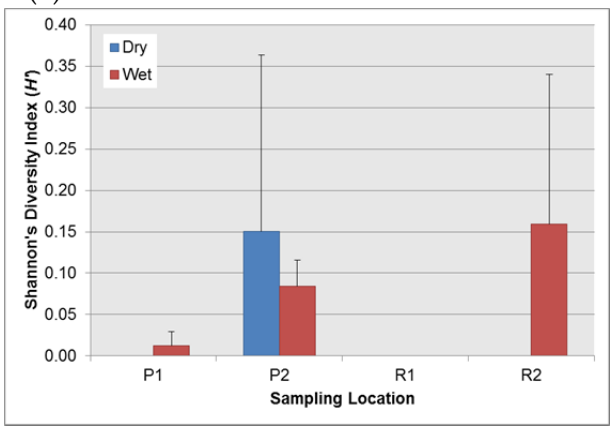
(a) Mean Abundance



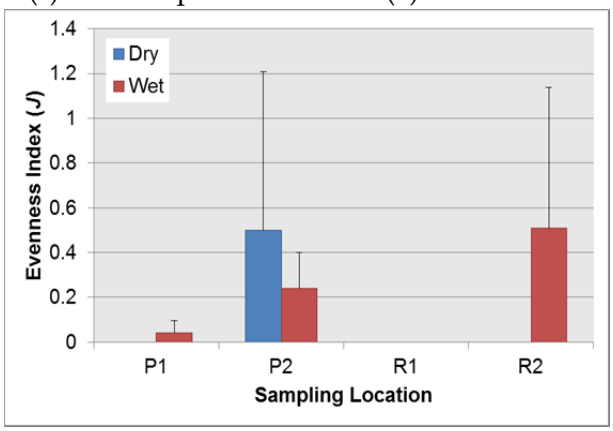
(b) Mean Biomass



(c) Mean Species Richness (S)



(d) Mean Shannon's Diversity Index (*H'*)



(e) Mean Evenness Index (*J*)

Table 3.12 ***Statistical Analyses of Spatio-seasonal Variation in Juvenile Fish Resources: (a) abundance, (b) biomass, (c) species richness (S), (d) Shannon's diversity index (H') and (e) Evenness index (J) between areas (reference vs impact), seasons (wet and dry), location nested within areas (Location(Area)) using three-factor, mixed model ANOVA. "+" indicates homogeneous of variance by Levene's Test of equal variance (p > 0.05). Significant differences are indicated by underline (p < 0.05).***

	Source	*df*	MS	*F*	*p*
a)	Abundance				
	Area	1	88209.000	1.396	0.265
	Season	1	43472.250	0.499	0.553
	Area * Season	1	20164.000	0.319	0.585
	Location(Area)	2	87156.250	1.379	0.296
	Residual	10			
b)	Biomass				
	Area	1	7396.000	0.635	0.509
	Season	1	9506.250	0.858	0.376
	Area * Season	1	12321.000	1.112	0.317
	Location(Area)	2	11640.625	1.050	0.385
	Residual	10			
c)	Species richness (S) +				
	Area	1	1.000	0.471	0.564
	Season	1	6.250	10.000	0.010
	Area * Season	1	0.000	0.000	1.000
	Location(Area)	2	2.125	3.400	0.075
	Residual	10			
d)	Diversity Index (*H'*)				
	Area	1	0.003	0.288	0.603
	Season	1	0.002	0.102	0.780
	Area * Season	1	0.011	1.201	0.299
	Location(Area)	2	0.019	1.965	0.191
	Residual	10			
e)	Evenness Index (*J*)				
	Area	1	0.021	0.193	0.670
	Season	1	0.018	0.098	0.784
	Area * Season	1	0.133	1.209	0.297
	Location(Area)	2	0.188	1.710	0.230
	Residual	10			

3.2.5 Species Composition

In comparison with adult fish and ichthyoplankton surveys under this Assignment, the number of juvenile fish species recorded in the Study Area was very low, with Engraulidae species as the dominant fish family among the five recorded fish families in terms of abundance, accounting for 97 % of total abundance and 34% of total biomass of juvenile fish species collected.

In the dry season, a total of 64 g of 167 individuals comprising three fish species from three families were recorded, in which 57g of 17 individuals were

recorded from IPA and 7g of 150 individuals were recorded from RFA. Family Engraulidae was the dominant species in terms of abundance in both Impact and Reference Areas. In the wet season, a total of 454g of 1,355 fish individuals comprising of five species from four families were recorded. In the IPA, a total of 30g of 327 individuals comprising of three species from three families were recorded. On the other hand, a total of 424g of 1,028 individuals comprising four species from three families were recorded at RFA. Engraulidae and Atherinidae were the dominant families recorded in terms of biomass during the wet season. Fish family Engraulidae was commonly recorded in both seasons and areas.

3.3 ICHTHYOPLANKTON SURVEY

In the ichthyoplankton survey, a total of 91 species from 42 families (including both fish egg and fish larvae) were recorded in the Study Area, which comprises of 49 fish egg species from 30 families, and 57 larvae species from 33 families. The dominant species of fish egg and fish larvae are *Gerres oyena* and *Chromis notata*, respectively, accounting for 22.4% and 29.5% of total density. These dominant species are considered of low to no commercial value. One species of conservation importance, *Hippocampus trimaculatus* in larvae stage, was recorded at T3 in the wet season, accounting for only 0.07% of the total larval density. The overall ichthyoplankton collected in the Study Area is summarized in *Table 3.13.* Full list of ichthyoplankton recorded is presented in *Annex C*.

Table 3.13 Results Summary of Ichthyoplankton Survey

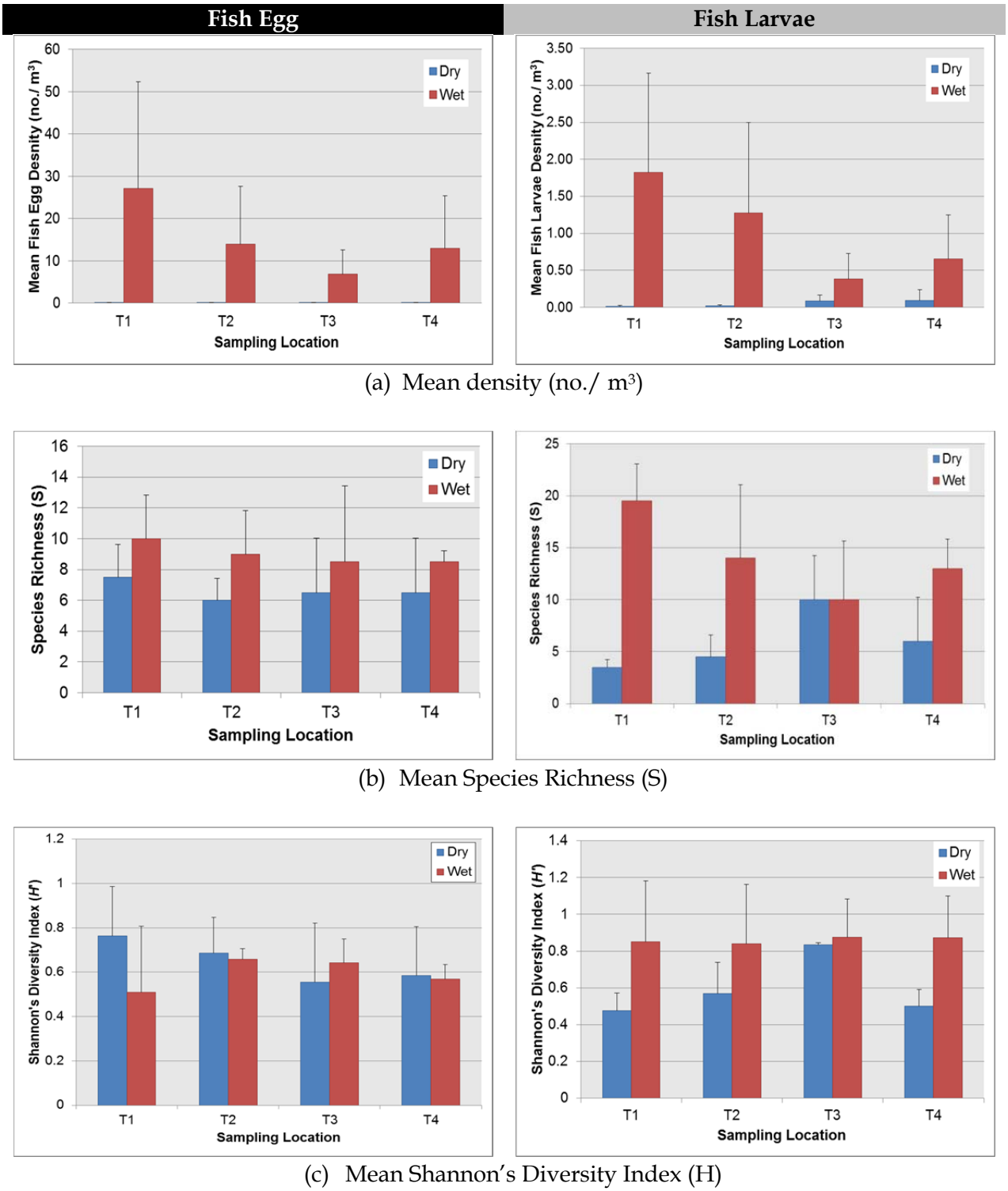
Sampling Location	Mean No. of Species (± S.D.)		Mean Density (no. / m³) (± S.D.)		Total No. of Species		Total Density (no. / m³)		Dominant Species	
	Egg	Larvae	Egg	Larvae	Egg	Larvae	Egg	Larvae	Egg	Larvae
T1 (IPA)	4.58 ± 1.93	11.50 ± 9.47	13.62 ± 22.07	0.92 ± 1.31	26	37	163.39	11.03	*Gerres oyena*	*Chromis notate*
T2 (IPA)	3.83 ± 1.64	9.25 ± 6.95	7.01 ± 11.72	0.65 ± 1.05	25	32	84.08	7.76	*Gerres oyena*	*Chromis notate*
T3 (RFA)	3.67 ± 1.72	10.00 ± 4.08	3.52 ± 5.20	0.23 ± 0.28	26	30	42.19	2.80	*Diagramma pictum*	*Chromis notate*
T4 (RFA)	3.58 ± 1.00	9.50 ± 5.00	6.54 ± 10.74	0.37 ± 0.51	26	31	78.49	4.50	*Nematalosa nasus*	*Chromis notate*
Overall total	3.92 ± 1.61	10.06 ± 6.06	7.67 ± 13.91	0.54 ± 0.90	49	57	368.14	26.08	*Gerres oyena*	*Chromis notate*

3.3.1 Spatio-seasonal Variation in Ichthyoplankton Assemblages

Strong seasonal variations in species richness, fish egg and fish larvae densities were observed, in which the abundance and species richness of fish egg and fish larvae were higher in the wet season than that in the dry season (*Figure 3.3* and *Table 3.14*). This is consistent with the findings in other

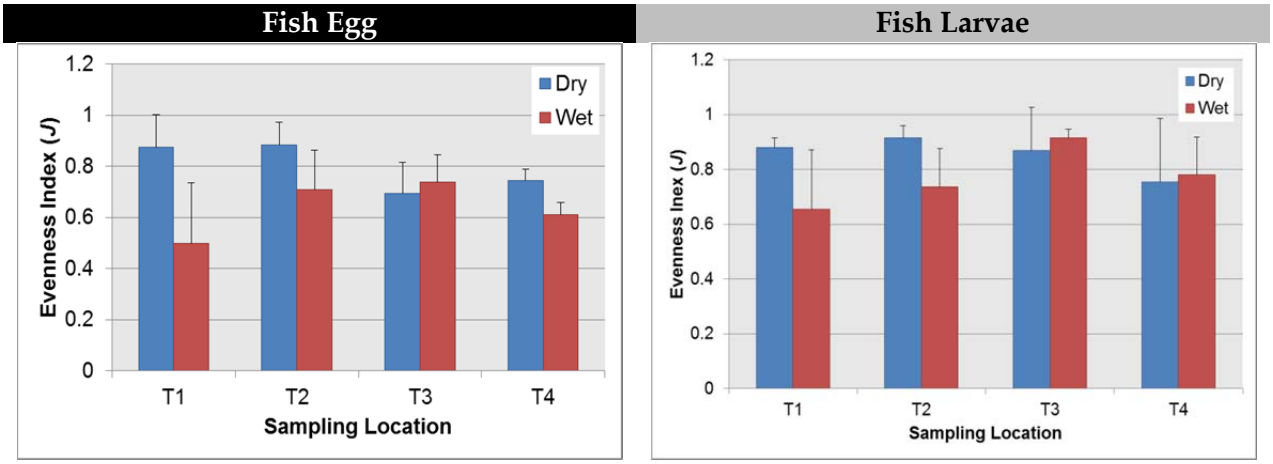
studies, where the abundance of ichthyoplankton assemblages were the highest in spring, followed by summer and lowest in winter (1) (2) (*Figure 3.4*).

Figure 3.3 Spatial and Seasonal Variation in Fish Egg and Fish Larvae in the Study Area



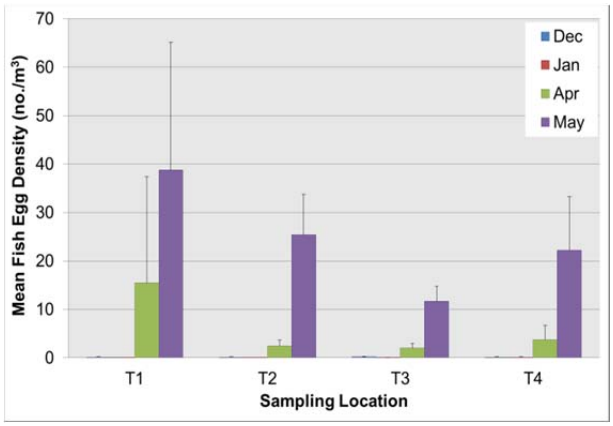
(1) Situ Y (2007) ibid.

(2) Sadovy Y (1998) Patterns of reproduction in marine fishes of Hong Kong and adjacent waters. The Marine Biology of the South China Sea. Proceedings of the Third International Conference on Marine Biology of South China Sea.

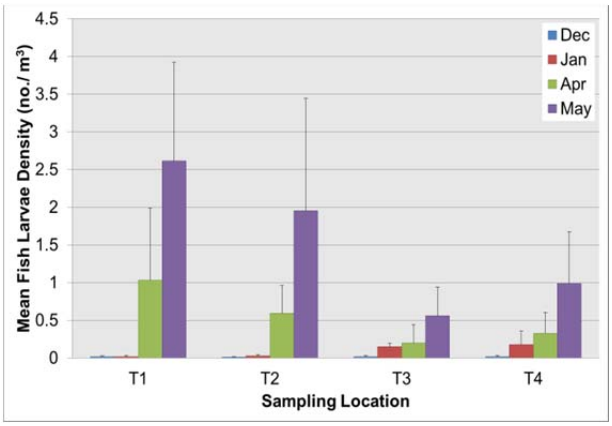


(d) Mean Evenness Index (J)

Figure 3.4 Distribution Pattern of Ichthyoplankton in the Study Area



(a) Mean fish egg density (no./ m^3)



(b) Mean fish larvae density (no./ m^3)

Table 3.14 ***Statistical Analyses of Spatio-seasonal Variation in Ichthyoplankton: (a) & (e) density, (b) & (f) species richness (S), (c) & (g) Shannon's diversity index (H') and (d) & (h) Evenness index (J) between areas (reference vs impact), seasons (wet vs dry), location nested within areas (Location(Area)) using three-factor, mixed model ANOVA. "+" indicates homogeneous of variance by Levene's Test of equal variance (p > 0.05). Significant differences are indicated by underline (p < 0.05).***

	Fish Egg						Fish Larvae				
	Source	*df*	MS	*F*	*p*		Source	*df*	MS	*F*	*p*
(a)	Density					(e)	Density				
	Area	1	334.900	2.113	0.283		Area	1	2.751	9.728	0.089
	Season	1	2737.228	21.457	< 0.001		Season	1	11.545	24.795	< 0.001
	Area * Season	1	340.856	2.672	0.110		Area * Season	1	3.655	7.850	0.008
	Location(Area)	2	158.491	1.242	0.299		Location(Area)	2	0.283	0.607	0.549
	Residual	10					Residual	10			
(b)	Species richness (S) +					(f)	Species richness (S) +				
	Area	1	4.083	2.390	0.262		Area	1	1.563	0.294	0.642
	Season	1	21.333	10.096	0.003		Season	1	264.063	13.962	0.004
	Area * Season	1	4.083	1.932	0.172		Area * Season	1	85.563	4.524	0.059
	Location(Area)	2	1.708	0.808	0.452		Location(Area)	2	5.313	0.281	0.761
	Residual	10					Residual	10			
(c)	Diversity Index (*H'*) +					(g)	Diversity Index (*H'*) +				
	Area	1	0.018	9.852	0.088		Area	1	0.030	1.015	0.420
	Season	1	0.011	0.341	0.572		Season	1	0.278	6.694	0.027
	Area * Season	1	0.032	0.962	0.350		Area * Season	1	0.013	0.318	0.585
	Location(Area)	2	0.002	0.054	0.948		Location(Area)	2	0.030	0.724	0.509
	Residual	10					Residual	10			
(d)	Evenness Index (*J*) +					(h)	Evenness Index (*J*)				
	Area	1	0.008	0.557	0.533		Area	1	0.004	0.231	0.678
	Season	1	0.102	5.959	0.035		Season	1	0.028	1.636	0.230
	Area * Season	1	0.054	3.146	0.106		Area * Season	1	0.057	3.385	0.096
	Location(Area)	2	0.014	0.806	0.473		Location(Area)	2	0.019	1.103	0.369
	Residual	10					Residual	10			

3.3.2 Species Composition

In total 91 species of ichthyoplankton recorded, and there were differences in species composition between seasons, and areas to a lesser extent. Among the recorded species, the majority of them (over 75%) are of no to low commercial value. The top ten species of fish egg and fish larvae by density are listed in *Table 3.15* and *Table 3.16*.

For fish egg density recorded in the dry season, species of low to no commercial value, namely Yellowfin seabream *Acanthopagrus schlegelii* and Black-stripe sweeper *Pempheris schwenkii*, as well as species of high commercial value, Large yellow croaker *Larimichthys crocea*, were the most abundant in IPA, together these species accounting for over 50% of the total density at IPA. In contrast, species of both high and low commercial value, namely Silver sillago *Sillago sihama*, Yellowfin seabream *Acanthopagrus schlegelii* and Red seabream *Pagrus major*, were abundant in RFA, and together these species accounted for over 65% of the total density in RFA. In the wet season, the dominant fish egg species at IPA were species of low values Common silver-biddy *Gerres oyena* and Chinese wrasse *Halichoeres tenuispinis*, and these species contributed >50% of total density in IPA. Although these species were also recorded in RFA, they only contributed <5% of total density at RFA. It is worth noting that species of high commercial value, such as Painted sweetlips *Diagramma pictum* and Japanese sillago *Sillago japonica*, were also recorded in RFA and contributed >50% of the total density at T3. The survey results showed that in terms of fish egg, the RFA appears to support a higher portion of species of high commercial value when compared to the IRA.

For fish larvae density, the species composition of fish larvae was similar across the sampling locations. In the dry season, the most abundant species was Marbled rockfish *Sebastiscus marmoratus* across the sampling locations, which is a species of high commercial value and accounted for about 26 – 42% and 33 – 58% of total density in IPA and RFA, respectively. In the wet season, however, the dominant fish larvae species were of low to high commercial values. The most abundant species of low commercial value included Pearl-spot chromis *Chromis notate* and Mauritian sardinella *Sardinella jussieu*, together these species contributed over 30% of the total density in IPA and RFA. For species of high commercial value, such as Yellow drum *Nibea albiflora*, the species accounted for <5% and <7% of total density in IPA and RFA, respectively. The survey results showed that species composition, in particular fish larvae, was similar between RFA and IPA. However RFA appears to support a higher proportion of species of high commercial value.

It is also worth noting that all sampling locations, in particular IPA, comprised largely reef-associated fish species, whilst RFA has recorded a higher proportion of demersal and pelagic fish species when compared with IPA (*Figure 3.5*). The pattern of fish egg and fish larval distribution could be somewhat related to the adult's preferences for habitat and consequently

associated with local recruitment success. Results of adult and juvenile fish surveys would help further determine whether the Study Area provides a substantial habitat for fish spawning and nursery. Details of potential local recruitment are discussed in *Section 3.4*.

Figure 3.5 Composition of Ichthyoplankton Assemblages

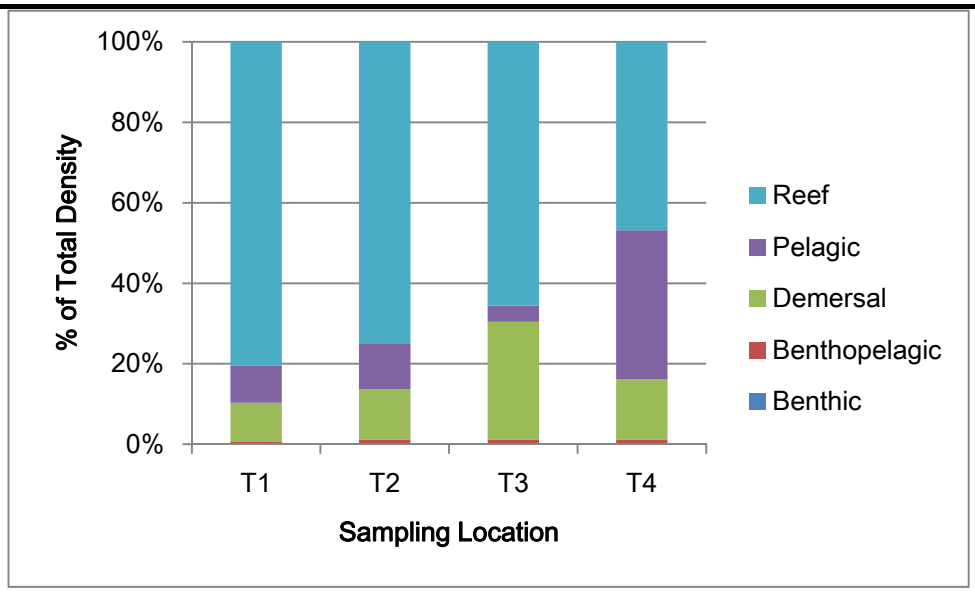


Table 3.15 Top Ten Fish Egg Species Recorded at the Four Sampling Locations

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
Dry Season						Wet Season					
T1	Sparidae	*Acanthopagrus schlegelii*	0.227	36.1	L	T1	Gerreidae	*Gerres oyena*	59.109	36.3	L
	Pempheridae	*Pempheris schwenkii*	0.095	15.2	X		Labridae	*Halichoeres tenuispinis*	37.698	23.2	L
	Sciaenidae	*Larimichthys crocea*	0.065	10.4	H		Engraulidae	*Encrasicholina punctifer*	14.544	8.9	L
	Sillaginidae	*Sillago sihama*	0.054	8.7	H		Leiognathidae	*Nuchequula nuchalis*	11.679	7.2	M
	Clupeidae	*Nematalosa japonica*	0.036	5.8	L		Labridae	*Stethojulis terina*	9.922	6.1	X
	Callionymidae	*Callionymus curvicornis*	0.022	3.4	X		Labridae	*Halichoeres nigrescens*	9.060	5.6	L
	Sparidae	*Evynnis cardinalis*	0.020	3.2	L		Haemulidae	*Diagramma pictum*	8.538	5.2	H
	Sparidae	*Sparidae* sp.	0.018	2.9	X		Gerreidae	*Gerres oblongus*	5.638	3.5	L
	Aulopidae	*Hime japonica*	0.018	2.9	L		Platycephalidae	*Inegocia japonica*	3.297	2.0	L
	Sparidae	*Acanthopagrus pacificus*	0.016	2.5	L		Clupeidae	*Nematalosa nasus*	1.923	1.2	L
T2	Sparidae	*Acanthopagrus schlegelii*	0.157	30.9	L	T2	Gerreidae	*Gerres oyena*	44.777	53.6	L
	Sciaenidae	*Larimichthys crocea*	0.127	25.0	H		Engraulidae	*Encrasicholina punctifer*	10.297	12.3	L
	Sillaginidae	*Sillago sihama*	0.118	23.2	H		Leiognathidae	*Nuchequula nuchalis*	7.423	8.9	M
	Pempheridae	*Pempheris schwenkii*	0.037	7.2	H		Labridae	*Halichoeres nigrescens*	4.378	5.2	L
	Sparidae	*Acanthopagrus pacificus*	0.023	4.5	L		Haemulidae	*Diagramma pictum*	3.998	4.8	H
	Platycephalidae	*Platycephalidae* sp.	0.009	1.7	X		Scorpaenidae	*Scorpaenidae* sp.	3.014	3.6	X
	Labridae	*Stethojulis terina*	0.009	1.7	L		Platycephalidae	*Inegocia japonica*	2.859	3.4	L

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
		Dry Season						Wet Season			
T2	Trichiuridae	*Trichiurus lepturus*	0.009	1.7	X	T2	Labridae	*Stethojulis terina*	2.675	3.2	X
	Synodontidae	*Synodus variegatus*	0.007	1.4	L		Labridae	*Halichoeres tenuispinis*	1.366	1.6	L
	Sparidae	*Sparidae* sp.	0.007	1.4	L		Clupeidae	*Nematalosa nasus*	1.041	1.2	L
T3	Sillaginidae	*Sillago sihama*	0.383	41.0	H	T3	Haemulidae	*Diagramma pictum*	12.296	29.8	H
	Sparidae	*Acanthopagrus schlegelii*	0.260	27.8	L		Sillaginidae	*Sillago japonica*	9.942	24.1	H
	Moronidae	*Lateolabrax japonicus*	0.134	14.4	L		Engraulidae	*Encrasicholina punctifer*	7.013	17.0	L
	Gobiidae	*Amblychaeturichthys hexanema*	0.050	5.4	X		Gerreidae	*Gerres oyena*	4.592	11.1	L
	Sciaenidae	*Larimichthys crocea*	0.020	2.1	H		Labridae	*Halichoeres tenuispinis*	1.636	4.0	L
	Sparidae	*Sparidae* sp.	0.019	2.0	L		Carangidae	*Decapterus macrosoma*	1.610	3.9	L
	Mugilidae	*Crenimugil crenilabis*	0.017	1.8	L		Sphyraenidae	*Sphyraena pinguis*	1.282	3.1	L
	Sparidae	*Pagrus major*	0.017	1.8	H		Platycephalidae	*Suggrundus sp.*	1.272	3.1	X
	Sparidae	*Acanthopagrus pacificus*	0.010	1.1	L		Platycephalidae	*Inegocia japonica*	0.615	1.5	L
	Platycephalidae	*Platycephalidae* sp.	0.010	1.1	X		Pempheridae	*Pempheris schwenkii*	0.354	0.9	X
T4	Sillaginidae	*Sillago sihama*	0.242	31.7	H	T4	Clupeidae	*Nematalosa nasus*	29.436	37.9	L
	Sparidae	*Acanthopagrus schlegelii*	0.170	22.3	L		Labridae	*Halichoeres nigrescens*	18.689	24.0	L
	Sparidae	*Pagrus major*	0.106	13.9	H		Engraulidae	*Encrasicholina punctifer*	10.553	13.6	L
	Pomacentridae	*Abudefduf vaigiensis*	0.096	12.5	L		Labridae	*Stethojulis terina*	6.821	8.8	X

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
Dry Season						Wet Season					
T4	Mugilidae	*Crenimugil crenilabis*	0.046	6.1	L	T4	Haemulidae	*Diagramma pictum*	4.052	5.2	H
	Pempheridae	*Pempheris schwenkii*	0.039	5.1	H		Sillaginidae	*Sillago japonica*	3.843	4.9	H
	Callionymidae	*Bathycallionymus kaianus*	0.031	4.1	X		Labridae	*Halichoeres tenuispinis*	1.968	2.5	L
	Sparidae	*Sparidae* sp.	0.007	0.9	L		Serranidae	*Epinephelus sexfasciatus*	0.769	1.0	H
	Clupeidae	*Konosirus punctatus*	0.007	0.9	L		Pempheridae	*Pempheris schwenkii*	0.472	0.6	X
	Sciaenidae	*Larimichthys crocea*	0.006	0.8	H		Paralichthyidae	*Pseudorhombus elevatus*	0.268	0.3	L

Notes:

a. H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species or no commercial value is evaluated

Table 3.16 Top Ten Fish Larvae Species Recorded at the Four Sampling Locations

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
Dry Season						Wet Season					
T1	Scorpaenidae	*Sebastiscus marmoratus*	0.038	42.3	H	T1	Pomacentridae	*Chromis notata*	2.517	23.0	X
	Sparidae	*Rhabdosargus sarba*	0.023	25.1	L		Clupeidae	*Sardinella jussieu*	1.862	17.0	L
	Callionymidae	*Bathycallionymus kaianus*	0.009	9.6	X		Pomacentridae	*Pomacentridae* sp.*1*	1.146	10.5	X
	Blenniidae	*Petroscirtes breviceps*	0.007	8.0	X		Ambassidae	*Ambassis* sp.	1.128	10.3	X
	Sparidae	*Acanthopagrus schlegelii*	0.007	7.5	L		Gobiidae	*Amblyotrypauchen arctocephalus*	0.658	6.0	X
	Clupeidae	*Konosirus punctatus*	0.007	7.5	L		Nemipteridae	*Nemipterus japonicus*	0.620	5.7	L
	-	-	-	-	-		Mugilidae	*Valamugil cunnesius*	0.428	3.9	M
	-	-	-	-	-		Clupeidae	*Sardinella melanura*	0.347	3.2	L
	-	-	-	-	-		Sciaenidae	*Nibea albiflora*	0.252	2.3	H
	-	-	-	-	-		Blenniidae	*Scartella* sp.	0.233	2.1	X
T2	Scorpaenidae	*Sebastiscus marmoratus*	0.028	26.1	H	T2	Pomacentridae	*Chromis notata*	1.915	25.0	X
	Mugilidae	*Chelon affinis*	0.023	21.5	X		Clupeidae	*Sardinella jussieu*	0.944	12.3	L
	Blenniidae	*Blenniidae spp.*	0.014	13.0	X		Mugilidae	*Valamugil cunnesius*	0.782	10.2	M
	Pomacentridae	*Abudefduf vaigiensis*	0.007	6.7	L		Ambassidae	*Ambassis* sp.	0.709	9.3	X
	Tetraodontidae	*Takifugu poecilonotus*	0.007	6.7	X		Clupeidae	*Sardinella melanura*	0.594	7.8	L

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
		Dry Season						Wet Season			
T2	Gobiidae	*Gobiidae* sp.	0.007	6.5	X	T2	Nemipteridae	*Nemipterus japonicus*	0.481	6.3	L
	Sparidae	*Acanthopagrus latus*	0.007	6.5	L		Pomacentridae	*Pomacentridae* sp.*1*	0.406	5.3	X
	Callionymidae	*Callionymus curvicornis*	0.007	6.5	X		Gobiidae	*Amblyotrypauchen arctocephalus*	0.332	4.3	X
	Triglidae	*Triglidae* sp.	0.007	6.5	X		Sciaenidae	*Nibea albiflora*	0.326	4.3	H
	-	-	-	-	-		Blenniidae	*Scartella* sp.	0.312	4.1	X
T3	Scorpaenidae	*Sebastiscus marmoratus*	0.166	32.7	H	T3	Pomacentridae	*Chromis notata*	0.537	23.4	X
	Sparidae	*Rhabdosargus sarba*	0.116	22.9	L		Mugilidae	*Valamugil cunnesius*	0.268	11.7	M
	Sparidae	*Acanthopagrus latus*	0.047	9.3	L		Sciaenidae	*Nibea albiflora*	0.189	8.2	H
	Blenniidae	*Blenniidae spp.*	0.029	5.7	X		Sillaginidae	*Sillago sihama*	0.161	7.0	H
	Blenniidae	*Petroscirtes breviceps*	0.024	4.6	X		Clupeidae	*Sardinella jussieu*	0.157	6.9	L
	Gobiidae	*Gobiidae* sp.	0.019	3.7	X		Ambassidae	*Ambassis* sp.	0.152	6.6	X
	Engraulidae	*Encrasicholina punctifer*	0.019	3.7	L		Gobiidae	*Amblyotrypauchen arctocephalus*	0.149	6.5	X
	Sparidae	*Pagrus* sp.	0.017	3.3	X		Apogonidae	*Ostorhinchus fasciatus*	0.148	6.5	L
	Sparidae	*Acanthopagrus schlegelii*	0.015	3.0	L		Pomacentridae	*Pomacentridae* sp.*1*	0.122	5.3	X
	Pomacentridae	*Abudefduf vaigiensis*	0.012	2.4	L		Blenniidae	*Blenniidae spp.*	0.121	5.3	X
T4	Scorpaenidae	*Sebastiscus marmoratus*	0.331	58.5	H	T4	Pomacentridae	*Chromis notata*	0.881	22.4	X
	Sparidae	*Rhabdosargus sarba*	0.075	13.2	L		Clupeidae	*Sardinella jussieu*	0.828	21.1	L

Location	Family	Species	Density	% of Total Density	Commercial Value	Location	Family	Species	Density	% of Total Density	Commercial Value
		Dry Season						Wet Season			
T4	Mugilidae	*Chelon affinis*	0.044	7.8	X	T4	Pomacentridae	*Pomacentridae* sp.*1*	0.390	9.9	X
	Blenniidae	*Blenniidae spp.*	0.041	7.3	X		Sciaenidae	*Nibea albiflora*	0.288	7.3	H
	Sparidae	*Acanthopagrus schlegelii*	0.027	4.9	L		Blenniidae	*Scartella* sp.	0.243	6.2	X
	Pomacentridae	*Abudefduf vaigiensis*	0.017	3.0	L		Blenniidae	*Blenniidae spp.*	0.211	5.4	X
	Sparidae	*Acanthopagrus latus*	0.011	1.9	L		Apogonidae	*Ostorhinchus fasciatus*	0.145	3.7	L
	Sillaginidae	*Sillago sihama*	0.007	1.2	H		Triglidae	*Lepidotrigla alata*	0.121	3.1	L
	Engraulidae	*Encrasicholina punctifer*	0.006	1.1	L		Sphyraenidae	*Sphyraenidae* sp.*1*	0.121	3.1	L
	Sparidae	*Pagrus* sp.	0.006	1.1	X		Sciaenidae	*Johnius grypotus*	0.115	2.9	L

Notes:

a. H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species or no commercial value is evaluated

3.4 LOCAL RECRUITMENT

A nursery ground refers to an area where the density of juvenile individuals is sufficiently high to recruit to adult stage/ habitat and sustain the adult population (1). A spawning ground, in generic sense, is an area for oviposition (i.e. egg laying) and parturition (i.e. live-bearing) (2). To examine the species composition among different stage of fish species, the families recorded from adult fish, juvenile fish and ichthyoplankton surveys were compared against one another (*Table 3.17*), which could provide some insights into the recruitment pattern and potential of the Study Area as an effective and hence potentially important spawning and nursery grounds.

Amongst the 49 fish families recorded in the Study Area, only two families, Gerreidae and Leiognathidae (i.e. 4.1%) was recorded in adult, juvenile and ichthyoplankton stages, and only three families (i.e. 6.1%) were recorded as fish larvae and adult or as juvenile and adult. It is evident that the relationship of species composition among different stage of fish species in the Study Area is weak. With the very low abundance of juvenile fish recorded and low percentage of overlap for adult fish and ichthyoplankton, it may reflect that:

- Ichthyoplankton in the Study Area do not seem to be locally produced, and they are transported to the Study Area passively by currents;
- Local recruitment success of ichthyoplankton in the Study Area is rather low, probably due to natural mortality at this early stage of development (3);
- It is likely that juvenile fish and adult fish of the Study Area represent fisheries production mostly through migration rather than local recruitment; and
- Even if spawning of adult fish may occur within the Study Area, the associated ichthyoplankton are likely to be dispersed to elsewhere with very limited local recruitment and also only few juveniles are recorded.

Based on the above, the Study Area does not appear to be an effective spawning or nursery grounds for commercial fisheries. It is thus unlikely to be an important spawning or nursery grounds for commercial fisheries.

(1) Dahlgren et al., (2006) Marine nurseries and effective juvenile habitats: concepts and applications. Marine Ecology-Progress Series (312): 291 - 295.

(2) Ellis et al., (2012) Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report (147). pp56

(3) Fok MSM (2008) Baseline Survey of Fish Juvenile Assemblages in Tolo Harbour and Channel, Hong Kong. Thesis for the Degree of Master of Philosophy. The University of Hong Kong.

Table 3.17 Occurrence of Fish Families in Adult Fish, Juvenile Fish and Ichthyoplankton Surveys within the Study Area

Family	Adult	Juvenile	Ichthyoplankton
Ambassidae			*
Apogonidae	*		*
Atherinidae		*	
Aulopidae			*
Blenniidae	*		*
Bothidae			*
Bregmacerotidae			*
Callionymidae			*
Carangidae	*		*
Cepolidae			*
Chaetodontidae	*		
Cheilodactylidae	*		
Cirrhitidae	*		
Clupeidae	*		*
Cynoglossidae			*
Dactylopteridae	*	*	
Engraulidae		*	*
Gerreidae	*	*	*
Gobiidae			*
Haemulidae	*		*
Kyphosidae	*		
Labridae	*		*
Leiognathidae	*	*	*
Monacanthidae	*		*
Moronidae			*
Mugilidae			*
Mullidae	*		*
Nemipteridae			*
Paralichthyidae	*		*
Pempheridae			*
Percidae			*
Platycephalidae			*
Pomacentridae	*		*
Scaridae			*
Sciaenidae	*		*
Scorpaenidae	*		*
Serranidae	*		*
Siganidae	*		
Sillaginidae	*		*
Soleidae	*		*
Sparidae	*		*
Sphyraenidae			*
Syngnathidae			*
Synodontidae	*		*
Terapontidae	*		*
Tetraodontidae	*		*
Trichiuridae			*
Triglidae			*
Tripterygiidae			*

3.5 COMPARISON WITH OTHER STUDIES

Reference was made to the following publicly available recent fisheries studies in Hong Kong to evaluate the level of fisheries resources in the Study Area against other areas of Hong Kong:

- Expansion of Hong Kong International Airport into a Three-Runway System – Environmental Impact Assessment Report (2013);
- Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities – Environmental Impact Assessment (2006); and
- Ichthyoplankton Assemblage at Cape D'Aguilar: Seasonal Variability and Family Composition (2007).

It is important to note that due to differences in sampling design, including mesh-size, sampling gear and sampling duration, as well as location and study duration, direct comparisons should not be made among the current survey and the above studies. However, the above studies could provide some references for understanding the general pattern of fish composition and level of fisheries resources in other areas of Hong Kong.

Table 3.18 summarized the survey findings of fisheries studies in Hong Kong waters and those under this Assignment. The mean larvae density and total larvae family under the current study are on the low side compared with the results reported in 3RS, LNG and CAPE projects. The level of juvenile fish resources and fish larvae density in the current Study are lower than those reported in other areas of Hong Kong. For adult fish, the general pattern of fisheries resources in the Study Area is compared to one study in the western waters of Hong Kong. In general, the species richness, biomass and abundance of adult fish in the Study Area are relatively higher than those in western waters of Hong Kong. For fish egg, the biomass and abundance recorded in the Study Area is relatively higher than those in western waters of Hong Kong, whilst the species richness recorded in the Study Area is relatively lower than those in western waters of Hong Kong. Mean egg density in the Study Area is within the range of the study in eastern waters of Hong Kong whilst the species richness is comparable of those in the eastern waters of Hong Kong.

Table 3.18 Comparison of Fisheries Resources in Hong Kong Waters

Project	Ichthyoplankton				Adult Fish			Juvenile Fish		
	Mean egg density (number/m^3)	Mean larvae density (number/m^3)	Total egg family	Total larvae family	Mean/ Total Biomass (g)	Mean/ Total Abundance	Total Number of Species	Total Number of Species	Mean/ Total Abundance	Mean/ Total Biomass (g)
3RS [a] [d]	-	0.14 - 2.63	-	27	425 - 1,084	11.3 - 43.5	17 - 19	26 - 32	174 - 767	1,099 - 14,963
LNG [b] [d]	0.08 - 8.44	0.08 - 3.34	38 - 41		-	-	-	-	-	-
CAPE [c] [e]	0.01 - 272.04	0.11 - 24.97	15		-	-	-	-	-	-
TKO – current study [e]	3.52 - 13.62	0.23 - 0.92	20	15 - 27	1,014.30 – 2,446.10	22.0 - 64.50	17 - 29	1 - 6	1.0 - 293.5	0.3 - 107.5

*Notes:

(a) EIA Study for Expansion of Hong Kong International Airport into a Three-Runway System
(b) EIA Study for Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities
(c) Ichthyoplankton assemblage at Cape d'Aguilar: seasonal variability and family composition.
(d) Fisheries survey in the western waters of Hong Kong
(e) Fisheries survey in the eastern waters of Hong Kong

The approved EIA Report (Register No.: *AEIAR-192/2015*) has concluded that fisheries importance of the Project Area and its vicinity is low when compared to other waters of Hong Kong. All potential construction and operational fisheries impacts identified are thus deemed acceptable. Survey findings in *Section 3* suggest that the Study Area does not appear to be an important spawning or nursery grounds for commercial fisheries, and the Project Area is confirmed to be of low importance to fisheries as presented in the approved EIA Report. Amendment to the findings of the fisheries impact assessment under the current EIA Study is not required. No mitigation measures of environmental monitoring and auditing (EM&A) programme additional to those presented in the approved EIA Report is considered necessary.

5 DESIGN RECOMMENDATIONS

This section provides a review of the design of overseas desalination plants with an aim to reduce impacts to the marine environment and summarizes the recommendation on the design, construction and operation of the seawater intake and submarine outfall of the desalination plant at Tseung Kwan O.

5.1 ALIGNMENT & LOCATION OF SEAWATER INTAKE & OUTFALL

The proposed alignment of seawater intake and outfall of the desalination plant have been assessed in the approved EIA Report, which adopted the design of offshore open intake and submarine outfall located at Joss House Bay. The approved EIA Report has concluded that the proposed design would minimize the impingement and entrainment of planktonic organisms by having an offshore intake where the productivity is relatively low, and thus are considered to be environmentally acceptable. The EIA findings are further supported by the updated fisheries surveys as presented in *Section 3*, which suggests that the Study Area does not appear to be an effective spawning or nursery grounds for commercial fisheries. The desktop information and survey findings are in line with the EIA findings that no significant operational phase impacts to fisheries resources, habitat and fishing operation are expected to occur. Therefore, change in the alignment and location of seawater intake and outfall is considered not necessary.

Recommendations contained in the approved EIA report shall, however, be implemented to ensure the impingement and entrainment of fisheries resources, if any, are fully and properly mitigated through appropriate design of the intake structure. The EIA recommendations include:

- The intake shall be located 200 – 250 m offshore to minimize impingement and entrainment of planktonic organisms;
- The diameter of intake pipes shall be sized to maintain sufficient cleaning velocity, whilst maintaining a slow intake velocity to minimize the potential of impingement and entrainment of eggs and larvae; and
- The outfall shall be located 300 – 350 m away from the shore in Joss House Bay to minimize potential impacts on onshore marine habitats.

Since no important spawning or nursery grounds have been identified within the Project Area, significant impact to fisheries resources as a result of impingement and entrainment during the operation of seawater intake is not expected under most circumstances. Measures to further minimize the potential loss of marine life and maintain the productivity and function of the marine environment in the vicinity of the intake as well as outfall are still worth further consideration during detailed design stage.

5.2 *RELEVANT BEST PRACTICES FOR SEAWATER INTAKE AND OUTFALL DESIGNS*

In addition to the EIA recommendations, some international best practices on design and configuration of seawater intake and outfall of industrial plant are also reviewed to provide some insight into fine-tune the detailed design of the seawater intake and submarine outfall facilities for the desalination plant at Tseung Kwan O. The findings of this review are summarized below.

A set of key considerations were derived to form the basis for the design of seawater intake and outfall of desalination plants. The process for deriving the key considerations has involved a review of the following:

- Relevant findings / requirements from the EIA Study of the Desalination Plant at Tseung Kwan O;
- Criteria adopted overseas on design of seawater intake and outfall for industrial plant; and
- Published research and practical operation experience of overseas industrial plant.

The following key considerations are recommended in designing the configuration of seawater intake and outfall of the desalination plant:

- Intake velocity – impingement occurs when the through-screen design intake velocity is too high that marine organisms such as crab and fish cannot swim away and are retained against the screens. The US Environmental Protection Agency (USEPA) has announced that if the intake velocity is ≤ 0.5 feet per second (i.e. ≤ 0.15 m/s) (1), the intake facility is considered to have met impingement mortality performance standards under their Clean Water Act Section 316 (b) (2). Therefore, designing intake screening facilities to operate at or below this velocity would reduce impingement impacts.
- Mesh size of the screen – typically a seawater intake has coarse screens with a mesh size of 20 mm to 150 mm followed by fine screens with mesh size of 1 mm to 10 mm, which preclude the majority of adult and juvenile marine organisms from entering the desalination plants. Studies on fine mesh screens have shown that the fine mesh screens with mesh size of 0.5 mm to 5 mm installed have successfully reduced entrainment of larvae, eggs and juvenile fish up to 80% at the water intake structure (3). Another design of the fine mesh screen at the intake is called passive screens or slot

(1) WaterReuse Desalination Committee (2011) White Paper of Desalination Plant Intakes – Impingement and Entrainment Impacts and Solutions. pp 21.

(2) US Environmental Protection Agency (2014) National Pollutant Discharge Elimination System—Final Regulations To Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities. Available at: https://www.gpo.gov/fdsys/pkg/FR-2014-08-15/pdf/2014-12164.pdf

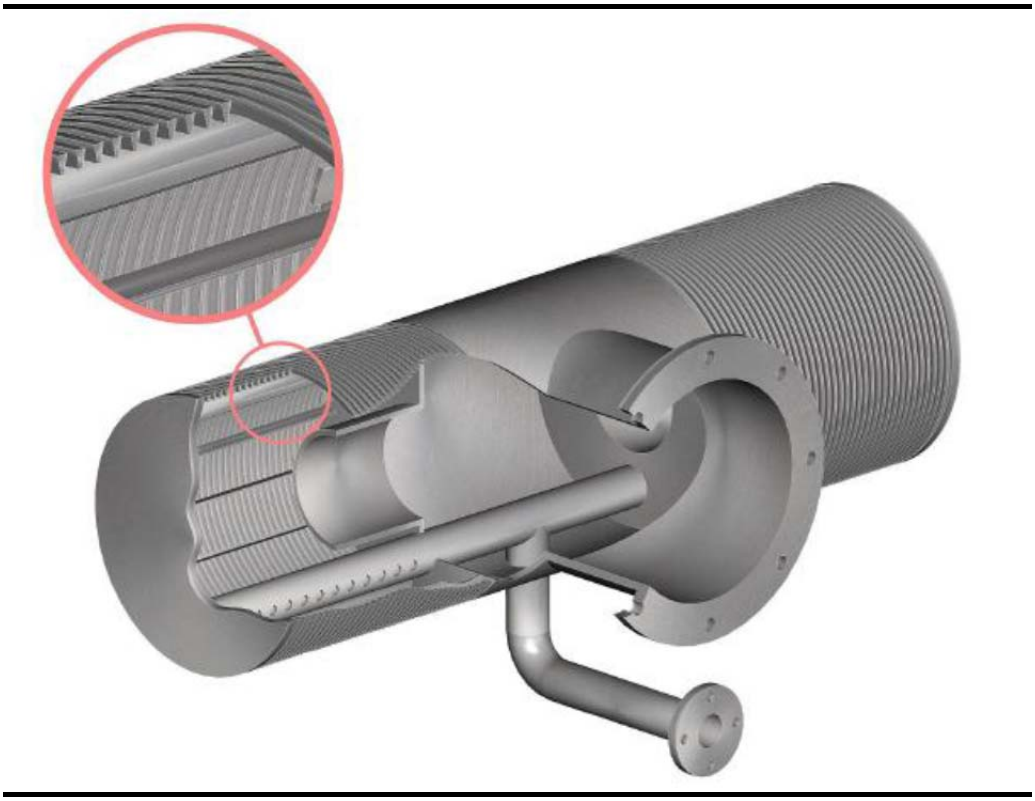
(3) Weisberg, SB (1987) Reductions in Ichthyoplankton Entrainment with Fine-mesh, Wedge-Wire Screens (7): 386-393pp.

wedge wire screens, which consist of cylindrical screens oriented on a horizontal axis with screens sizes from 0.5 mm to 10 mm and are usually maintained at a velocity of less than 1.5 m/s to minimize debris and marine life impingement. The diameter of these passive screens ranges from 0.4 m to 2.1 m and the length ranges from 0.5 m to 8 m. Passive screens are usually installed with air backwash system to clear screens if debris accumulations do occur. Due to their slot width and low through-flow velocity, the passive screen of 1 mm mesh size has been demonstrated to be highly effective for larval exclusion and reduce entrainment by 80% or more. A study was conducted at the Logan Generating Plant in the US to evaluate the performance of 1 mm passive screens (1). Samples were collected from the water adjacent to the plant by towing plankton net and from water that had passed through the passive screens by pumping water from the plant's intake wet well for comparison of larval densities. The results have shown that the intake passive screens have reduced entrainment by 90% of the fish larvae. There is, however, no local study conducted on the passive screen design of seawater intake for the purpose of reducing marine life impingement.

The above key considerations are not meant to be exhaustive but represent the concepts to support the design of seawater intake as well as submarine outfall in an ecologically friendly approach. It should be note that engineering consideration or any physical constraint in the environment should also be taken into account for the detailed design of the seawater intake and submarine outfall facilities for the desalination plant.

(1) Ehrler, C and Raifsnider, C (2000) Evaluation of the effectiveness of intake wedge wire screens (3): 361-368pp.

Figure 5.1 Example of Passive Screen / Slot Wedge Wire Screen (1)



(1) Weisberg, SB (1987) Op. cit.

Adult fish, juvenile fish and ichthyoplankton surveys were completed as per plan under this Assignment to verify if there is any fish spawning and nursery grounds in the vicinity of the planned location and alignment of the proposed seawater intake and submarine outfall of the TKO desalination plant.

For adult fish survey, a total 26,995 g of 723 individuals comprising 56 species from 33 families were recorded. The dominant species in terms of biomass and abundance were Spotted puffer (*Takifugu alboplumbeus)* and Threadfin porgy (*Evynnis cardinalis*), and these species are of low and moderate to high commercial value, respectively. Besides fish species, other invertebrate species, including cuttlefish, octopus, crab, shrimp and mantis shrimp, were also recorded. Within the Study Area, the majority of commercial fish species recorded are of low commercial value, with some species of medium to high commercial values also recorded. It is therefore considered that the overall commercial value of adult fish resources in the Study Area is low and low to moderate.

For juvenile fish survey, a total 519 g of 1,523 individuals comprising eight species from six families were recorded. The dominant species in terms of biomass and abundance was Engraulidae sp.. Seasonal difference in species richness is observed with higher species richness in the wet season than the dry season. However, the juvenile fish resources in the Study Area is considered to be of very low diversity and production level.

In the ichthyoplankton survey, a total of 91 species from 42 families (including both fish egg and fish larvae) were recorded in the Study Area, which comprises 49 fish egg species from 30 families, and 57 larvae species from 33 families. The mean larvae density and total larvae family under the current study are on the low side compared with the results reported in 3RS, LNG and CAPE projects. The dominant species of fish egg and fish larvae were *Gerres oyena* and *Chromis notata*, respectively. One species of conservation importance, *Hippocampus trimaculatus* in larvae stage, was recorded at one of the reference stations in the wet season at a very low density (only 0.07% of the total larval density). Strong seasonal variations in species richness, fish egg and fish larvae densities were observed, in which the density and species richness of fish egg and fish larvae were higher in the wet season than those in the dry season. The observed seasonal pattern of ichthyoplankton assemblages was consistent with those reported in other previous fisheries studies in Hong Kong waters.

Overall, the survey findings showed that the abundance and diversity of fish eggs and larvae are on the low side for the Study Area (with dominant species of low to no commercial value), and the abundance and diversity of juveniles are very low for the Study Area. Survey findings also showed that there was a very weak relationship in recorded families between ichthyoplankton assemblages, adult fish and juvenile fish in the Study Area, which implies that

the Study Area does not appear to be an important spawning or nursery grounds for commercial fisheries.

The survey findings and desktop reviewed literatures affirm the conclusion made in the approved EIA Report that all potential construction and operational impacts to fisheries resources are insignificant. Thus, no amendment to the findings of the fisheries impact assessment in the approved EIA Report is required

The recommendation on the design of intake velocity, intake screen size and discharge angle of outfall set out in the approved EIA Report and reviewed literatures are summarized below:

Aspect	**Recommendation**
Submarine Intake	• The intake shall be located 200 – 250 m offshore to minimize impingement and entrainment of planktonic organisms. • The diameter of intake pipes shall be sized to maintain sufficient cleaning velocity, whilst maintaining a slow intake velocity to minimize the potential of impingement and entrainment of eggs and larvae. • Passive screen / slot wedge wire screen is recommended as the type of intake screen. • It is recommended to adopt coarse screen size of 20 mm to 150 mm followed by fine screen size of 0.5 mm to 10 mm. • Design intake velocity at ≤ 0.5 feet per second (i.e. ≤ 0.15 m/s) is recommended.
Submarine Outfall	• The outfall shall be designed to locate 300 – 350 m away from the shore in Joss House Bay to minimize the potential impact to the onshore marine habitats.

Annex A

Full List of Adult Fish Data

Gear	Season	Year	Month	Location	Group	Family	Species Name	Common Name	Chinese Name	Commercial Value [(a)]	Quantity	Weight (g)	TL (cm)	SL (cm)	FL (cm)
Cage	Dry	2015	Dec	P1	Fish	Pomacentridae	*Neopomacentrus bankieri*	Chinese demoiselle	黃尾石剎	L	1	3	6.5	4.8	5.7
Cage	Dry	2015	Dec	P1	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	6	161	13.0	10.0	11.5
Cage	Dry	2015	Dec	P1	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	49	15.0	12.0	-
Cage	Dry	2015	Dec	P1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	3	174	15.0	12.0	-
Cage	Dry	2015	Dec	P2	Fish	Apogonidae	*Ostorhinchus fleurieu*	Golden cardinalfish	金梭羅	L	1	33	12.8	10.7	11.7
Cage	Dry	2015	Dec	P2	Fish	Monacanthidae	*Monacanthus chinensis*	Fan-bellied leatherjacket	沙孟	M	1	15	9.0	7.0	-
Cage	Dry	2015	Dec	P2	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	13	106	4.5 - 10	3.7 - 7	4 - 8
Cage	Dry	2015	Dec	P2	Fish	Pomacentridae	*Abudefduf vaigiensis*	Five banded damsefish	石剎婆	L	2	40	10.0	7.0	9.0
Cage	Dry	2015	Dec	P2	Crab	Portunidae	*Charybdis* spp.	-	-	X	3	137	-	-	-
Cage	Dry	2015	Dec	P2	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	46	14.0	11.5	-
Cage	Dry	2015	Dec	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	6	189	11 - 14	9 - 11.8	10.6 - 13.5
Cage	Dry	2015	Dec	P2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	1	38	12.3	10.0	-
Cage	Dry	2015	Dec	R1	Fish	Apogonidae	*Ostorhinchus fleurieu*	Golden cardinalfish	金梭羅	L	4	130	13.5	10.0	12.0
Cage	Dry	2015	Dec	R1	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	5	136	13.0	10.0	11.0
Cage	Dry	2015	Dec	R1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Puffer fish	雞泡	X	16	628	11.5 - 14.5	9 - 11.5	10 - 12.5
Cage	Dry	2015	Dec	R2	Fish	Apogonidae	*Apogon doederleini*	Doederleini's cardinalfish	梭羅	L	2	63	12.5	10.0	11.5
Cage	Dry	2015	Dec	R2	Fish	Apogonidae	*Ostorhinchus fleurieu*	Golden cardinalfish	金梭羅	L	13	426	10.5 - 14.8	8 - 13.8	10 - 12
Cage	Dry	2015	Dec	R2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	66	14.4	11.4	-
Cage	Dry	2015	Dec	R2	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	6	150	12.0	8.7	10.0
Cage	Dry	2015	Dec	R2	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	202	22.3	19.0	-
Cage	Dry	2015	Dec	R2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	3	69	14.2 - 18	11 - 14.5	13.4 - 17.1
Cage	Dry	2015	Dec	R2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	22	693	9.5 - 14	7.7 - 11.3	-
Cage	Dry	2015	Dec	R2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	9	726	13.3 - 17.4	10.5 - 14.4	-
Cage	Dry	2015	Dec	R2	Fish	Tetraodontidae	*Takifugu niphobles*	Snowy puffer	雞泡	X	1	32	12.6	10.5	-
Cage	Dry	2016	Jan	P1	Fish	Apogonidae	*Apogonichthyoides pseudotaeniatus*	Doublebar cardinalfish	大炮梭羅	L	1	26	11.5	9.5	10.5
Cage	Dry	2016	Jan	P1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	3	157	15.0	12.5	-
Cage	Dry	2016	Jan	P2	Fish	Cirrhitidae	*Cirrhitichthys aureus*	Yellow hawkfish	哨牙婆	X	1	45	13.3	10.5	-
Cage	Dry	2016	Jan	P2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	3	195	14.0	11.0	-
Cage	Dry	2016	Jan	R1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	30	13.3	11.0	13.0
Cage	Dry	2016	Jan	R1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	10	578	12 - 20.3	10 - 16.3	-
Cage	Dry	2016	Jan	R2	Fish	Apogonidae	*Apogon doederleini*	Doederleini's cardinalfish	梭羅	L	1	28	12.5	10.0	11.0
Cage	Dry	2016	Jan	R2	Fish	Apogonidae	*Ostorhinchus fleurieu*	Golden cardinalfish	金梭羅	L	1	33	12.5	10.5	12.0
Cage	Dry	2016	Jan	R2	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	1	15	10.5	7.5	8.3
Cage	Dry	2016	Jan	R2	Fish	Scorpaenidae	*Sebastiscus marmoratus*	Common rockfish	石狗公	H	1	50	14.5	12.0	-
Cage	Dry	2016	Jan	R2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	3	281	17.0	14.0	-
Cage	Dry	2016	Jan	R2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	36	1555	12 - 15	10 - 12	-
Cage	Wet	2016	Jul	P1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	15	10.0	-	-
Cage	Wet	2016	Jul	P1	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮸	M-H	8	112	8.5 - 10	7.5 - 8	8 - 9.5
Cage	Wet	2016	Jul	P2	Fish	Blenniidae	*Meiacanthus grammistes*	Striped poison fang blenny	黑帶稀棘盒	X	1	12	10.0	9.0	-
Cage	Wet	2016	Jul	P2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	31	11.5	9.0	-
Cage	Wet	2016	Jul	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	2	39	12.0	11.0	-
Cage	Wet	2016	Jul	P2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮸	M-H	1	16	10.0	8.0	-
Cage	Wet	2016	Jul	R1	Fish	Apogonidae	*Apogon doederleini*	Doederleini's cardinalfish	梭羅	L	1	18	11.0	9.0	10.0
Cage	Wet	2016	Jul	R1	Cephalopod	Octopodidae	*Octopus* sp.	Octopus	八爪魚	L	1	1285	-	-	-
Cage	Wet	2016	Jul	R2	-	-	-	-	-	-	0	0	-	-	-
Cage	Wet	2016	Aug	P1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	4	80	11 - 12.5	10 - 10.5	9 - 12
Cage	Wet	2016	Aug	P1	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮸	M-H	27	339	8.5 - 9.5	7 - 8	8 - 9
Cage	Wet	2016	Aug	P2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	98	16.0	13.0	-
Cage	Wet	2016	Aug	P2	Fish	Mullidae	*Upeneus japonicus*	Bensasi goatfish	三鬚	L	3	94	14.0	11.0	12.0
Cage	Wet	2016	Aug	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	11	217	11 - 13	9 - 11.5	-
Cage	Wet	2016	Aug	P2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮸	M-H	121	1750	8.5 - 9.5	6.5 - 8	8 - 9

Gear	Season	Year	Month	Location	Group	Family	Species Name	Common Name	Chinese Name	Commercial Value [(a)]	Quantity	Weight (g)	TL (cm)	SL (cm)	FL (cm)
Cage	Wet	2016	Aug	R1	Fish	Apogonidae	*Apogon doederleini*	Doederleini's cardinalfish	梭羅	L	1	17	11.0	9.0	10.0
Cage	Wet	2016	Aug	R2	Fish	Apogonidae	*Apogon doederleini*	Doederleini's cardinalfish	梭羅	L	2	50	12 - 13.5	10 - 11	10 - 13
Cage	Wet	2016	Aug	R2	Fish	Monacanthidae	*Monacanthus chinensis*	Fan-bellied leatherjacket	沙孟	M	1	77	15.0	12.0	-
Cage	Wet	2016	Aug	R2	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	13	191	7 - 12	6 - 10	6.5 - 11
Cage	Wet	2016	Aug	R2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	2	47	12.0	10.0	11.5
Cage	Wet	2016	Aug	R2	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	1	47	13.0	11.0	-
Net	Dry	2015	Dec	P1	Fish	Dactylopteridae	*Dactyloptena peterseni*	Starry flying gurnard	飛機魚	L	1	37	14	11.5	-
Net	Dry	2015	Dec	P1	Crab	Portunidae	*Charybdis* spp.	-	-	X	1	137	-	-	-
Net	Dry	2015	Dec	P1	Crab	Portunidae	*Charybdis* spp.	-	-	X	1	21	-	-	-
Net	Dry	2015	Dec	P1	Cephalopod	Sepiidae	*Sepia* sp.	Cuttlefish	墨魚	L	1	309	25	-	-
Net	Dry	2015	Dec	P1	Fish	Serranidae	*Epinephelus awoara*	Yellow grouper	黃釘	H	1	19	10	8	-
Net	Dry	2015	Dec	P1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	1	108	17	14	-
Net	Dry	2015	Dec	P2	Fish	Leiognathidae	*Leiognathus brevirostris*	Shortnose ponyfish	油力	M	9	106	9.4	7.5	8.2
Net	Dry	2015	Dec	P2	Fish	Pomacentridae	*Neopomacentrus cyanomos*	Regal damselfish	石剎	L	3	30	9	6.8	8
Net	Dry	2015	Dec	P2	Fish	Serranidae	*Diploprion bifasciatum*	Two-banded perch	火燒腰	L	1	50	14	12	-
Net	Dry	2015	Dec	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbit fish	泥孟	L	1	18	10.5	9	10
Net	Dry	2015	Dec	R1	Fish	Gerreidae	*Gerres oblongus*	Silver biddy	連米	L	2	180	18 - 20	15 - 16.7	16.3 - 17.2
Net	Dry	2015	Dec	R1	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	108	16	12	-
Net	Dry	2015	Dec	R1	Fish	Mullidae	*Parupeneus biaculeatus*	Pointed goatfish	三蘇	M	1	159	22	18.5	20
Net	Dry	2015	Dec	R1	Fish	Paralichthyidae	*Pseudorhombus cinnamoneus*	Cinnamon flounder	地寶， 左口	M	1	53	18	14.7	-
Net	Dry	2015	Dec	R1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	45	15.5	12	14
Net	Dry	2015	Dec	R1	Fish	Tetraodontidae	*Takifugu alboplumbeus*	Spotted puffer	雞泡	X	6	496	13 - 19	11 - 16	-
Net	Dry	2015	Dec	R2	Fish	Carangidae	*Caranx ignobilis*	Giant trevally	酒排魚	H	1	66	15	13	14
Net	Dry	2015	Dec	R2	Fish	Gerreidae	*Gerres oblongus*	Silver biddy	連米	L	9	450	13.5 - 16	11.5 - 13	12.3 - 14
Net	Dry	2015	Dec	R2	Fish	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	雞魚	L	1	64	16.5	14	-
Net	Dry	2015	Dec	R2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	2	160	15.3	12.3	-
Net	Dry	2015	Dec	R2	Fish	Sillaginidae	*Sillago sihama*	Silver sillago	沙鑽	H	3	85	16	14	-
Net	Dry	2015	Dec	R2	Fish	Synodontidae	*Trachinocephalus myops*	Snakefish	花棍，花狗棍，沙棍	L	2	40	14.4	12	12.6
Net	Dry	2015	Dec	R2	Fish	Synodontidae	*Saurida tumbil*	Greater lizardfish	狗棍	L	1	210	31	27	28
Net	Dry	2016	Jan	P1	Crab	Calappidae	*Calappa philargius*	Box crab	饅頭蟹	L	1	25	11	-	-
Net	Dry	2016	Jan	P1	Fish	Gerreidae	*Gerres oblongus*	Silver biddy	連米	L	4	264	18	15	16
Net	Dry	2016	Jan	P1	Fish	Labridae	*Stethojulis interrupta*	Cutribbon wrasse	蠔魚	L	1	25	12.3	10.5	-
Net	Dry	2016	Jan	P1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	34	1695	14.7 - 17.0	12.2 - 14.0	14.4 - 16.5
Net	Dry	2016	Jan	P1	Fish	Sillaginidae	*Sillago sihama*	Silver sillago	沙鑽	H	1	125	25	21.5	23.5
Net	Dry	2016	Jan	P1	Fish	Sparidae	*Acanthopagrus schlegeli*	Black sea bream	黑沙	H	1	81	16	13.5	15.4
Net	Dry	2016	Jan	P2	Fish	Labridae	*Stethojulis interrupta*	Cutribbon wrasse	蠔魚	L	2	88	9 - 14.5	8 - 12.5	-
Net	Dry	2016	Jan	P2	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	55	15	12.3	-
Net	Dry	2016	Jan	R1	Fish	Chaetodontidae	*Chaetodon auripes*	Oriental butterflyfish	荷包魚	L	1	47	10.5	9.3	-
Net	Dry	2016	Jan	R1	Fish	Cheilodactylidae	*Cheilodactylus zonatus*	Spottedtail morwong	斬三刀	H	1	101	20	17	19
Net	Dry	2016	Jan	R1	Fish	Synodontidae	*Trachinocephalus myops*	Snakefish	花棍，花狗棍，沙棍	L	1	20	13	11.5	-
Net	Dry	2016	Jan	R2	Fish	Scorpaenidae	*Sebastiscus marmoratus*	Common rockfish	石狗公	H	1	31	13	11	-
Net	Dry	2016	Jan	R2	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	35	13.5	11	-
Net	Wet	2016	Jul	P1	Fish	Leiognathidae	*Leiognathus brevirostris*	Shortnose ponyfish	油力	M	4	70	11	9	10
Net	Wet	2016	Jul	P1	Fish	Sciaenidae	*Dendrophysa russelii*	Goatee croaker	滑仔	L	2	160	19	16	-
Net	Wet	2016	Jul	P1	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鯧	M-H	9	160	9.5 - 10	8 - 8.5	9 - 9.5
Net	Wet	2016	Jul	P1	Mantis shrimp	Squillidae	*Oratosquilla oratoria*	Mantis shrimp	口蝦蛄	H	1	21	12	-	-
Net	Wet	2016	Jul	P2	Fish	Carangidae	*Decapterus maruadsi*	Japanese scad	青鰺	L	1	40	14	12.5	13.5
Net	Wet	2016	Jul	P2	Fish	Leiognathidae	*Leiognathus equulus*	Common ponyfish	大梗	L	5	102	12	10	11
Net	Wet	2016	Jul	P2	Fish	Leiognathidae	*Secutor insidiator*	Pugnose ponyfish	竹梯橫	L	1	20	11	9	10
Net	Wet	2016	Jul	P2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	24	11	8.5	-
Net	Wet	2016	Jul	P2	Fish	Paralichthyidae	*Pseudorhombus cinnamoneus*	Cinnamon flounder	地寶， 左口	M	1	8	12	10	-

Gear	Season	Year	Month	Location	Group	Family	Species Name	Common Name	Chinese Name	Commercial Value [a]	Quantity	Weight (g)	TL (cm)	SL (cm)	FL (cm)
Net	Wet	2016	Jul	P2	Fish	Sciaenidae	*Dendrophysa russelii*	Goatee croaker	滑仔	L	5	490	18 - 20	16 - 17	-
Net	Wet	2016	Jul	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	81	19	16	18.5
Net	Wet	2016	Jul	P2	Fish	Soleidae	*Aseraggodes kobensis*	Mikyspotted sole	撻沙	L	1	14	10	8.5	-
Net	Wet	2016	Jul	P2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮍	M-H	1	12	9	7.5	8.5
Net	Wet	2016	Jul	R1	Fish	Carangidae	*Selaroides leptolepis*	Yellowstripe scad	金邊鰺	L	9	488	16 - 17	13 - 14	14 - 15
Net	Wet	2016	Jul	R1	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	4	250	12 - 15	10 - 13	-
Net	Wet	2016	Jul	R1	Fish	Mullidae	*Parupeneus biaculeatus*	Pointed goatfish	三蘇	M	3	112	13.5	11.5	12
Net	Wet	2016	Jul	R1	Cephalopod	Octopodidae	*Octopus* sp.	Octopus	八爪魚	L	1	445	-	-	-
Net	Wet	2016	Jul	R1	Crab	Portunidae	*Charybdis* spp.	-	-	X	1	35	4	-	-
Net	Wet	2016	Jul	R1	Fish	Scorpaenidae	*Sebastiscus marmoratus*	Common rockfish	石狗公	H	2	70	10 - 14.5	8.5 - 13.5	-
Net	Wet	2016	Jul	R1	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	1	62	15.5	13	-
Net	Wet	2016	Jul	R1	Fish	Sparidae	*Pagrus major*	Red seabream	紅鮍	M	1	70	16.5	13.5	15.5
Net	Wet	2016	Jul	R2	Crab	Calappidae	*Calappa philargius*	Box crab	饅頭蟹	L	3	44	-	-	-
Net	Wet	2016	Jul	R2	Fish	Carangidae	*Decapterus maruadsi*	Japanese scad	青鰺	L	14	442	13.5 - 14.5	11 - 12	12 - 13.5
Net	Wet	2016	Jul	R2	Fish	Clupeidae	*Sardinella aurita*	Round sardinella	黃澤	L	6	476	18 - 20	16 - 17	16.5 - 18
Net	Wet	2016	Jul	R2	Fish	Gerreidae	*Gerres* sp.	-	連米	-	3	10.5	12.5 - 14	10 - 12	11 -13
Net	Wet	2016	Jul	R2	Fish	Leiognathidae	*Secutor insidiator*	Pugnose ponyfish	竹梯橫	L	3	56	10 - 12	9 - 10	9.5 - 11
Net	Wet	2016	Jul	R2	Fish	Leiognathidae	*Leiognathus brevirostris*	Shortnose ponyfish	油力	M	1	29	13.5	11	12.5
Net	Wet	2016	Jul	R2	Fish	Mullidae	*Upeneus japonicus*	Bensasi goatfish	三鬚	L	1	26	14	11	12
Net	Wet	2016	Jul	R2	Fish	Paralichthyidae	*Pseudorhombus cinnamoneus*	Cinnamon flounder	地寶， 左口	M	1	10	11	9.5	-
Net	Wet	2016	Jul	R2	Crab	Portunidae	*Charybdis* spp.	-	-	X	1	50	-	-	-
Net	Wet	2016	Jul	R2	Fish	Sillaginidae	*Sillago sihama*	Silver sillago	沙鑽	H	2	46	13.5 - 17	12 - 15	-
Net	Wet	2016	Jul	R2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮍	M-H	63	1356	9.5 - 10.5	8 - 9	9 - 10
Net	Wet	2016	Jul	R2	Fish	Synodontidae	*Trachinocephalus myops*	Snakefish	花棍，花狗棍，沙棍	L	3	243	24	21	22
Net	Wet	2016	Jul	R2	Fish	Synodontidae	*Saurida tumbil*	Greater lizardfish	狗棍	L	1	23	14	12	13.5
Net	Wet	2016	Jul	R2	Fish	Terapontidae	*Pelates quadrilineatus*	Fourlined terapon	釘公	L	1	60	17	14	16.5
Net	Wet	2016	Aug	P1	Fish	Leiognathidae	*Secutor insidiator*	Pugnose ponyfish	竹梯橫	L	4	50	7 - 9	6 - 8	7 - 8.5
Net	Wet	2016	Aug	P1	Fish	Leiognathidae	*Leiognathus brevirostris*	Shortnose ponyfish	油力	M	1	23	12	10	11
Net	Wet	2016	Aug	P1	Fish	Paralichthyidae	*Pseudorhombus cinnamoneus*	Cinnamon flounder	地寶， 左口	M	2	74	14 - 18	11 - 15	-
Net	Wet	2016	Aug	P1	Shrimp	Penaeidae	*Metapenaeus* sp.	-	-	H	1	33	17	-	-
Net	Wet	2016	Aug	P1	Crab	Portunidae	*Charybdis* spp.	-	-	X	1	24	3	-	-
Net	Wet	2016	Aug	P1	Crab	Portunidae	*Portunus pelagicus*	Blue crab	花蟹	H	1	140	7	-	-
Net	Wet	2016	Aug	P1	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮍	M-H	2	50	9 - 12	7 - 10	8 - 11
Net	Wet	2016	Aug	P2	Fish	Clupeidae	*Konosirus punctatus*	Dotted gizzard shad	**黃魚**	L	1	78	19	16	17
Net	Wet	2016	Aug	P2	Fish	Leiognathidae	*Secutor insidiator*	Pugnose ponyfish	竹梯橫	L	3	40	10	8	9
Net	Wet	2016	Aug	P2	Fish	Leiognathidae	*Leiognathus brevirostris*	Shortnose ponyfish	油力	M	6	107	9.5 - 12	8 - 10	8.5 - 11
Net	Wet	2016	Aug	P2	Fish	Monacanthidae	*Stephanolepis cirrhifer*	Threadsail filefish	沙孟	M	1	65	14	11.5	-
Net	Wet	2016	Aug	P2	Crab	Portunidae	*Charybdis* spp.	-	-	X	2	61	3	-	-
Net	Wet	2016	Aug	P2	Fish	Sciaenidae	*Dendrophysa russelii*	Goatee croaker	滑仔	L	3	356	20 - 22	18 - 19	-
Net	Wet	2016	Aug	P2	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	36	14.5	12	14
Net	Wet	2016	Aug	P2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮍	M-H	9	175	9 - 16	7.5 - 9.8	8.5 - 9
Net	Wet	2016	Aug	P2	Fish	Sparidae	*Rhabdosargus sarba*	Golden-lined sea bream	金絲鮍	M	1	52	15	13	14
Net	Wet	2016	Aug	P2	Mantis shrimp	Squillidae	*Oratosquillina interrupta*	Mantis shrimp	斷脊口蝦蛄	H	1	39	16	-	-
Net	Wet	2016	Aug	R1	Fish	Cheilodactylidae	*Cheilodactylus zonatus*	Spottedtail morwong	斬三刀	H	1	53	17	13	15
Net	Wet	2016	Aug	R1	Fish	Gerreidae	*Gerres* sp.	-	連米	-	2	103	15.3	12	13
Net	Wet	2016	Aug	R1	Fish	Labridae	*Halichoeres nigrescens*	Bubblefin wrasse	蠔妹	L	6	209	13 - 16	11.5 - 13	-
Net	Wet	2016	Aug	R1	Fish	Monacanthidae	*Monacanthus chinensis*	Fan-bellied leatherjacket	**沙孟**	M	2	170	15.5	12	-
Net	Wet	2016	Aug	R1	Fish	Mullidae	*Upeneus japonicus*	Bensasi goatfish	三鬚	L	3	152	15 - 17	13 - 14	14 - 15
Net	Wet	2016	Aug	R1	Crab	Portunidae	*Charybdis* spp.	-	-	X	3	120	4	-	-
Net	Wet	2016	Aug	R1	Fish	Siganidae	*Siganus canaliculatus*	Rabbitfish	泥孟	L	1	51	16	13	15
Net	Wet	2016	Aug	R2	Fish	Kyphosidae	*Microcanthus strigatus*	Stripey	花并	L	1	30	11	9	-

Gear	Season	Year	Month	Location	Group	Family	Species Name	Common Name	Chinese Name	Commercial Value [(a)]	Quantity	Weight (g)	TL (cm)	SL (cm)	FL (cm)
Net	Wet	2016	Aug	R2	Fish	Labridae	*Halichoeres nigrescens*	Bubblefin wrasse	蠟妹	L	2	36	9.5 - 12	8 - 11	-
Net	Wet	2016	Aug	R2	Fish	Mullidae	*Upeneus japonicus*	Bensasi goatfish	三鬚	L	1	48	16	13	14
Net	Wet	2016	Aug	R2	Fish	Mullidae	*Parupeneus indicus*	Indian goatfish	三鬚	M	1	223	26	21	23
Net	Wet	2016	Aug	R2	Cephalopod	Octopodidae	*Octopus* sp.	Octopus	八爪魚	L	1	680	-	-	-
Net	Wet	2016	Aug	R2	Fish	Scorpaenidae	*Sebastiscus marmoratus*	Common rockfish	石狗公	H	1	46	14	12	-
Net	Wet	2016	Aug	R2	Fish	Serranidae	*Cephalopholis boenak*	Chocolate hind	烏絲	H	2	173	18	16	-
Net	Wet	2016	Aug	R2	Fish	Sparidae	*Evynnis cardinalis*	Threadfin porgy	扯旗鮸	M-H	3	83	10 - 13.5	8 - 11	9 - 12
Net	Wet	2016	Aug	R2	Fish	Sparidae	*Rhabdosargus sarba*	Golden-lined sea bream	金絲鮸	M	7	426	15 - 17	13 - 14	14 - 15

a) References of Catch Value:
FishBase (2015) Available at: http://www.fishbase.org/
Fish Marketing Organization (2016) Available at: http://www.fmo.org.hk/index/lang_en/page_price-sea/
Mott (2013) Expansion of Hong Kong Airport into a Three-Runway System.
H = H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species； "-" = no commercial value is evaluated

Annex A2 Biomass (g) of Adult Fish Surveys

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Pomacentridae	*Abudefduf vaigiensis*	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sparidae	*Acanthopagrus schlegeli*	0	0	0	0	81	0	0	0	0	0	0	0	0	0	0	0
Apogonidae	*Apogon doederleini*	0	0	0	63	0	0	0	28	0	0	18	0	0	0	17	50
Apogonidae	*Apogonichthyoides pseudotaeniatus*	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0
Soleidae	*Aseraggodes kobensis*	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0
Calappidae	*Calappa philargius*	0	0	0	0	25	0	0	0	0	0	0	44	0	0	0	0
Carangidae	*Caranx ignobilis*	0	0	0	66	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	*Cephalopholis boenak*	49	46	0	202	0	55	0	35	0	0	62	0	0	0	0	173
Chaetodontidae	*Chaetodon auripes*	0	0	0	0	0	0	47	0	0	0	0	0	0	0	0	0
Portunidae	*Charybdis* spp.	158	137	0	0	0	0	0	0	0	0	35	50	24	61	120	0
Cheilodactylidae	*Cheilodactylus zonatus*	0	0	0	0	0	0	101	0	0	0	0	0	0	0	53	0
Cirrhitidae	*Cirrhitichthys aureus*	0	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0
Dactylopteridae	*Dactyloptena peterseni*	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carangidae	*Decapterus maruadsi*	0	0	0	0	0	0	0	0	0	40	0	442	0	0	0	0
Sciaenidae	*Dendrophysa russelii*	0	0	0	0	0	0	0	0	160	490	0	0	0	356	0	0
Serranidae	*Diploprion bifasciatum*	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	*Epinephelus awoara*	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sparidae	*Evynnis cardinalis*	0	0	0	0	0	0	0	0	272	28	0	1356	389	1925	0	83
Gerreidae	*Gerres oblongus*	0	0	180	450	264	0	0	0	0	0	0	0	0	0	0	0
Gerreidae	*Gerres* sp.	0	0	0	0	0	0	0	0	0	0	0	10.5	0	0	103	0
Labridae	*Halichoeres nigrescens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	209	36
Clupeidae	*Konosirus punctatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	78	0	0
Leiognathidae	*Leiognathus brevirostris*	0	106	0	0	0	0	0	0	70	0	0	29	23	107	0	0
Leiognathidae	*Leiognathus equulus*	0	0	0	0	0	0	0	0	0	102	0	0	0	0	0	0
Blenniidae	*Meiacanthus grammistes*	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
Penaeidae	*Metapenaeus* sp.	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0
Kyphosidae	*Microcanthus strigatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Monacanthidae	*Monacanthus chinensis*	0	15	0	0	0	0	0	0	0	0	0	0	0	0	170	77
Pomacentridae	*Neopomacentrus bankieri*	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacentridae	*Neopomacentrus cyanomos*	161	136	136	150	0	0	0	15	0	0	0	0	0	0	0	191
Octopodidae	*Octopus* sp.	0	0	0	0	0	0	0	0	0	0	1730	0	0	0	0	680
Squillidae	*Oratosquilla oratoria*	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0
Squillidae	*Oratosquillina interrupta*	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0
Apogonidae	*Ostorhinchus fleurieu*	0	33	130	426	0	0	0	33	0	0	0	0	0	0	0	0
Sparidae	*Pagrus major*	0	0	0	0	0	0	0	0	0	0	70	0	0	0	0	0
Haemulidae	*Parapristipoma trilineatum*	0	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0
Mullidae	*Parupeneus biaculeatus*	0	0	159	0	0	0	0	0	0	0	112	0	0	0	0	0
Mullidae	*Parupeneus indicus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	223
Terapontidae	*Pelates quadrilineatus*	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	0
Portunidae	*Portunus pelagicus*	0	0	0	0	0	0	0	0	0	0	0	0	140	0	0	0
Paralichthyidae	*Pseudorhombus cinnamoneus*	0	0	53	0	0	0	0	0	0	8	0	10	74	0	0	0
Sparidae	*Rhabdosargus sarba*	0	0	0	0	0	0	0	0	0	0	0	0	0	52	0	426
Clupeidae	*Sardinella aurita*	0	0	0	0	0	0	0	0	0	0	0	476	0	0	0	0
Synodontidae	*Saurida tumbil*	0	0	0	210	0	0	0	0	0	0	0	23	0	0	0	0
Scorpaenidae	*Sebastiscus marmoratus*	0	0	0	0	0	0	0	81	0	0	70	0	0	0	0	46
Leiognathidae	*Secutor insidiator*	0	0	0	0	0	0	0	0	0	20	0	56	50	40	0	0
Carangidae	*Selaroides leptolepis*	0	0	0	0	0	0	0	0	0	0	488	0	0	0	0	0
Sepiidae	*Sepia* sp.	309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Siganidae	*Siganus canaliculatus*	0	207	45	69	1695	0	30	0	15	120	0	0	80	253	51	47

Annex A2 Biomass (g) of Adult Fish Surveys

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Sillaginidae	*Sillago sihama*	0	0	0	85	125	0	0	0	0	0	0	46	0	0	0	0
Monacanthidae	*Stephanolepis cirrhifer*	0	0	108	226	0	0	0	0	0	55	250	0	0	163	0	0
Labridae	*Stethojulis interrupta*	0	0	0	0	25	88	0	0	0	0	0	0	0	0	0	0
Tetraodontidae	*Takifugu alboplumbeus*	282	38	1124	1419	157	195	578	1836	0	0	0	0	0	0	0	47
Tetraodontidae	*Takifugu niphobles*	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0
Synodontidae	*Trachinocephalus myops*	0	0	0	40	0	0	20	0	0	0	0	243	0	0	0	0
Mullidae	*Upeneus japonicus*	0	0	0	0	0	0	0	0	0	0	0	26	0	94	152	48

Annex A3 Abundance of Adult Fish Surveys

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Pomacentridae	*Abudefduf vaigiensis*	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sparidae	*Acanthopagrus schlegeli*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Apogonidae	*Apogon doederleini*	0	0	0	2	0	0	0	1	0	0	1	0	0	0	1	2
Apogonidae	*Apogonichthyoides pseudotaeniatus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Soleidae	*Aseraggodes kobensis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Calappidae	*Calappa philargius*	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0
Carangidae	*Caranx ignobilis*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	*Cephalopholis boenak*	1	1	0	1	0	1	0	1	0	0	1	0	0	0	0	2
Chaetodontidae	*Chaetodon auripes*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Portunidae	*Charybdis* spp.	2	3	0	0	0	0	0	0	0	0	1	1	1	2	3	0
Cheilodactylidae	*Cheilodactylus zonatus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Cirrhitidae	*Cirrhitichthys aureus*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Dactylopteridae	*Dactyloptena peterseni*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carangidae	*Decapterus maruadsi*	0	0	0	0	0	0	0	0	0	1	0	14	0	0	0	0
Sciaenidae	*Dendrophysa russelii*	0	0	0	0	0	0	0	0	2	5	0	0	0	3	0	0
Serranidae	*Diploprion bifasciatum*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Serranidae	*Epinephelus awoara*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sparidae	*Evynnis cardinalis*	0	0	0	0	0	0	0	0	17	2	0	63	29	130	0	3
Gerreidae	*Gerres oblongus*	0	0	2	9	4	0	0	0	0	0	0	0	0	0	0	0
Gerreidae	*Gerres* sp.	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0
Labridae	*Halichoeres nigrescens*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2
Clupeidae	*Konosirus punctatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Leiognathidae	*Leiognathus brevirostris*	0	9	0	0	0	0	0	0	4	0	0	1	1	6	0	0
Leiognathidae	*Leiognathus equulus*	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
Blenniidae	*Meiacanthus grammistes*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Penaeidae	*Metapenaeus sp.*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Kyphosidae	*Microcanthus strigatus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Monacanthidae	*Monacanthus chinensis*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Pomacentridae	*Neopomacentrus bankieri*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pomacentridae	*Neopomacentrus cyanomos*	6	16	5	6	0	0	0	1	0	0	0	0	0	0	0	13
Octopodidae	*Octopus* sp.	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
Squillidae	*Oratosquilla oratoria*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Squillidae	*Oratosquillina interrupta*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Apogonidae	*Ostorhinchus fleurieu*	0	1	4	13	0	0	0	1	0	0	0	0	0	0	0	0
Sparidae	*Pagrus major*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Haemulidae	*Parapristipoma trilineatum*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mullidae	*Parupeneus biaculeatus*	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0
Mullidae	*Parupeneus indicus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Terapontidae	*Pelates quadrilineatus*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Portunidae	*Portunus pelagicus*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Paralichthyidae	*Pseudorhombus cinnamoneus*	0	0	1	0	0	0	0	0	0	1	0	1	2	0	0	0
Sparidae	*Rhabdosargus sarba*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7
Clupeidae	*Sardinella aurita*	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
Synodontidae	*Saurida tumbil*	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Scorpaenidae	*Sebastiscus marmoratus*	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	1
Leiognathidae	*Secutor insidiator*	0	0	0	0	0	0	0	0	0	1	0	3	4	3	0	0
Carangidae	*Selaroides leptolepis*	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
Sepiidae	*Sepia* sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Siganidae	*Siganus canaliculatus*	0	7	1	3	34	0	1	0	1	3	0	0	4	12	1	2

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Sillaginidae	*Sillago sihama*	0	0	0	3	1	0	0	0	0	0	0	2	0	0	0	0
Monacanthidae	*Stephanolepis cirrhifer*	0	0	1	3	0	0	0	0	0	2	4	0	0	2	0	0
Labridae	*Stethojulis interrupta*	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0
Tetraodontidae	*Takifugu alboplumbeus*	4	1	22	31	3	3	10	39	0	0	0	0	0	0	0	1
Tetraodontidae	*Takifugu niphobles*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Synodontidae	*Trachinocephalus myops*	0	0	0	2	0	0	1	0	0	0	0	3	0	0	0	0
Mullidae	*Upeneus japonicus*	0	0	0	0	0	0	0	0	0	0	0	1	0	3	3	1

Annex B

Full List of Juvenile Fish Data

Season	Year	Month	Location	Group	Family	Species Name	Common Name	Chinese Name	Commercial Value [(a)]	Quantity	Weight (g)	TL (cm)	SL (cm)	FL (cm)
Dry	2015	Dec	P1	-	-	-	-	-	-	-	-	-	-	-
Dry	2015	Dec	P2	Fish	Gerreidae	*Gerres oblongus*	Silver biddy	連米	L	1	48	15.7	13	13.5
Dry	2015	Dec	P2	Fish	Engraulidae	*Stolephorus insularis*	Hardenberg's anchovy	鮸仔	L	1	2	5.6	4.7	5
Dry	2015	Dec	R1	-	-	-	-	-	-	-	-	-	-	-
Dry	2015	Dec	R2	Fish	Engraulidae	*Engraulidae* sp.	-	-	-	150	7	2.1	-	-
Dry	2016	Jan	P1	Fish	Engraulidae	*Stolephorus insularis*	Hardenberg's anchovy	鮸仔	L	15	7	4	3.6	-
Dry	2016	Jan	P2	-	-	-	-	-	-	-	-	-	-	-
Dry	2016	Jan	R1	-	-	-	-	-	-	-	-	-	-	-
Dry	2016	Jan	R2	-	-	-	-	-	-	-	-	-	-	-
Wet	2016	Jul	P1	Fish	Engraulidae	Engraulidae sp.	-	-	-	35	9	2.2 - 4	1.9 - 3.3	-
Wet	2016	Jul	P2	Fish	Dactylopteridae	*Dactyloptena* sp.	-	-	-	1	<1	4	3.5	-
Wet	2016	Jul	P2	Bivalve	Mytilidae	*Perna viridis*	Green mussel	青口	X	1	1	2	-	-
Wet	2016	Jul	P2	Fish	Engraulidae	Engraulidae sp.	-	-	-	70	8	1 - 3	-	-
Wet	2016	Jul	P2	Fish	Engraulidae	Engraulidae sp.	-	-	-	3	2	4	3.5	-
Wet	2016	Jul	P2	Fish	Atherinidae	*Atherinomorus* sp.	-	-	-	1	1	4	3.6	-
Wet	2016	Jul	R1	-	-	-	-	-	-	-	-	-	-	-
Wet	2016	Jul	R2	Fish	Atherinidae	*Atherinomorus lacunosus*	Hardyhead silverside	重鱗	L	12	282	11 - 15	10.5 - 14	9.5 - 13
Wet	2016	Jul	R2	Fish	Engraulidae	Engraulidae sp.	-	-	-	1003	138	2.5 - 3.5	2.4 - 3.5	-
Wet	2016	Jul	R2	Fish	Atherinidae	*Atherinomorus* sp.	-	-	-	1	1	4	3.5	-
Wet	2016	Aug	P1	Fish	Atherinidae	*Atherinomorus* sp.	-	-	-	2	<1	1.5	-	-
Wet	2016	Aug	P1	Fish	Engraulidae	Engraulidae sp.	-	-	-	200	4	1.2	-	-
Wet	2016	Aug	P2	Fish	Engraulidae	Engraulidae sp.	-	-	-	1	<1	3.5	-	-
Wet	2016	Aug	P2	Fish	Atherinidae	*Atherinomorus* sp.	-	-	-	14	6	3 - 4.5	-	-
Wet	2016	Aug	R1	Fish	Atherinidae	*Atherinomorus* sp.	-	-	-	4	1	3.5 - 5.5	-	-
Wet	2016	Aug	R2	Fish	Leiognathidae	*Leiognathus* sp.	-	-	-	3	1	2.5 - 3	-	-
Wet	2016	Aug	R2	Fish	Engraulidae	Engraulidae sp.	-	-	-	5	1	2.5 - 3	-	-

a) References of Catch Value:
FishBase (2015) Available at: http://www.fishbase.org/
Fish Marketing Organization (2016) Available at: http://www.fmo.org.hk/index/lang_en/page_price-sea/
Mott (2013) Expansion of Hong Kong Airport into a Three-Runway System.
H = H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); X = not commercially important species； "-" = no commercial value is evaluated

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Atherinidae	*Atherinomorus lacunosus*	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0
Atherinidae	*Atherinomorus* sp.	0	0	0	0	0	0	0	0	0	1	0	1	2	14	4	0
Dactylopteridae	*Dactyloptena* sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Engraulidae	*Engraulidae* sp.	0	0	0	150	0	0	0	0	35	73	0	1003	200	1	0	5
Gerreidae	*Gerres oblongus*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leiognathidae	*Leiognathus* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Mytilidae	*Perna viridis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Engraulidae	*Stolephorus insularis*	0	1	0	0	15	0	0	0	0	0	0	0	0	0	0	0

Annex B3 Biomass (g) of Juvenile Fish Resources

Family	Species	Dec				Jan				Jul				Aug			
		P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2	P1	P2	R1	R2
Atherinidae	*Atherinomorus lacunosus*	0	0	0	0	0	0	0	0	0	0	0	282	0	0	0	0
Atherinidae	*Atherinomorus* sp.	0	0	0	0	0	0	0	0	0	1	0	1	0	6	1	0
Dactylopteridae	*Dactyloptena* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Engraulidae	*Engraulidae* sp.	0	0	0	7	0	0	0	0	9	10	0	138	4	0	0	1
Gerreidae	*Gerres oblongus*	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leiognathidae	*Leiognathus* sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mytilidae	*Perna viridis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Engraulidae	*Stolephorus insularis*	0	2	0	0	7	0	0	0	0	0	0	0	0	0	0	0

Annex C

Full List of Ichthyoplankton Data

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Dry	2015	Dec	T2	Blenniidae	Blenniidae spp.	Blenny fish	鰕科	-	-	Larvae	13.91
Dry	2015	Dec	T3	Blenniidae	Blenniidae spp.	Blenny fish	鰕科	-	-	Larvae	6.50
Dry	2015	Dec	T4	Blenniidae	Blenniidae spp.	Blenny fish	鰕科	-	-	Larvae	20.18
Dry	2015	Dec	T1	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰕	x	-	Larvae	7.21
Dry	2015	Dec	T3	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰕	x	-	Larvae	13.40
Dry	2015	Dec	T1	Callionymidae	*Bathycallionymus kaianus*	Kaia's dragonet	基島深水鰭	x	-	Larvae	8.66
Dry	2015	Dec	T1	Callionymidae	*Callionymus curvicornis*	Horn dragonet	彎角鰭	x	-	Egg	21.64
Dry	2015	Dec	T3	Engraulidae	*Engraulis japonicus*	Japanese anchovy	日本鯷	L	-	Larvae	6.79
Dry	2015	Dec	T2	Gobiidae	Gobiidae sp.	Goby fish	鰕虎科	-	-	Larvae	6.96
Dry	2015	Dec	T3	Gobiidae	Gobiidae sp.	Goby fish	鰕虎科	-	-	Larvae	6.50
Dry	2015	Dec	T1	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	95.27
Dry	2015	Dec	T2	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	27.85
Dry	2015	Dec	T3	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	6.50
Dry	2015	Dec	T4	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	38.83
Dry	2015	Dec	T1	Sciaenidae	*Larimichthys crocea*	Large yellow croaker	大黃魚	H	-	Egg	65.06
Dry	2015	Dec	T2	Sciaenidae	*Larimichthys crocea*	Large yellow croaker	大黃魚	H	-	Egg	126.86
Dry	2015	Dec	T3	Sciaenidae	*Larimichthys crocea*	Large yellow croaker	大黃魚	H	-	Egg	19.50
Dry	2015	Dec	T4	Sciaenidae	*Larimichthys crocea*	Large yellow croaker	大黃魚	H	-	Egg	6.29
Dry	2015	Dec	T1	Scorpaenidae	*Sebastiscus marmoratus*	Marbled rockfish	石狗公	H	-	Larvae	24.55
Dry	2015	Dec	T3	Sillaginidae	*Sillago aeolus*	Oriental sillago	星沙鮻	H	-	Larvae	6.70
Dry	2015	Dec	T1	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	47.69
Dry	2015	Dec	T2	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	117.73
Dry	2015	Dec	T3	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	358.45
Dry	2015	Dec	T4	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	225.15
Dry	2015	Dec	T4	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	6.66
Dry	2015	Dec	T2	Sparidae	*Acanthopagrus latus*	Yellowfin seabream	黃鰭棘鯛	L	-	Larvae	6.95
Dry	2015	Dec	T3	Sparidae	*Acanthopagrus latus*	Yellowfin seabream	黃鰭棘鯛	L	-	Larvae	6.70
Dry	2015	Dec	T1	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	226.95
Dry	2015	Dec	T2	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	156.77
Dry	2015	Dec	T3	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	259.62
Dry	2015	Dec	T3	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Larvae	6.70
Dry	2015	Dec	T4	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	170.38
Dry	2015	Dec	T4	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Larvae	13.32
Dry	2015	Dec	T1	Synodontidae	*Synodus variegatus*	Variegated lizardfish	花斑狗母魚	L	-	Egg	8.66
Dry	2015	Dec	T2	Synodontidae	*Synodus variegatus*	Variegated lizardfish	花斑狗母魚	L	-	Egg	6.96
Dry	2016	Jan	T1	Aulopidae	*Hime japonica*	Japanese thread-sail fish	日本姬魚	L	-	Egg	18.24
Dry	2016	Jan	T3	Blenniidae	Blenniidae spp.	Blenny fish	鰕科	-	-	Larvae	22.34
Dry	2016	Jan	T4	Blenniidae	Blenniidae spp.	Blenny fish	鰕科	-	-	Larvae	21.23
Dry	2016	Jan	T3	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰕	x	-	Larvae	10.13
Dry	2016	Jan	T2	Bothidae	*Arnoglossus polyspilus*	Many-spotted lefteye flounder	多斑羊舌鮃	x	-	Egg	6.94
Dry	2016	Jan	T3	Bregmacerotidae	Bregmacerotidae sp.	Codlet	海鰍鱈科	-	-	Larvae	8.41
Dry	2016	Jan	T4	Callionymidae	*Bathycallionymus kaianus*	Kaia's dragonet	基島深水鰭	x	-	Egg	31.40
Dry	2016	Jan	T2	Callionymidae	*Callionymus curvicornis*	Horn dragonet	彎角鰭	x	-	Larvae	6.94
Dry	2016	Jan	T1	Clupeidae	*Konosirus punctatus*	Dotted gizzard shad	窩斑鰶	L	-	Larvae	6.71
Dry	2016	Jan	T4	Clupeidae	*Konosirus punctatus*	Dotted gizzard shad	窩斑鰶	L	-	Egg	7.07
Dry	2016	Jan	T1	Clupeidae	*Nematalosa japonica*	Japanese gizzard shad	日本海鰶	L	-	Egg	36.48
Dry	2016	Jan	T3	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	8.41

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Dry	2016	Jan	T3	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Larvae	18.55
Dry	2016	Jan	T4	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Larvae	6.28
Dry	2016	Jan	T3	Gobiidae	*Amblychaeturichthys hexanema*	Pinkgray goby	六絲鈍尾鰕虎	x	-	Egg	50.47
Dry	2016	Jan	T3	Gobiidae	Gobiidae sp.	Goby fish	鰕虎科	-	-	Larvae	12.21
Dry	2016	Jan	T2	Labridae	*Stethojulis terina*	Blue-lined wrasses	斷紋紫胸魚	x	-	Egg	8.72
Dry	2016	Jan	T3	Moronidae	*Lateolabrax japonicus*	Japanese seabass	日本花鱸	L	-	Egg	134.05
Dry	2016	Jan	T3	Moronidae	*Lateolabrax japonicus*	Japanese seabass	日本花鱸	L	-	Larvae	12.21
Dry	2016	Jan	T4	Moronidae	*Lateolabrax japonicus*	Japanese seabass	日本花鱸	L	-	Egg	6.28
Dry	2016	Jan	T2	Mugilidae	*Chelon affinis*	Eastern keelback mullet	前鱗龜鮻	x	-	Larvae	22.97
Dry	2016	Jan	T4	Mugilidae	*Chelon affinis*	Eastern keelback mullet	前鱗龜鮻	x	-	Larvae	44.41
Dry	2016	Jan	T3	Mugilidae	*Crenimugil crenilabis*	Fringelip mullet	粒唇鯔	L	-	Egg	16.82
Dry	2016	Jan	T4	Mugilidae	*Crenimugil crenilabis*	Fringelip mullet	粒唇鯔	L	-	Egg	46.34
Dry	2016	Jan	T3	Mullidae	*Upeneus japonicus*	Bensasi goatfish	日本緋鯉	L	-	Larvae	10.13
Dry	2016	Jan	T4	Mullidae	*Upeneus japonicus*	Bensasi goatfish	日本緋鯉	L	-	Egg	6.28
Dry	2016	Jan	T1	Pempheridae	Pempheridae sp.	Sweepers	擬金眼鯛科	-	-	Egg	15.87
Dry	2016	Jan	T2	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	8.72
Dry	2016	Jan	T2	Platycephalidae	Platycephalidae sp.	Flatheads	牛尾魚科	L	-	Egg	8.72
Dry	2016	Jan	T3	Platycephalidae	Platycephalidae sp.	Flatheads	牛尾魚科	L	-	Egg	10.13
Dry	2016	Jan	T2	Pomacentridae	*Abudefduf vaigiensis*	Indo-Pacific sergeant	條紋豆娘魚	L	-	Larvae	7.13
Dry	2016	Jan	T3	Pomacentridae	*Abudefduf vaigiensis*	Indo-Pacific sergeant	條紋豆娘魚	L	-	Larvae	12.21
Dry	2016	Jan	T4	Pomacentridae	*Abudefduf vaigiensis*	Indo-Pacific sergeant	條紋豆娘魚	L	-	Egg	95.56
Dry	2016	Jan	T4	Pomacentridae	*Abudefduf vaigiensis*	Indo-Pacific sergeant	條紋豆娘魚	L	-	Larvae	16.90
Dry	2016	Jan	T1	Scorpaenidae	Scorpaenidae sp.	Scorpionfish	鮋科	-	-	Egg	15.87
Dry	2016	Jan	T1	Scorpaenidae	*Sebastiscus marmoratus*	Marbled rockfish	石狗公	H	-	Larvae	13.43
Dry	2016	Jan	T2	Scorpaenidae	*Sebastiscus marmoratus*	Marbled rockfish	石狗公	H	-	Larvae	27.94
Dry	2016	Jan	T3	Scorpaenidae	*Sebastiscus marmoratus*	Marbled rockfish	石狗公	H	-	Larvae	165.97
Dry	2016	Jan	T4	Scorpaenidae	*Sebastiscus marmoratus*	Marbled rockfish	石狗公	H	-	Larvae	331.41
Dry	2016	Jan	T1	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	6.71
Dry	2016	Jan	T3	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	24.41
Dry	2016	Jan	T4	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Egg	16.90
Dry	2016	Jan	T1	Soleidae	*Zebrias zebra*	Zebra sole	條鰨	L	-	Egg	15.87
Dry	2016	Jan	T3	Sparidae	*Acanthopagrus latus*	Yellowfin seabream	黃鰭棘鯛	L	-	Larvae	40.54
Dry	2016	Jan	T4	Sparidae	*Acanthopagrus latus*	Yellowfin seabream	黃鰭棘鯛	L	-	Larvae	10.62
Dry	2016	Jan	T1	Sparidae	*Acanthopagrus pacificus*	Pacific seabream	太平洋棘鯛	L	-	Egg	15.87
Dry	2016	Jan	T2	Sparidae	*Acanthopagrus pacificus*	Pacific seabream	太平洋棘鯛	L	-	Egg	22.97
Dry	2016	Jan	T3	Sparidae	*Acanthopagrus pacificus*	Pacific seabream	太平洋棘鯛	L	-	Egg	10.13
Dry	2016	Jan	T1	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Larvae	6.71
Dry	2016	Jan	T3	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Larvae	8.41
Dry	2016	Jan	T4	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Larvae	14.14
Dry	2016	Jan	T1	Sparidae	*Evynnis cardinalis*	Threadfin porgy	二長棘犁齒鯛	L	-	Egg	20.14
Dry	2016	Jan	T3	Sparidae	*Pagrus major*	Red seabream	真鯛	H	-	Egg	16.82
Dry	2016	Jan	T4	Sparidae	*Pagrus major*	Red seabream	真鯛	H	-	Egg	106.17
Dry	2016	Jan	T3	Sparidae	*Pagrus* sp.	Sea bream	真鯛屬	-	-	Larvae	16.82
Dry	2016	Jan	T4	Sparidae	*Pagrus* sp.	Sea bream	真鯛屬	-	-	Larvae	6.28
Dry	2016	Jan	T1	Sparidae	*Rhabdosargus sarba*	Goldlined seabream	平鯛	L	-	Larvae	22.58
Dry	2016	Jan	T3	Sparidae	*Rhabdosargus sarba*	Goldlined seabream	平鯛	L	-	Larvae	116.32
Dry	2016	Jan	T4	Sparidae	*Rhabdosargus sarba*	Goldlined seabream	平鯛	L	-	Larvae	74.66

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Dry	2016	Jan	T1	Sparidae	Sparidae sp.	Sea bream	鯛科	-	-	Egg	18.24
Dry	2016	Jan	T2	Sparidae	Sparidae sp.	Sea bream	鯛科	-	-	Egg	6.94
Dry	2016	Jan	T3	Sparidae	Sparidae sp.	Sea bream	鯛科	-	-	Egg	18.55
Dry	2016	Jan	T4	Sparidae	Sparidae sp.	Sea bream	鯛科	-	-	Egg	7.07
Dry	2016	Jan	T2	Tetraodontidae	*Takifugu poecilonotus*	Finepatterned Puffer	斑點多紀魨	x	-	Larvae	7.13
Dry	2016	Jan	T2	Trichiuridae	*Trichiurus lepturus*	Largehead hairtail	白帶魚	H	-	Egg	8.72
Dry	2016	Jan	T2	Triglidae	Triglidae sp.	Sea robins/ Gurnards	角魚科	-	-	Larvae	6.94
Wet	2016	April	T1	Apogonidae	*Ostorhinchus semilineatus*	Half-lined cardinal	半線鸚天竺鯛	L	-	Larvae	111.07
Wet	2016	April	T2	Apogonidae	*Ostorhinchus semilineatus*	Half-lined cardinal	半線鸚天竺鯛	L	-	Larvae	51.90
Wet	2016	April	T4	Apogonidae	*Ostorhinchus semilineatus*	Half-lined cardinal	半線鸚天竺鯛	L	-	Larvae	23.29
Wet	2016	April	T1	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰨	x	-	Larvae	28.09
Wet	2016	April	T2	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰨	x	-	Larvae	19.73
Wet	2016	April	T1	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰨屬	-	-	Larvae	91.75
Wet	2016	April	T2	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰨屬	-	-	Larvae	169.87
Wet	2016	April	T4	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰨屬	-	-	Larvae	37.73
Wet	2016	April	T1	Callionymidae	*Callionymus curvicornis*	Horn dragonet	彎角鰤	x	-	Larvae	7.48
Wet	2016	April	T1	Clupeidae	*Nematalosa japonica*	Japanese gizzard shad	日本海鰶	L	-	Egg	22.43
Wet	2016	April	T2	Clupeidae	*Nematalosa japonica*	Japanese gizzard shad	日本海鰶	L	-	Egg	18.80
Wet	2016	April	T3	Clupeidae	*Nematalosa japonica*	Japanese gizzard shad	日本海鰶	L	-	Egg	37.18
Wet	2016	April	T1	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	225.25
Wet	2016	April	T2	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	63.28
Wet	2016	April	T3	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	127.39
Wet	2016	April	T4	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	142.55
Wet	2016	April	T1	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	1783.01
Wet	2016	April	T2	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	928.71
Wet	2016	April	T3	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	2525.33
Wet	2016	April	T4	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	1024.32
Wet	2016	April	T1	Engraulidae	*Engraulis japonicus*	Japanese anchovy	日本鯷	L	-	Larvae	28.09
Wet	2016	April	T4	Gerreidae	*Gerres erythrourus*	Deep-bodied mojarra	短鑽嘴魚	L	-	Larvae	11.65
Wet	2016	April	T1	Gobiidae	*Amblychaeturichthys hexanema*	Pinkgray goby	六絲鈍尾鰕虎	x	-	Larvae	16.23
Wet	2016	April	T4	Gobiidae	*Amblychaeturichthys hexanema*	Pinkgray goby	六絲鈍尾鰕虎	x	-	Larvae	44.95
Wet	2016	April	T2	Gobiidae	*Istigobius campbelli*	Campbel's Goby	康培氏銜鰕虎	x	-	Larvae	43.55
Wet	2016	April	T4	Gobiidae	*Istigobius campbelli*	Campbel's Goby	康培氏銜鰕虎	x	-	Larvae	11.65
Wet	2016	April	T1	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	三線磯鱸	L	-	Larvae	50.52
Wet	2016	April	T2	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	三線磯鱸	L	-	Egg	460.57
Wet	2016	April	T3	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	三線磯鱸	L	-	Larvae	82.40
Wet	2016	April	T4	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	三線磯鱸	L	-	Egg	244.04
Wet	2016	April	T1	Labridae	*Halichoeres tenuispinis*	Chinese wrasse	細棘海豬魚	L	-	Egg	37698.36
Wet	2016	April	T2	Labridae	*Halichoeres tenuispinis*	Chinese wrasse	細棘海豬魚	L	-	Egg	1366.11
Wet	2016	April	T3	Labridae	*Halichoeres tenuispinis*	Chinese wrasse	細棘海豬魚	L	-	Egg	1635.74
Wet	2016	April	T4	Labridae	*Halichoeres tenuispinis*	Chinese wrasse	細棘海豬魚	L	-	Egg	1967.53
Wet	2016	April	T1	Labridae	*Stethojulis terina*	Blue-lined wrasses	斷紋紫胸魚	x	-	Egg	4283.49
Wet	2016	April	T2	Labridae	*Stethojulis terina*	Blue-lined wrasses	斷紋紫胸魚	x	-	Egg	2675.44
Wet	2016	April	T4	Labridae	*Stethojulis terina*	Blue-lined wrasses	斷紋紫胸魚	x	-	Egg	6821.48
Wet	2016	April	T1	Mugilidae	*Chelon affinis*	Eastern keelback mullet	前鱗龜鮻	x	-	Larvae	7.48
Wet	2016	April	T1	Mugilidae	*Moolgarda cunnesius*	Longarm mullet	長鰭莫鯔	L	-	Larvae	74.23

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Wet	2016	April	T2	Mugilidae	*Moolgarda cunnesius*	Longarm mullet	長鰭莫鯔	L	-	Larvae	20.66
Wet	2016	April	T4	Mugilidae	*Moolgarda cunnesius*	Longarm mullet	長鰭莫鯔	L	-	Larvae	11.65
Wet	2016	April	T2	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	日本金線魚	L	-	Larvae	75.72
Wet	2016	April	T4	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	日本金線魚	L	-	Egg	21.66
Wet	2016	April	T4	Paralichthyidae	*Pseudorhombus elevatus*	Deep flounder	高體斑鮃	L	-	Egg	267.88
Wet	2016	April	T1	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	28.09
Wet	2016	April	T1	Percidae	*Etheostoma uniporum*	Current darter	急流鏢鱸	x	-	Egg	28.09
Wet	2016	April	T1	Platycephalidae	*Inegocia japonica*	Japanese flathead	日本眼眶牛尾魚	L	-	Egg	2536.91
Wet	2016	April	T2	Platycephalidae	*Inegocia japonica*	Japanese flathead	日本眼眶牛尾魚	L	-	Egg	1526.95
Wet	2016	April	T3	Platycephalidae	*Inegocia japonica*	Japanese flathead	日本眼眶牛尾魚	L	-	Egg	615.33
Wet	2016	April	T1	Platycephalidae	*Platycephalus indicus*	Bartail flathead	印度牛尾魚	L	-	Larvae	54.89
Wet	2016	April	T4	Platycephalidae	*Platycephalus indicus*	Bartail flathead	印度牛尾魚	L	-	Larvae	11.65
Wet	2016	April	T1	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	2033.88
Wet	2016	April	T2	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	1013.95
Wet	2016	April	T3	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	147.99
Wet	2016	April	T4	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	376.63
Wet	2016	April	T1	Sciaenidae	*Nibea albiflora*	Yellow drum	黃姑魚	H	-	Larvae	252.07
Wet	2016	April	T2	Sciaenidae	*Nibea albiflora*	Yellow drum	黃姑魚	H	-	Larvae	326.05
Wet	2016	April	T3	Sciaenidae	*Nibea albiflora*	Yellow drum	黃姑魚	H	-	Larvae	125.49
Wet	2016	April	T4	Sciaenidae	*Nibea albiflora*	Yellow drum	黃姑魚	H	-	Larvae	287.86
Wet	2016	April	T4	Serranidae	*Epinephelus sexfasciatus*	Sixbar grouper	六帶石斑魚	H	-	Egg	768.71
Wet	2016	April	T2	Sillaginidae	*Sillago maculata*	Trumpeter sillago	斑沙鮻	H	-	Egg	291.38
Wet	2016	April	T3	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	103.00
Wet	2016	April	T1	Soleidae	*Solea ovata*	Ovate sole	卵鰨	L	-	Larvae	16.23
Wet	2016	April	T4	Soleidae	*Solea ovata*	Ovate sole	卵鰨	L	-	Larvae	15.25
Wet	2016	April	T1	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	7.48
Wet	2016	April	T4	Sparidae	*Acanthopagrus schlegelii*	Blackhead Seabream	黑棘鯛	L	-	Egg	10.83
Wet	2016	April	T3	Sphyraenidae	*Sphyraena pinguis*	Red barracuda	油金梭魚	L	-	Egg	1282.40
Wet	2016	April	T3	Syngnathidae	*Hippocampus trimaculatus*	Three-spotted Seahorse	三斑海馬	-	IUCN Red List - Vulnerable; CITIES Appendix II	Larvae	18.59
Wet	2016	April	T1	Terapontidae	*Rhynchopelates oxyrhynchus*	Sharpnose Grunter	尖突吻鯛	L	-	Larvae	84.27
Wet	2016	April	T1	Triglidae	*Lepidotrigla alata*	Sea robin	翼鱗角魚	L	-	Larvae	7.48
Wet	2016	April	T1	Tripterygiidae	*Tripterygiidae sp.*	Threefin blenny	三鰭鰌科	-	-	Larvae	7.48
Wet	2016	May	T1	Ambassidae	*Ambassis* sp.	Glassfish	雙邊魚屬	-	-	Larvae	1127.70
Wet	2016	May	T2	Ambassidae	*Ambassis* sp.	Glassfish	雙邊魚屬	-	-	Larvae	709.34
Wet	2016	May	T3	Ambassidae	*Ambassis* sp.	Glassfish	雙邊魚屬	-	-	Larvae	151.85
Wet	2016	May	T4	Ambassidae	*Ambassis* sp.	Glassfish	雙邊魚屬	-	-	Larvae	63.31
Wet	2016	May	T2	Apogonidae	*Apogon unicolor*	Big red cardinalfish	單色天竺鯛	L	-	Larvae	47.09
Wet	2016	May	T2	Apogonidae	*Apogonichthyoides cathetogramma*	Cardinalfish	垂帶似天竺鯛	L	-	Larvae	48.53
Wet	2016	May	T4	Apogonidae	*Apogonichthyoides cathetogramma*	Cardinalfish	垂帶似天竺鯛	L	-	Larvae	63.31
Wet	2016	May	T1	Apogonidae	*Ostorhinchus fasciatus*	Broadbanded cardinalfish	寬條鸚天竺鯛	L	-	Larvae	126.39
Wet	2016	May	T2	Apogonidae	*Ostorhinchus fasciatus*	Broadbanded cardinalfish	寬條鸚天竺鯛	L	-	Larvae	118.72
Wet	2016	May	T3	Apogonidae	*Ostorhinchus fasciatus*	Broadbanded cardinalfish	寬條鸚天竺鯛	L	-	Larvae	148.18
Wet	2016	May	T4	Apogonidae	*Ostorhinchus fasciatus*	Broadbanded cardinalfish	寬條鸚天竺鯛	L	-	Larvae	145.08
Wet	2016	May	T1	Blenniidae	Blenniidae spp.	Blenny fish	鰌科	-	-	Larvae	99.21
Wet	2016	May	T2	Blenniidae	Blenniidae spp.	Blenny fish	鰌科	-	-	Larvae	47.09

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Wet	2016	May	T3	Blenniidae	Blenniidae spp.	Blenny fish	鰧科	-	-	Larvae	121.11
Wet	2016	May	T4	Blenniidae	Blenniidae spp.	Blenny fish	鰧科	-	-	Larvae	211.46
Wet	2016	May	T1	Blenniidae	*Petroscirtes breviceps*	Short-headed blenny	短頭跳岩鰧	x	-	Larvae	189.04
Wet	2016	May	T1	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰧屬	-	-	Larvae	141.39
Wet	2016	May	T2	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰧屬	-	-	Larvae	141.77
Wet	2016	May	T4	Blenniidae	*Scartella* sp.	Blenny fish	頂鬚鰧屬	-	-	Larvae	205.72
Wet	2016	May	T2	Carangidae	*Decapterus akaadsi*	Scad	紅尾圓鯵	L	-	Larvae	24.98
Wet	2016	May	T3	Carangidae	*Decapterus macrosoma*	Shortfin scad	長身圓鯵	L	-	Egg	1610.26
Wet	2016	May	T1	Cepolidae	*Acanthocepola sp.*	Bandfish	棘赤刀魚屬	-	-	Larvae	50.34
Wet	2016	May	T1	Clupeidae	*Nematalosa nasus*	Bloch's gizzard shad	高鼻海鰶	L	-	Egg	1922.63
Wet	2016	May	T2	Clupeidae	*Nematalosa nasus*	Bloch's gizzard shad	高鼻海鰶	L	-	Egg	1040.96
Wet	2016	May	T3	Clupeidae	*Nematalosa nasus*	Bloch's gizzard shad	高鼻海鰶	L	-	Egg	301.87
Wet	2016	May	T4	Clupeidae	*Nematalosa nasus*	Bloch's gizzard shad	高鼻海鰶	L	-	Egg	29435.81
Wet	2016	May	T1	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	1637.14
Wet	2016	May	T2	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	880.94
Wet	2016	May	T3	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	29.82
Wet	2016	May	T4	Clupeidae	*Sardinella jussieu*	Mauritian sardinella	裘氏小沙丁魚	L	-	Larvae	684.96
Wet	2016	May	T1	Clupeidae	*Sardinella melanura*	Blacktip sardinella	黑尾小沙丁魚	L	-	Larvae	346.76
Wet	2016	May	T2	Clupeidae	*Sardinella melanura*	Blacktip sardinella	黑尾小沙丁魚	L	-	Larvae	593.99
Wet	2016	May	T3	Clupeidae	*Sardinella melanura*	Blacktip sardinella	黑尾小沙丁魚	L	-	Larvae	29.82
Wet	2016	May	T4	Clupeidae	*Sardinella melanura*	Blacktip sardinella	黑尾小沙丁魚	L	-	Larvae	63.31
Wet	2016	May	T2	Cynoglossidae	*Cynoglossus puncticeps*	Speckled tonguesole	斑頭舌鰨	H	-	Larvae	47.59
Wet	2016	May	T3	Cynoglossidae	*Cynoglossus puncticeps*	Speckled tonguesole	斑頭舌鰨	H	-	Larvae	63.31
Wet	2016	May	T1	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	12761.15
Wet	2016	May	T2	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	9368.46
Wet	2016	May	T3	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	4487.63
Wet	2016	May	T4	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	銀灰半稜鯷	L	-	Egg	9528.34
Wet	2016	May	T3	Gerreidae	*Gerres limbatus*	Saddleback silver-biddy	緣邊鑽嘴魚	L	-	Larvae	63.31
Wet	2016	May	T1	Gerreidae	*Gerres oblongus*	Slender silver-biddy	長身鑽嘴魚	L	-	Egg	5638.06
Wet	2016	May	T1	Gerreidae	*Gerres oyena*	Common silver-biddy	奧奈鑽嘴魚	L	-	Egg	59109.49
Wet	2016	May	T2	Gerreidae	*Gerres oyena*	Common silver-biddy	奧奈鑽嘴魚	L	-	Egg	44776.69
Wet	2016	May	T3	Gerreidae	*Gerres oyena*	Common silver-biddy	奧奈鑽嘴魚	L	-	Egg	4592.22
Wet	2016	May	T1	Gobiidae	*Amblyotrypauchen arctocephalus*	Armour eelgoby	窄頭鈍孔鰕虎	x	-	Larvae	658.17
Wet	2016	May	T2	Gobiidae	*Amblyotrypauchen arctocephalus*	Armour eelgoby	窄頭鈍孔鰕虎	x	-	Larvae	331.62
Wet	2016	May	T3	Gobiidae	*Amblyotrypauchen arctocephalus*	Armour eelgoby	窄頭鈍孔鰕虎	x	-	Larvae	149.10
Wet	2016	May	T1	Haemulidae	*Diagramma pictum*	Painted sweetlips	密點少棘胡椒鯛	H	-	Egg	8537.95
Wet	2016	May	T2	Haemulidae	*Diagramma pictum*	Painted sweetlips	密點少棘胡椒鯛	H	-	Egg	3997.50
Wet	2016	May	T3	Haemulidae	*Diagramma pictum*	Painted sweetlips	密點少棘胡椒鯛	H	-	Egg	12296.05
Wet	2016	May	T4	Haemulidae	*Diagramma pictum*	Painted sweetlips	密點少棘胡椒鯛	H	-	Egg	4051.92
Wet	2016	May	T1	Haemulidae	*Parapristipoma trilineatum*	Chicken grunt	三線磯鱸	L	-	Larvae	19.01
Wet	2016	May	T1	Labridae	*Halichoeres nigrescens*	Bubblefin wrasse	黑帶海豬魚	L	-	Egg	9060.11
Wet	2016	May	T2	Labridae	*Halichoeres nigrescens*	Bubblefin wrasse	黑帶海豬魚	L	-	Egg	4377.83
Wet	2016	May	T4	Labridae	*Halichoeres nigrescens*	Bubblefin wrasse	黑帶海豬魚	L	-	Egg	18688.52
Wet	2016	May	T1	Labridae	*Stethojulis terina*	Blue-lined wrasses	斷紋紫胸魚	x	-	Egg	5638.06
Wet	2016	May	T1	Leiognathidae	*Nuchequula nuchalis*	Spotnape ponyfish	項斑項鰏	M	-	Egg	11678.83
Wet	2016	May	T2	Leiognathidae	*Nuchequula nuchalis*	Spotnape ponyfish	項斑項鰏	M	-	Egg	7423.27
Wet	2016	May	T4	Leiognathidae	*Nuchequula nuchalis*	Spotnape ponyfish	項斑項鰏	M	-	Larvae	112.09

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value (a)	Conservation Status	Stage	Sum Density (Number/1000m3)
Wet	2016	May	T1	Monacanthidae	*Paramonacanthus sulcatus*	Mudbank filefish	絨鱗副單棘魨	M	-	Larvae	189.04
Wet	2016	May	T2	Monacanthidae	*Paramonacanthus sulcatus*	Mudbank filefish	絨鱗副單棘魨	M	-	Larvae	23.55
Wet	2016	May	T1	Mugilidae	*Valamugil cunnesius*	Longarm mullet	長鰭莫鯔	M	-	Larvae	428.42
Wet	2016	May	T2	Mugilidae	*Valamugil cunnesius*	Longarm mullet	長鰭莫鯔	M	-	Larvae	781.95
Wet	2016	May	T3	Mugilidae	*Valamugil cunnesius*	Longarm mullet	長鰭莫鯔	M	-	Larvae	268.38
Wet	2016	May	T4	Mugilidae	*Valamugil cunnesius*	Longarm mullet	長鰭莫鯔	M	-	Larvae	90.57
Wet	2016	May	T1	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	日本金線魚	L	-	Larvae	620.29
Wet	2016	May	T2	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	日本金線魚	L	-	Larvae	405.17
Wet	2016	May	T3	Nemipteridae	*Nemipterus japonicus*	Japanese threadfin bream	日本金線魚	L	-	Larvae	29.82
Wet	2016	May	T1	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	100.68
Wet	2016	May	T1	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Larvae	19.01
Wet	2016	May	T2	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	774.68
Wet	2016	May	T3	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	354.16
Wet	2016	May	T4	Pempheridae	*Pempheris schwenkii*	Black-stripe sweeper	南方擬金眼鯛	x	-	Egg	472.10
Wet	2016	May	T1	Percidae	*Etheostoma uniporum*	Current darter	急流鏢鱸	x	-	Egg	76.05
Wet	2016	May	T1	Platycephalidae	*Inegocia japonica*	Japanese flathead	日本眼眶牛尾魚	L	-	Egg	760.46
Wet	2016	May	T2	Platycephalidae	*Inegocia japonica*	Japanese flathead	日本眼眶牛尾魚	L	-	Egg	1332.38
Wet	2016	May	T3	Platycephalidae	*Suggrundus* sp.	Flathead	大眼牛尾魚屬	-	-	Egg	1271.68
Wet	2016	May	T1	Platycephalidae	*Thysanophrys celebica*	Celebes flathead	西里伯多棘牛尾魚	x	-	Egg	1088.28
Wet	2016	May	T2	Platycephalidae	*Thysanophrys celebica*	Celebes flathead	西里伯多棘牛尾魚	x	-	Egg	99.94
Wet	2016	May	T3	Platycephalidae	*Thysanophrys celebica*	Celebes flathead	西里伯多棘牛尾魚	x	-	Egg	59.64
Wet	2016	May	T4	Platycephalidae	*Thysanophrys celebica*	Celebes flathead	西里伯多棘牛尾魚	x	-	Egg	230.32
Wet	2016	May	T1	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	482.66
Wet	2016	May	T2	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	900.67
Wet	2016	May	T3	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	389.49
Wet	2016	May	T4	Pomacentridae	*Chromis notata*	Pearl-spot chromis	尾斑光鰓雀鯛	x	-	Larvae	504.68
Wet	2016	May	T1	Pomacentridae	Pomacentridae sp.1	Damselfishes	雀鯛科	-	-	Larvae	1146.35
Wet	2016	May	T2	Pomacentridae	Pomacentridae sp.1	Damselfishes	雀鯛科	-	-	Larvae	406.12
Wet	2016	May	T3	Pomacentridae	Pomacentridae sp.1	Damselfishes	雀鯛科	-	-	Larvae	122.03
Wet	2016	May	T4	Pomacentridae	Pomacentridae sp.1	Damselfishes	雀鯛科	-	-	Larvae	389.52
Wet	2016	May	T3	Scaridae	*Scarus ghobban*	Blue-barred parrotfish	藍點鸚哥魚	x	-	Egg	119.28
Wet	2016	May	T4	Scaridae	*Scarus ghobban*	Blue-barred parrotfish	藍點鸚哥魚	x	-	Egg	218.04
Wet	2016	May	T1	Sciaenidae	*Johnius grypotus*	Croaker	叫姑魚	L	-	Larvae	42.18
Wet	2016	May	T4	Sciaenidae	*Johnius grypotus*	Croaker	叫姑魚	L	-	Larvae	115.16
Wet	2016	May	T3	Sciaenidae	*Nibea albiflora*	Yellow drum	黃姑魚	H	-	Larvae	63.31
Wet	2016	May	T2	Scorpaenidae	Scorpaenidae sp.	Scorpionfish	鮋科	-	-	Egg	3013.89
Wet	2016	May	T3	Sillaginidae	*Sillago japonica*	Japanese sillago	日本沙鮻	H	-	Egg	9942.20
Wet	2016	May	T4	Sillaginidae	*Sillago japonica*	Japanese sillago	日本沙鮻	H	-	Egg	3843.39
Wet	2016	May	T1	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	220.37
Wet	2016	May	T2	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	47.09
Wet	2016	May	T3	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	57.80
Wet	2016	May	T4	Sillaginidae	*Sillago sihama*	Silver sillago	多鱗沙鮻	H	-	Larvae	63.31
Wet	2016	May	T3	Soleidae	*Aseraggodes* sp.	Peppered sole	櫛鱗鰨屬	-	-	Egg	63.31
Wet	2016	May	T1	Sphyraenidae	*Sphyraena pinguis*	Red barracuda	油金梭魚	L	-	Larvae	149.55
Wet	2016	May	T2	Sphyraenidae	*Sphyraena pinguis*	Red barracuda	油金梭魚	L	-	Larvae	118.72
Wet	2016	May	T1	Sphyraenidae	Sphyraenidae sp.1	Barracudas	金梭魚科	L	-	Larvae	19.01
Wet	2016	May	T4	Sphyraenidae	Sphyraenidae sp.1	Barracudas	金梭魚科	L	-	Larvae	120.89

Annex C1 Full List of Ichthyoplankton Data

Season	Year	Month	Location	Family	Scientific name	Common name	中文名	Commercial Value [(a)]	Conservation Status	Stage	Sum Density (Number/1000m3)
Wet	2016	May	T2	Synodontidae	Synodontidae sp.	Lizardfish	合齒魚科	-	-	Egg	95.17
Wet	2016	May	T3	Synodontidae	Synodontidae sp.	Lizardfish	合齒魚科	-	-	Egg	63.31
Wet	2016	May	T4	Synodontidae	Synodontidae sp.	Lizardfish	合齒魚科	-	-	Egg	126.62
Wet	2016	May	T1	Triglidae	*Lepidotrigla alata*	Sea robin	翼鱗角魚	L	-	Larvae	88.36
Wet	2016	May	T2	Triglidae	*Lepidotrigla alata*	Sea robin	翼鱗角魚	L	-	Larvae	191.24
Wet	2016	May	T4	Triglidae	*Lepidotrigla alata*	Sea robin	翼鱗角魚	L	-	Larvae	120.89
Wet	2016	May	T1	Tripterygiidae	*Tripterygiidae* sp.	Threefin blenny	三鰭鰌科	-	-	Larvae	42.18

a) References of Catch Value:
FishBase (2015) Available at: http://www.fishbase.org/
Fish Marketing Organization (2016) Available at: http://www.fmo.org.hk/index/lang_en/page_price-sea/
Mott (2013) Expansion of Hong Kong Airport into a Three-Runway System.
H = H= High (> 60 HK$/kg); M = Medium (50 – 60 HK$/kg); L = Low (< 50 HK$/kg); x = not commercially important species； "-" = no commercial value is evaluated

Annex C2 Desnity of Fish Larave (number/1000m^3)

Family	Species	Dec				Jan				April				May			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Pomacentridae	*Abudefduf vaigiensis*	0.00	0.00	0.00	0.00	0.00	7.13	12.21	16.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cepolidae	*Acanthocepola sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.34	0.00	0.00	0.00
Sparidae	*Acanthopagrus latus*	0.00	6.95	6.70	0.00	0.00	0.00	40.54	10.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sparidae	*Acanthopagrus schlegelii*	0.00	0.00	6.70	13.32	6.71	0.00	8.41	14.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ambassidae	*Ambassis sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1127.70	709.34	151.85	63.31
Gobiidae	*Amblychaeturichthys hexanema*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.23	0.00	0.00	44.95	0.00	0.00	0.00	0.00
Gobiidae	*Amblyotrypauchen arctocephalus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	658.17	331.62	149.10	0.00
Apogonidae	*Apogon unicolor*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.09	0.00	0.00
Apogonidae	*Apogonichthyoides cathetogramma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.53	0.00	63.31
Callionymidae	*Bathycallionymus kaianus*	8.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blenniidae	*Blenniidae spp.*	0.00	13.91	6.50	20.18	0.00	0.00	22.34	21.23	0.00	0.00	0.00	0.00	99.21	47.09	121.11	211.46
Bregmacerotidae	*Bregmacerotidae sp.*	0.00	0.00	0.00	0.00	0.00	0.00	8.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Callionymidae	*Callionymus curvicornis*	0.00	0.00	0.00	0.00	0.00	6.94	0.00	0.00	7.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mugilidae	*Chelon affinis*	0.00	0.00	0.00	0.00	0.00	22.97	0.00	44.41	7.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pomacentridae	*Chromis notata*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2033.88	1013.95	147.99	376.63	482.66	900.67	389.49	504.68
Cynoglossidae	*Cynoglossus puncticeps*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.59	63.31	0.00
Carangidae	*Decapterus akaadsi*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.98	0.00	0.00
Engraulidae	*Encrasicholina punctifer*	0.00	0.00	0.00	0.00	0.00	0.00	18.55	6.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engraulidae	*Engraulis japonicus*	0.00	0.00	6.79	0.00	0.00	0.00	0.00	0.00	28.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gerreidae	*Gerres erythrourus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.65	0.00	0.00	0.00	0.00
Gerreidae	*Gerres limbatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.31	0.00
Gobiidae	*Gobiidae sp.*	0.00	6.96	6.50	0.00	0.00	0.00	12.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Syngnathidae	*Hippocampus trimaculatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.59	0.00	0.00	0.00	0.00	0.00
Gobiidae	*Istigobius campbelli*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.55	0.00	11.65	0.00	0.00	0.00	0.00
Sciaenidae	*Johnius grypotus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.18	0.00	0.00	115.16
Clupeidae	*Konosirus punctatus*	0.00	0.00	0.00	0.00	6.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moronidae	*Lateolabrax japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	12.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triglidae	*Lepidotrigla alata*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.48	0.00	0.00	0.00	88.36	191.24	0.00	120.89
Mugilidae	*Moolgarda cunnesius*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.23	20.66	0.00	11.65	0.00	0.00	0.00	0.00
Nemipteridae	*Nemipterus japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.72	0.00	0.00	620.29	405.17	29.82	0.00
Sciaenidae	*Nibea albiflora*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	252.07	326.05	125.49	287.86	0.00	0.00	63.31	0.00
Leiognathidae	*Nuchequula nuchalis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	112.09
Apogonidae	*Ostorhinchus fasciatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	126.39	118.72	148.18	145.08
Apogonidae	*Ostorhinchus semilineatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	111.07	51.90	0.00	23.29	0.00	0.00	0.00	0.00
Sparidae	*Pagrus sp.*	0.00	0.00	0.00	0.00	0.00	0.00	16.82	6.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monacanthidae	*Paramonacanthus sulcatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.04	23.55	0.00	0.00
Haemulidae	*Parapristipoma trilineatum*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.52	0.00	82.40	0.00	19.01	0.00	0.00	0.00
Pempheridae	*Pempheris schwenkii*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.01	0.00	0.00	0.00
Blenniidae	*Petroscirtes breviceps*	7.21	0.00	13.40	0.00	0.00	0.00	10.13	0.00	28.09	19.73	0.00	0.00	189.04	0.00	0.00	0.00
Platycephalidae	*Platycephalus indicus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54.89	0.00	0.00	11.65	0.00	0.00	0.00	0.00
Pomacentridae	*Pomacentridae sp.1*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1146.35	406.12	122.03	389.52
Sparidae	*Rhabdosargus sarba*	0.00	0.00	0.00	0.00	22.58	0.00	116.32	74.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Terapontidae	*Rhynchopelates oxyrhynchus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clupeidae	*Sardinella jussieu*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	225.25	63.28	127.39	142.55	1637.14	880.94	29.82	684.96
Clupeidae	*Sardinella melanura*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	346.76	593.99	29.82	63.31
Blenniidae	*Scartella sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.75	169.87	0.00	37.73	141.39	141.77	0.00	205.72
Scorpaenidae	*Sebastiscus marmoratus*	24.55	0.00	0.00	0.00	13.43	27.94	165.97	331.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sillaginidae	*Sillago aeolus*	0.00	0.00	6.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sillaginidae	*Sillago sihama*	0.00	0.00	0.00	6.66	0.00	0.00	0.00	0.00	0.00	0.00	103.00	0.00	220.37	47.09	57.80	63.31

Annex C2 Desnity of Fish Larave (number/1000m^3)

Family	Species	Dec				Jan				April				May			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Soleidae	*Solea ovata*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.23	0.00	0.00	15.25	0.00	0.00	0.00	0.00
Sphyraenidae	*Sphyraena pinguis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	149.55	118.72	0.00	0.00
Sphyraenidae	*Sphyraenidae sp.1*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.01	0.00	0.00	120.89
Tetraodontidae	*Takifugu poecilonotus*	0.00	0.00	0.00	0.00	0.00	7.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triglidae	*Triglidae sp.*	0.00	0.00	0.00	0.00	0.00	6.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tripterygiidae	*Tripterygiidae sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.48	0.00	0.00	0.00	42.18	0.00	0.00	0.00
Mullidae	*Upeneus japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	10.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mugilidae	*Valamugil cunnesius*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	428.42	781.95	268.38	90.57

Annex C3 Density of Fish Egg (number/m^3)

Family	Species	Dec				Jan				April				May			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Pomacentridae	*Abudefduf vaigiensis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sparidae	*Acanthopagrus pacificus*	0.00	0.00	0.00	0.00	15.87	22.97	10.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sparidae	*Acanthopagrus schlegelii*	226.95	156.77	259.62	170.38	0.00	0.00	0.00	0.00	7.48	0.00	0.00	10.83	0.00	0.00	0.00	0.00
Gobiidae	*Amblychaeturichthys hexanema*	0.00	0.00	0.00	0.00	0.00	0.00	50.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bothidae	*Arnoglossus polyspilus*	0.00	0.00	0.00	0.00	0.00	6.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soleidae	*Aseraggodes sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.31	0.00
Callionymidae	*Bathycallionymus kaianus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Callionymidae	*Callionymus curvicornis*	21.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mugilidae	*Crenimugil crenilabis*	0.00	0.00	0.00	0.00	0.00	0.00	16.82	46.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carangidae	*Decapterus macrosoma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1610.26	0.00
Haemulidae	*Diagramma pictum*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8537.95	3997.50	12296.05	4051.92
Engraulidae	*Encrasicholina punctifer*	0.00	0.00	0.00	0.00	0.00	0.00	8.41	0.00	1783.01	928.71	2525.33	1024.32	12761.15	9368.46	4487.63	9528.34
Serranidae	*Epinephelus sexfasciatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	768.71	0.00	0.00	0.00	0.00
Percidae	*Etheostoma uniporum*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.09	0.00	0.00	0.00	76.05	0.00	0.00	0.00
Sparidae	*Evynnis cardinalis*	0.00	0.00	0.00	0.00	20.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gerreidae	*Gerres oblongus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5638.06	0.00	0.00	0.00
Gerreidae	*Gerres oyena*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59109.49	44776.69	4592.22	0.00
Labridae	*Halichoeres nigrescens*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9060.11	4377.83	0.00	18688.52
Labridae	*Halichoeres tenuispinis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37698.36	1366.11	1635.74	1967.53	0.00	0.00	0.00	0.00
Aulopidae	*Hime japonica*	0.00	0.00	0.00	0.00	18.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Platycephalidae	*Inegocia japonica*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2536.91	1526.95	615.33	0.00	760.46	1332.38	0.00	0.00
Clupeidae	*Konosirus punctatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sciaenidae	*Larimichthys crocea*	65.06	126.86	19.50	6.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Moronidae	*Lateolabrax japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	134.05	6.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clupeidae	*Nematalosa japonica*	0.00	0.00	0.00	0.00	36.48	0.00	0.00	0.00	22.43	18.80	37.18	0.00	0.00	0.00	0.00	0.00
Clupeidae	*Nematalosa nasus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1922.63	1040.96	301.87	29435.81
Nemipteridae	*Nemipterus japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.66	0.00	0.00	0.00	0.00
Leiognathidae	*Nuchequula nuchalis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11678.83	7423.27	0.00	0.00
Sparidae	*Pagrus major*	0.00	0.00	0.00	0.00	0.00	0.00	16.82	106.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haemulidae	*Parapristipoma trilineatum*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	460.57	0.00	244.04	0.00	0.00	0.00	0.00
Pempheridae	*Pempheridae sp.*	0.00	0.00	0.00	0.00	15.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pempheridae	*Pempheris schwenkii*	95.27	27.85	6.50	38.83	0.00	8.72	0.00	0.00	28.09	0.00	0.00	0.00	100.68	774.68	354.16	472.10
Platycephalidae	*Platycephalidae sp.*	0.00	0.00	0.00	0.00	0.00	8.72	10.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paralichthyidae	*Pseudorhombus elevatus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	267.88	0.00	0.00	0.00	0.00
Scaridae	*Scarus ghobban*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	119.28	218.04
Scorpaenidae	*Scorpaenidae sp.*	0.00	0.00	0.00	0.00	15.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3013.89	0.00	0.00
Sillaginidae	*Sillago japonica*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9942.20	3843.39
Sillaginidae	*Sillago maculata*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	291.38	0.00	0.00	0.00	0.00	0.00	0.00
Sillaginidae	*Sillago sihama*	47.69	117.73	358.45	225.15	6.71	0.00	24.41	16.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sparidae	*Sparidae sp.*	0.00	0.00	0.00	0.00	18.24	6.94	18.55	7.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sphyraenidae	*Sphyraena pinguis*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1282.40	0.00	0.00	0.00	0.00	0.00
Labridae	*Stethojulis terina*	0.00	0.00	0.00	0.00	0.00	8.72	0.00	0.00	4283.49	2675.44	0.00	6821.48	5638.06	0.00	0.00	0.00
Platycephalidae	*Suggrundus sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1271.68	0.00
Synodontidae	*Synodontidae sp.*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.17	63.31	126.62
Synodontidae	*Synodus variegatus*	8.66	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Platycephalidae	*Thysanophrys celebica*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1088.28	99.94	59.64	230.32
Trichiuridae	*Trichiurus lepturus*	0.00	0.00	0.00	0.00	0.00	8.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mullidae	*Upeneus japonicus*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soleidae	*Zebrias zebra*	0.00	0.00	0.00	0.00	15.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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