

Indonesia Blue Swimming Crab Fishery Improvement Project

NON-TARGET SPECIES FIELD ASSESSMENT 2016

*Using the Marine Stewardship Council's Risk Based Framework for Data Limited Fisheries
using MSC's Productivity, Susceptibility Analysis*



REPORT AS OF DECEMBER 2016

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RESEARCH TEAM

1. Dr. Hawis Madduppa
2. Dr. Zairion
3. Indri Verawati, S.IK
4. Muhammad Sefri Khoirur Roziqin, S.Pi
5. Miftahul Khair, S.IK
6. Meilia Rusfayeni
7. Naila Khuril Aini

INTRODUCTION

The issues surrounding bycatch and discarding are amongst the most important facing the management of fisheries throughout the world. Considerable research over the past decade has shown that discarding can affect the yields of fisheries and the functioning of ecosystems (Fennessey 1994; Jennings and Kaiser 1998; Hall 1999; Kaiser and deGroot 2000). Consequently, much emphasis is being placed on reducing discarding in all types of fisheries. In developing strategies to manage discarding, it is fundamental to determine and define the real level of discarding and how it varies in space and time among different fishing operations (Alverson et al 1994; Kennelly 1995; Hall 1999). An understanding of the behavior and selectivity of fishing gears and the species captured can help ascertain ways to mitigate discarding (Hall 1999; Broadhurst 2000). Such information has been successfully used to reduce discarding and wastage in some fisheries (see Hall 1999; Broadhurst 2000; Kaiser and deGroot 2000).

The objectives of the field survey of non target species (bycatch) using the the Marine Stewardship Council's (MSC) Risk Based Framework (RBF) for data limited fisheries are threefold

1. To identify all non-target species (NTS) that are **potentially** at risk of being impacted negatively by a blue swimming crab fishery
2. To identify all non-target species (NTS) that are **at risk** of being impacted negatively by a blue swimming crab fishery, using MSC's P2 Default Decision Making Tree
3. To assess the **level of risk** for each **at risk** species using MSC's Productivity, Susceptibility Analysis

Non Target Species assessment research activities required an appropriate reference data collection, relevant and in accordance with scientific principles. So in this case we need a standard procedure data collection which is called Standard Operating Procedures (SOP). Outlined in the SOP regarding sampling technique and strategies in the collecting data related to Non target Species and stock assessment research. Sampling technique is one of the important things that are known and mastered by researches and technicians. Because the fish population is not uniform in space and time, so the strategy for sampling should be considered to avoid or minimize error.

Location for research Non Target Species Assessment are Rembang, Lancang Island (Seribu Island, Jakarta), and Madura. This research will be held for 20 days every location. Total boat are being recorded is 200 boat every gear.

DATA COLLECTION

1 Land Survey

Data was collected at three sampling sites: Jakarta, Rembang, and Madura (Figure 1). Sampling was conducted in blue swimming crab landings (fishing, container/traders and collectors/miniplan). In order to obtain continuous data then will be appointed enumerators at a certain location and given a brief training regarding the collection of data required.

Sampling is mainly carried out on catches obtain ship/boat catcher who use fishing gear traps (bubu), and trammel net and etc.

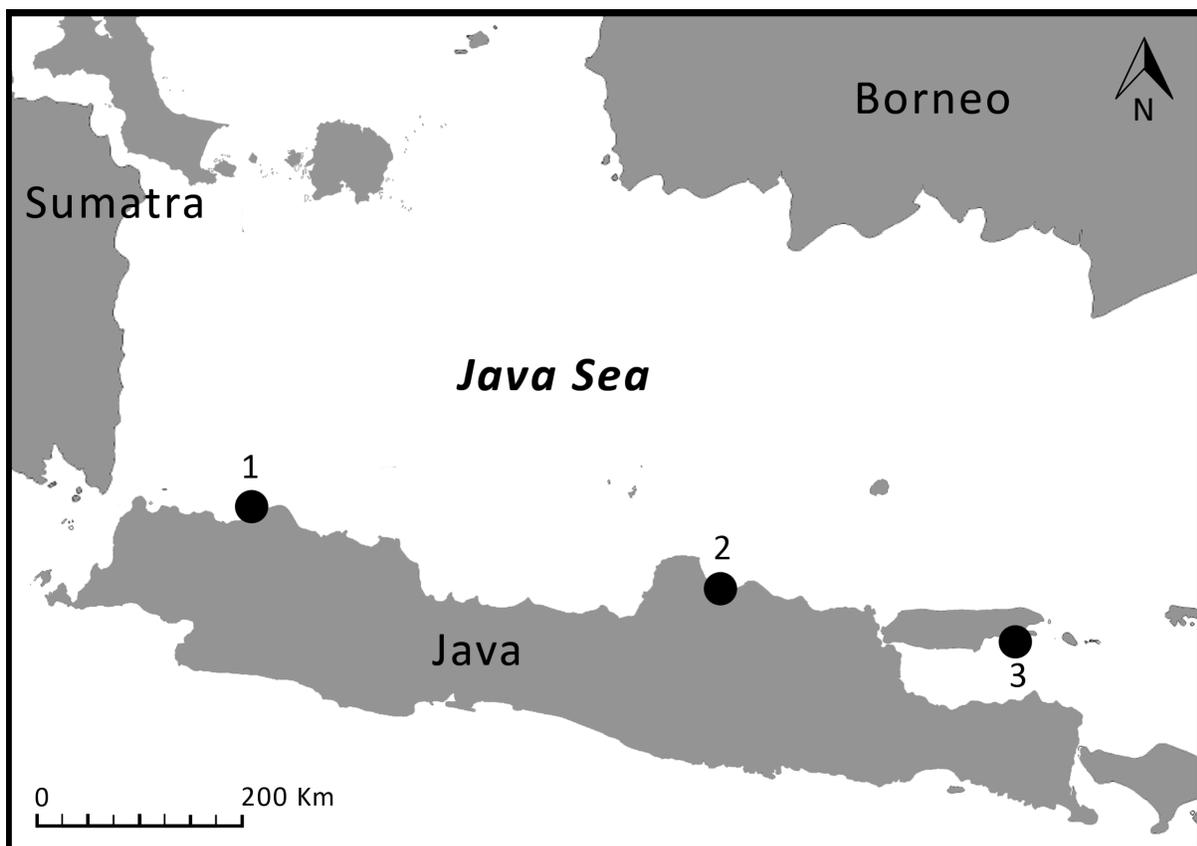


Figure 1. Sampling site for BSC research activities in Java sea (1: Jakarta, 2: Rembang, 3: Pamekasan) over period May to November 2016

1.1 Data Collection Catch

The data production collected from the records collectors. Based on the records obtained data on catches per trip (kg) per gear, the number of trips, total catches in every day and every month. The composition of the catch, recorded directly from the catch landed by fishermen.

1.2 Data Collection Bycatch

The data bycatch collected from the record collectors. Based on the records obtained data catches per trip (kg) for *Portunus pelagicus* and other catches per gear, the number of trips, total bycatch, conduct a rapid appraisal (assessment) of the NTS found in the catch of the selected gear type, Code each NTS using a simple coding system, and categorise each NTS according to MSC's PS Default Decision Making Tree as either.

2.1 Sampling Non Target Species

In this study, we define the term 'byproduct' as the total retained crab bycatch, and the term 'total bycatch' refers to the sum of the total crab byproduct and the total discarded bycatch from commercial trap. The procedure of Non Target Species is the following Marine Stewardship Council's Risk Based Framework for Data Limited Fisheries. :

1. Select and define your BSC fishery based on

- Geographic area (i.e., bay, lagoon, estuary, sea)
- Administrative area (divisions, districts, provinces)
- Fishing villages / landing centres
- No of boats with types of gear (note you are going to have to do a Field Assessment for each type of gear, as the bycatch will be different for traps and crab nets)

2. Select location and gear type

3. Organise a short 45 minute discussion with BSC fishermen in the village / landing centre to explain

- What you are going to do (non target species assessment);
- How you are going to do it (counting and weighing the retained and discarded bycatch) and

- Why you are going to do it (to assess the ecological impact of the fishery in non target species)
- Distribute an A5 Information flyer (See Annex A) (Appendix 1)
- Ask for their help in conducting the study

4. Spend a day or two in the target village and conduct a rapid appraisal (assessment) of the NTS found in the catch of the selected gear type

- Photograph each NTS several times, from several angles
- Write down the local name(s) for each NTS against each Code
- Code each NTS using a simple coding system e.g.,
 - F = Fish
 - C = Crustacean
 - M = Mollusc
 - E = Echinoderms
 - = Other
- Once you get back home, categorize each NTS according to MSC's PS Default Decision Making Tree as either
 - ETP = Endangered, Threatened or Protected
 - OS = Out of Scope Species (*i.e.*, not fish but not ETP either)
 - Primary = Managed species with Target Reference Points for the fishery
 - Secondary = unmanaged species
- Most if not all of your NTS will be Secondary NTS
- If you think that two NTS are similar but are different species, give each one a separate Code at the start. You can always add Codes together later, if you decide or discover that they are the same species. But you can't separate species later if you have given two species the same Code.

5. Then make and print a Field Guide to Non Target Species for your field researchers

- One sheet of A4 or A5 for each NTS, with photographs, identifying features and the NTS Code clearly marked
- The English name is optional, you don't need to do this at this stage, but as your students are likely to be scientists, it will be difficult to stop them.....

- Don't waste time identifying species at this stage. You may have 50 NTS, but it is unlikely that more than five (5) will be present in the bycatch above the RBF Threshold for Secondary Species of >2%.
- All NTS with a frequency of <2% - even if they are less resilient - are classed as Secondary Minor Species, which you don't need to assess (unless you want to)

6. Field Data Collection I – Pre Departure

One field data collection team should consist of two people. Either two students or one student and a local assistant.

- Each Field Data Collection Team should aim to assess the bycatch (NTS) of 10 to 15 boats per day. Don't try to do more than this. It must be done quickly, without delays to the fishermen's work
- Field Equipment needed includes
 - Two plastic trays per boat (e.g., 10 boats = 20 trays. Ideally two colours)
 - Field Data Collection Sheet (Annex B) (Appendix 2)
 - Clipboard and Pen
 - Electronic Kitchen Weighing Scales
 - Sun Hats
 - Sun Cream

7. Field Data Collection II – Start of the Day

- At the start of each day the team will give two plastic trays to each boat, as it returns to the landing centre.
- The Field Team will write down the name of the fishermen on a Field Data Collection Sheet (Annex A): one for each boat
- The teams will ask fishermen to put all the RETAINED bycatch in one plastic tray (e.g., Blue Tray) and all DISCARDED bycatch in the other plastic tray (e.g., Yellow Plastic Tray)
- RETAINED bycatch is any species other than BSC that is either sold or taken home to be eaten or dried
- DISCARDED bycatch is any species other than BSC that is simply thrown away

8. Field Data Collection III – Data Collection

- The Field Data Collection Team should move up and down the beach / landing centre removing RETAINED non target species from the RETAINED bycatch tray, as the fishermen remove them from the traps / nets.
- Each NTS should be identified by its Code, the number of individuals should be counted and the total weight of all the individuals of the species should be recorded.
- The Field Team will need to move from boat to boat identifying and weighing and counting RETAINED NTS because these species will be either sold or taken home quickly by fishermen or their families.
- Once all the RETAINED NTS trays are empty, then the Field Team can start to identify (by Code), count and weigh each NTS in the DISCARD trays.
- Once the DISCARDED trays have been emptied for all boats, then the Field Team will go to the Collection Centre and record the total weight of BSC landed by each boat, according to the fishermen's name
- The total weight of BSC will be the last piece of information recorded on each Field Data Collection Sheet.

9. Field Data Collection IV – End of the Day

- Pack up all the field equipment, clip the datasheets

10. Field Data Analysis I – Compile the Daily Data Sheet from the Individual Boat / Catch Data Sheets and enter Daily Data into the Excel Workbook at the end of each day

- Transfer the BSC data from Field Data Sheet for each boat to a Daily Field Data Sheet (Annex C) (Appendix 3)
- Transfer the NTS data from Field Data Sheet for each boat to a Daily Field Data Sheet (Annex C)
- Enter the weight of BSC caught by each boat into the BSC Worksheet in the NTS Field Assessment Excel Workbook (Annex D) (Appendix 4)
- Enter the number of each NTS and the weight of each NTS into the RETAINED Worksheets and the DISCARDED Worksheet in the NTS Field Assessment

11. Repeat Steps 7 – 10 until the catches of 150 – 200 boats have been

- 150 – 200 samples is more than enough. If you collect less than 100 someone is always going to say you haven't sampled enough. If you sample more than 200 you are wasting your time collecting more of the same data
- Eventually you need to collect this data from several locations in the fishery an ideally at different times of the year. The bycatch may change throughout the year and the percent of bycatch will be different during the peak fishing season (lower) and the offseason (higher), but all that is for later.
- First survey one village and one gear type in a village and work through the results

12. At the end of your field survey the Excel Workbook should look something like the image overleaf

- What you need to do then is use the Categories and the % of the Total Catch to work out which NTS need to be assessed using MSC's Risk Based Framework
- **Not all NTS species need to be assessed!!!**
- **All ETP** need to be assessed using the Productivity Susceptibility Analysis (PSA)
- **All OS** need to be assessed using the PSA
- **Less Resilient Primary species \geq 2%** of the total catch need to be assessed using the PSA
- **Resilient Primary species \geq 5%** of the total catch need to be assessed using the PSA
- **Less Resilient Secondary species \geq 2%** of the total catch need to be assessed using the PSA
- **Resilient Secondary species \geq 5%** of the total catch need to be assessed using the PSA
- For now you don't have to worry about Resilience, just identify all Primary and Secondary species above 2% of the total catch.

13. Field Data Analysis II – Use the Excel Workbook to identify the Codes of each NTS that is at risk, according to the MSC's P2 Default Decision Tree for the Risk Based Framework

- Now you should be able to identify the Codes (NTS) that you need to identify to the genus / species level. Up to this point in the survey you **DON'T** need to know the scientific names of the bycatch, you can just work with Codes.

- If you are not able to identify any one ETP or OS or Primary ($\geq 2\%$) or Secondary ($\geq 2\%$) then you need to take more pictures and or collect samples to analyse in the university, before you head home.
- What you should have is a much shorter list of Codes / Local Names / Genus / Species for the NTS that are might be at risk of negative ecological impacts, due to the BSC fishery, based on MSC's P2 Default Decision Tree.
- In one of the Indonesian fisheries the list of Codes / Local Names / Genus / Species for the NTS that may be at risk from ecological impacts looked like this. Only five NTS out of 84 might be at risk of negative ecological impacts, due to the BSC fishery, based on MSC's P2 Default Decision Tree.
- All the other NTS were Secondary species, occurring at $< 2\%$, which means even if they are LESS RESILIENT species, they are considered by MSC to be Secondary Minor species so we can forget about them.

14. Identifying Main and Minor NTS

- Last task before you start on the Productivity Susceptibility Analysis (PSA)
- Any Primary or Secondary NTS with a frequency of $> 5\%$ of the Total Catch is a Main NTS. In the example above M08 and F11 are Secondary Main species. All main species must be assessed using the PSA, to investigate the risk of negative ecological impact from the BSC fishery (this is what Hannah did with her examples in the workshop)
- Any Primary or Secondary NTS with a frequency of $> 2\%$ but $< 5\%$ of the Total Catch need to be assessed for RESILIENCE (to fishing mortality). Less resilient species are slow growing, have low fecundity, high size / age on maturity and or restricted distribution (e.g., endemic species). In the example above F08 and C14 both occur in the catch at $> 2\%$ but $< 5\%$.
- Stingrays (F08) are less resilient species, therefore F08 is a Secondary Main species and needs to be assessed using the PSA.
- Mud crabs (C14) are resilient species, therefore C14 is a Secondary Minor species, which you don't need to assess.
- All Out of Scope NTS must be assessed using the PSA.
- The final list of NTS that may be at risk of negative ecological impacts from the BSC (in this Sri Lankan example) are as follows.

15. Productivity & Susceptibility Analysis

- To conduct a PSA analysis on each of the ETP / OS / MAIN non target species identified by your field assessment survey, using the two tables shown overleaf. These are based on the MSC tables, but they are much prettier.
- Then you simply punch the results into the MSC Risk Based Framework Workbook 2.0 (Annex E) and it will automatically generated an MSC PSA Score for each species and an overall assessment for the fishery's MSC for impact on non target species.

RESULTS

Rembang

I. Description of the Target Species

Species Type	Invertebrate
Subphylum	Crustacea
Family Name	Portunidae
Scientific Name	<i>Scylla serrata</i>
Common Name	Mud Crab

II. Target Species Productivity Susceptibility Score using [MSC's Risk Based Framework](#) (see Table 1 and Table 2 for details)

Productivity Attributes	Score
Average Age at Maturity	1
Average Maximum Age	1
Fecundity	1
Average Maximum Size	
Average Size at Maturity	
Reproductive Strategy	3
Trophic Level	3
Density Dependence	3
Total Productivity (Average)	2.00

Susceptibility Attributes	Score
Availability	2
Encounter-ability	2
Selectivity	3
Post Capture Mortality	3
Total (Multiplicative)	1.88

PSA Score = 2.74

MSC PSA Derived Score = 80

MSC Risk Category Name = Low

MSC Scoring Guidepost = ≥ 80

Mud Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <small>not to be used when scoring invertebrates</small>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <small>not to be used when scoring invertebrate</small>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <small>(to be used when scoring invertebrate species only)</small>	Compensatory dynamics at low population size demonstrated or likely	No dependatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Total Score
Productivity Score (Average)

Mud Crab	Verification	Score
1 year	http://www.sms.si.edu/irlspec/Scylla_serrata.htm	1
3 years	http://www.sea-ex.com/fishphotos/crab,mud.htm	1
1 – 6 millions eggs in a single spawning	http://www.fao.org/fishery/culturedspecies/Scylla_serrata/en	1
N/A		--
N/A		--
Guarders / Brood hiders	http://www.sea-ex.com/fishphotos/crab,mud.htm	3
No Data	http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A208814	3
No data on density dependence	No Verification	3

12
2.00

Mud Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3
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Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)

Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
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No Data	http://eol.org/pages/1038449/details	2
1-26 m depth range	http://eol.org/pages/1038449/details	2
No Data		3
No Data		
99.7% Retained	See Table	3

Total Score
Susceptibility Score (Multiplicative)

10
1.88

Sheep Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No depensatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Total Score

Productivity Score (Average)

Sheep Crab	Verification	Score
No Data	Based of Max Age	1
4 years	status2003sheepcrabs.pdf	1
125,000-500,000 eggs	https://www.montereybayaquarium.org/animal-guide/invertebrates/sheep-crab	1
N/A		--
N/A		--
Bearers	http://www.sealifebase.org/summary/Loxorhynchus-grandis.html	3
No Data	http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A441602	3
No data on density dependence	No Verification	3

12

2.00

Sheep Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3
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Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)

Total Score
Susceptibility Score (Multiplicative)

Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
------------------------	-----------------------	----------------------

No Data		3
No Data		3
No Data		3
No Data		
49.3% Retained	See Table	2

11
2.33

I. Description of the Target Species

Species Type Invertebrate
Subphylum Mollusca
Family Name Buccinidae
Scientific Name *Babylonia spirata*
Common Name Spiral Babylon

**II. Target Species Productivity Susceptibility Score using MSC's Risk Based Framework
 (see Table 1 and Table 2 for details)**

Productivity Attributes	Score
Average Age at Maturity	1
Average Maximum Age	1
Fecundity	1
Average Maximum Size	
Average Size at Maturity	
Reproductive Strategy	1
Trophic Level	1
Density Dependence	3
Total Productivity (Average)	1.33

Susceptibility Attributes	Score
Availability	3
Encounter-ability	3
Selectivity	3
Post Capture Mortality	3
Total (Multiplicative)	3.00

PSA Score = 3.28

MSC PSA Derived Score = 65

MSC Risk Category Name = Med

MSC Scoring Guidepost = 60-79

Spiral Babylon - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No depensatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Total Score
Productivity Score (Average)

Spiral Babylon	Verification	Score
		1
3-4 years	reference\babylonia.pdf	1
41,985 eggs	reference\bernandis(2001)babylonia.pdf	1
N/A		--
N/A		--
Spawner	http://www.sealifebase.org/summary/Babylonia-spirata.html	1
1	reference\Collapse Appendix.pdf	1
No data on density dependence	No Verification	3

8
1.33

Spiral Babylon - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3
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Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)

Total Score

Susceptibility Score (Multiplicative)

Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
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No Data	http://www.sealifebase.org/summary/Babylonia-spirata.html	3
No Data	http://www.sealifebase.org/summary/Babylonia-spirata.html	3
No Data		3
No Data		
100% Retained	See Table	3

12

3.00

Whelk - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No depensatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Whelk	Verification	Score
No Data		1
No Data		1
No Data		1
N/A		--
N/A		--
Broadcast Spawner	http://www.sealifebase.org/summary/Latisipho-hallii.html	1
		1
No data on density dependence	No Verification	3

Total Score

8

Productivity Score (Average)

1.33

Whelk - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3	Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap	No Data	http://www.sealifebase.org/summary/Latisiphohallii.html	3
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)	No Data	http://www.sealifebase.org/summary/Latisiphohallii.html	3
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught	No Data		3
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear	No Data		
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)	84.96% Retained	See Table	3
Total Score						12
Susceptibility Score (Multiplicative)						3.00

Lancang

I. Description of the Target Species

Species Type	Invertebrate
Subphylum	Crustacea
Family Name	Goneplacidae
Scientific Name	<i>Carcinoplax vestita</i>
Common Name	Crab

II. Target Species Productivity Susceptibility Score using [MSC's Risk Based Framework](#) (see Table 1 and Table 2 for details)

Productivity Attributes	Score
Average Age at Maturity	1
Average Maximum Age	1
Fecundity	1
Average Maximum Size	
Average Size at Maturity	
Reproductive Strategy	3
Trophic Level	3
Density Dependence	3
Total Productivity (Average)	2.00

Susceptibility Attributes	Score
Availability	2
Encounter-ability	2
Selectivity	3
Post Capture Mortality	1
Total (Multiplicative)	1.28

PSA Score = 2.37

MSC PSA Derived Score = 89

MSC Risk Category Name = Low

MSC Scoring Guidepost = ≥80

Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No densapatory or compensatory dynamics demonstrated or likely	Densapatory dynamics at low population sizes (Allee effects) demonstrated or likely

Total Score

Productivity Score (Average)

Crab	Verification	Score
No Data		1
No Data		1
7,800-57,000 eggs	https://www.montereybayaquarium.org/animal-guide/invertebrates/sheep-crab	1
N/A		--
N/A		--
Bearers	http://www.sealifebase.org/	3
No Data	http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A441602	3
No data on density dependence	No Verification	3

12

2.00

Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3	Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap	No Data		2
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)	No Data		2
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught	No Data		3
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear	No Data		
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)	0% Retained	See Table	1
Total Score						8
Susceptibility Score (Multiplicative)						1.28

Pamekasan

I. Description of the Target Species

Species Type	Invertebrate
Subphylum	Crustacea
Family Name	Majidae
Scientific Name	<i>Loxorhynchus grandis</i>
Common Name	Sheep Crab

II. Target Species Productivity Susceptibility Score using [MSC's Risk Based Framework](#)

(see Table 1 and Table 2 for details)

Productivity Attributes	Score
Average Age at Maturity	1
Average Maximum Age	1
Fecundity	1
Average Maximum Size	
Average Size at Maturity	
Reproductive Strategy	3
Trophic Level	3
Density Dependence	3
Total Productivity (Average)	2.00

Susceptibility Attributes	Score
Availability	3
Encounter-ability	3
Selectivity	3
Post Capture Mortality	1
Total (Multiplicative)	1.65

PSA Score = 2.59

MSC PSA Derived Score = 84

MSC Risk Category Name = Low

MSC Scoring Guidepost = ≥ 80

Sheep Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No dependatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Sheep Crab	Verification	Score
No Data	Based of Max Age	1
4 years	status2003sheepcrabs.pdf	1
125,000-500,000 eggs	https://www.montereybayaquarium.org/animal-guide/invertebrates/sheep-crab	1
N/A		--
N/A		--
Bearers	http://www.sealifebase.org/summary/Loxorhynchus-grandis.html	3
No Data	http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A441602	3
No data on density dependence	No Verification	3

Total Score
Productivity Score (Average)

12
2.00

Sheep Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3
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Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)

Total Score
Susceptibility Score (Multiplicative)

Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
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No Data		3
No Data		3
No Data		3
No Data		
0% Retained	See Table	1

11
1.65

Hermit Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No depensatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Hermit Crab	Verification	Score
No Data		1
20-62 month	reference\Bronco(2002)hermitcrab.pdf	1
637.1 ± 762.7 eggs	http://www.ingentaconnect.com/content/umrsmas/bullmar/1999/00000064/0000002/art00008?crawler=true	2
N/A		--
N/A		--
Bearers	http://www.sealifebase.org/	3
No Data	http://www.sealifebase.org/	3
No data on density dependence	No Verification	3

Total Score
Productivity Score (Average)

13
2.17

Hermit Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3	Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap	No Data		3
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)	No Data		3
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught	No Data		3
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear	No Data		
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)	08% Retained	See Table	1
Total Score						10
Susceptibility Score (Multiplicative)						1.65

I. Description of the Target Species

Species Type Invertebrate
Subphylum Chelicerata
Family Name Limulidae
Scientific Name *Carcinoscorpius rotundicauda*
Common Name Horseshoe Crab

**II. Target Species Productivity Susceptibility Score using MSC’s Risk Based Framework
 (see Table 1 and Table 2 for details)**

Productivity Attributes	Score
Average Age at Maturity	2
Average Maximum Age	3
Fecundity	1
Average Maximum Size	
Average Size at Maturity	
Reproductive Strategy	1
Trophic Level	3
Density Dependence	3
Total Productivity (Average)	2.17

Susceptibility Attributes	Score
Availability	1
Encounter-ability	1
Selectivity	3
Post Capture Mortality	3
Total (Multiplicative)	1.20

PSA Score = 2.48

MSC PSA Derived Score = 87

MSC Risk Category Name = Low

MSC Scoring Guidepost = ≥80

Horseshoe Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1	Horseshoe Crab	Verification	Score
Average Age at Maturity	>15 years	5-15 years	<5 years	10 years	http://horseshoecrab.org/nh/life.html#	2
Average Max Age (Tmax)	>25 years	10-25 years	<10 years			3
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year	80,000 eggs	http://horseshoecrab.org/nh/spawn.html	1
Average Max Size (TL) <small>not to be used when scoring invertebrates</small>	>300 cm	100-300 cm	<100 cm	N/A		--
Average Size at Maturity <small>not to be used when scoring invertebrate</small>	>200 cm	40-200 cm	<40 cm	N/A		--
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner	Spawner	http://horseshoecrab.org/nh/spawn.html	1
Trophic Level	>3.25	2.75-3.25	<2.75	No Data	http://www.gbif.org/species/113222504	3
Density dependence * <small>(to be used when scoring invertebrate species only)</small>	Compensatory dynamics at low population size demonstrated or likely	No densapatory or compensatory dynamics demonstrated or likely	Densapatory dynamics at low population sizes (Allee effects) demonstrated or likely	No data on density dependence	No Verification	3
Total Score						13
Productivity Score (Average)						2.17

References

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| <p>Anand & Soundarapandian 2011
Dineshababu <i>et al.</i>, 2008
Ehsan, K <i>et al</i> 2010
Potter & de Lestang 2000
Sukumaran & Neelakantan 1996

Zacherai, P. U</p> | <p>Sea ranching of commercially important blue swimming crab <i>Portunus pelagicus</i> (Linnaeus, 1758) in parangipettai coast.
Biology and exploitation of the blue swimmer crab, <i>Portunus pelagicus</i> (Linnaeus, 1758), from south Karnataka coast, India
Stock Assessment and Reproductive Biology of the Blue Swimming Crab, <i>Portunus pelagicus</i> in Bandar Abbas Coastal Waters, Northern Persian Gulf
Biology of the blue swimmer crab <i>Portunus pelagicus</i> in Leschenault Estuary and Koombana Bay, south-western Australia
Mortality and stock assessment of two marine portunid crabs, <i>Portunus</i> (<i>Portunus</i>) <i>sanguinolentus</i> (Herbst) and <i>Portunus</i> (<i>Portunus</i>) <i>pelagicus</i> (Linnaeus) along the southwest coast of India
Trophic Levels and Food Chains, CMFRI Cochi, Kerala, India</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Horseshoe Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3
Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)

Total Score
Susceptibility Score (Multiplicative)

Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
No Data	http://horseshoecrab.org/nh/habitat.html	1
No Data	http://horseshoecrab.org/nh/habitat.html	1
No Data		3
No Data		
86.3% Retained	See Table	3

8
1.20

Three-spot Swimming Crab - productivity attributes, rankings and score

Productivity Attributes	Low Productivity Score = 3	Moderate Productivity Score = 2	High Productivity Score = 1
Average Age at Maturity	>15 years	5-15 years	<5 years
Average Max Age (Tmax)	>25 years	10-25 years	<10 years
Fecundity	<100 eggs per year	100-20,000 eggs per year	>20,000 eggs per year
Average Max Size (TL) <i>not to be used when scoring invertebrates</i>	>300 cm	100-300 cm	<100 cm
Average Size at Maturity <i>not to be used when scoring invertebrate</i>	>200 cm	40-200 cm	<40 cm
Reproductive Strategy	Live bearer	Demersal egg layer	Broadcast Spawner
Trophic Level	>3.25	2.75-3.25	<2.75
Density dependence * <i>(to be used when scoring invertebrate species only)</i>	Compensatory dynamics at low population size demonstrated or likely	No compensatory or compensatory dynamics demonstrated or likely	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely

Three-spot Swimmig Crab	Verification	Score
6 months	reference\Dinesh(2007).pdf	1
2.5 years	reference\Dinesh(2007).pdf	1
1 millions	reference\Lee(2003)threespotcrab.pdf	1
N/A		--
N/A		--
Bearer	http://www.sealifebase.org/summary/P_ortunus-sanguinolentus.html	3
No Data	http://www.sealifebase.org/summary/P_ortunus-sanguinolentus.html	3
No data on density dependence	No Verification	3

Total Score
Productivity Score (Average)

12
2.00

Three-spot Swimming Crab - susceptibility attributes, rankings and score

Susceptibility Attributes	Low Susceptibility Score = 1	Moderate Susceptibility Score = 2	High Susceptibility Score = 3	Indonesian BSC Fishery	Means of Verification	Indonesian BSC Score
Areal overlap (availability) <i>Overlap of the fishing effort with a species concentration of the stock</i>	<10% overlap	10% - 30% overlap	>30% overlap	No Data	http://www.sealifebase.org/summary/Portunus-sanguinolentus.html	3
Encounter ability <i>The position of the stock/species within the water column relative to the fishing gear, and the position of the stock/species within the habitat relative to the position of the gear</i>	Low overlap with fishing gear (low encounterability)	Medium overlap with fishing gear	High overlap with fishing gear (high encounter ability) Default score for target species (P1)	No Data	http://www.sealifebase.org/summary/Portunus-sanguinolentus.html	3
Selectivity of gear type <i>Potential of the gear to retain species</i>	a. Individuals < size at maturity are rarely caught	a. Individuals < size at maturity are regularly caught	a. Individuals < size at maturity are frequently caught	No Data		3
	b. Individuals < size at maturity can escape or avoid gear	b. Individuals < half the size at maturity can escape or avoid gear	b. Individuals < half the size at maturity are retained by gear	No Data		
Post Capture Mortality <i>The chance that, if captured, a species would be released and that it would be in a condition permitting subsequent survival</i>	Evidence of majority released post-capture and survival	Evidence of some released post-capture and survival	Retained species or majority dead when released Default score for retained species (P1 or P2)	100% Retained	See Table	3
Total Score						12
Susceptibility Score (Multiplicative)						3.00

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APPENDIX

Appendix 1. Catch percentage of target species (BSC) and bycatch from Lancang, Rembang and Pamekasan

Data Lancang

		% Total Catch
Total Weight of BSC Catch	458.90 kg	87%
Total Weight of Retained Bycatch	7.97 kg	2%
Total Weight of Discarded Bycatch	61.02 kg	12%
Total Non Target Species	68.99 kg	13%
Total Catch	527.89 kg	

SLN	RBF Category	Retained		Discarded		Total			RBF Threshold	Actual % Catch	RBF
		No.	kg	No.	kg	No.	kg	Av. Kg			
F2	Secondary	-	-	1.00	0.05	1.0	0.1	0.050	≥2%	0.01%	M
F3	Secondary	-	-	34.00	2.41	34.0	2.4	0.071	≥2%	0.46%	M
F4	Secondary	20.00	1.94	30.00	1.54	50.0	3.5	0.070	≥2%	0.66%	M
F5	Secondary	-	-	3.00	0.11	3.0	0.1	0.037	≥2%	0.02%	M
F7	Secondary	-	-	19.00	0.50	19.0	0.5	0.026	≥2%	0.09%	M
F11	Secondary	-	-	1.00	0.03	1.0	0.0	0.030	≥2%	0.01%	M
F12	Secondary	-	-	2.00	0.09	2.0	0.1	0.045	≥2%	0.02%	M
F13	Secondary	-	-	2.00	0.13	2.0	0.1	0.065	≥2%	0.02%	M

F14	Secondary	-	-	4.00	0.11	4.0	0.1	0.028	≥2%	0.02%	M
F17	Secondary	-	-	2.00	0.18	2.0	0.2	0.090	≥2%	0.03%	M
F27	Secondary	-	-	22.00	0.77	22.0	0.8	0.035	≥2%	0.15%	M
F28	Secondary	8.00	1.08	10.00	0.90	18.0	2.0	0.110	≥2%	0.38%	M
F29	Secondary	-	-	27.00	1.02	27.0	1.0	0.038	≥2%	0.19%	M
F30	Secondary	-	-	3.00	0.08	3.0	0.1	0.027	≥2%	0.02%	M
F31	Secondary	-	-	3.00	0.20	3.0	0.2	0.067	≥2%	0.04%	M
F32	Secondary	1.00	0.04	1.00	0.04	2.0	0.1	0.040	≥2%	0.02%	M
F33	Secondary	1.00	0.05	4.00	0.24	5.0	0.3	0.058	≥2%	0.05%	M
F34	Secondary	1.00	0.14	-	-	1.0	0.1	0.140	≥2%	0.03%	M
F35	Secondary	-	-	4.00	0.15	4.0	0.2	0.038	≥2%	0.03%	M
F36	Secondary	-	-	2.00	0.03	2.0	0.0	0.015	≥2%	0.01%	M
F37	Secondary	-	-	12.00	0.15	12.0	0.2	0.013	≥2%	0.03%	M
C1	Secondary	1.02	1.02	5.00	0.18	6.0	1.2	0.199	≥2%	0.23%	M
C2	Secondary	-	-	88.00	8.41	88.0	8.4	0.096	≥2%	1.59%	M
C3	Secondary	-	-	163.00	11.67	163.0	11.7	0.072	≥2%	2.21%	M
C4	Secondary	3.00	1.12	27.00	0.87	30.0	2.0	0.066	≥2%	0.38%	M
C5	Secondary	-	-	28.00	0.38	28.0	0.4	0.014	≥2%	0.07%	M
C7	Secondary	-	-	305.00	9.95	305.0	10.0	0.033	≥2%	1.88%	M
C9	Secondary	-	-	18.00	1.66	18.0	1.7	0.092	≥2%	0.31%	M
C10	Secondary	7.00	0.38	188.00	7.01	195.0	7.4	0.038	≥2%	1.40%	M
C13	Secondary	-	-	99.00	4.57	99.0	4.6	0.046	≥2%	0.87%	M
C15	Secondary	-	-	7.00	0.25	7.0	0.3	0.036	≥2%	0.05%	M
C16	Secondary	-	-	10.00	0.36	10.0	0.4	0.036	≥2%	0.07%	M
C17	Secondary	-	-	41.00	3.09	41.0	3.1	0.075	≥2%	0.59%	M
C18	Secondary	-	-	2.00	0.19	2.0	0.2	0.095	≥2%	0.04%	M
C19	Secondary	-	-	1.00	0.04	1.0	0.0	0.040	≥2%	0.01%	M
C21	Secondary	-	-	5.00	0.13	5.0	0.1	0.026	≥2%	0.02%	M
C22	Secondary	-	-	3.00	0.14	3.0	0.1	0.047	≥2%	0.03%	M
M1	Secondary	-	-	4.00	0.05	4.0	0.1	0.013	≥2%	0.01%	M
M2	Secondary	-	-	76.00	0.66	76.0	0.7	0.009	≥2%	0.13%	M
M3	Secondary	5.00	2.10	6.00	0.18	11.0	2.3	0.207	≥2%	0.43%	M

M4	Secondary	-	-	2.00	0.08	2.0	0.1	0.040	≥2%	0.02%	M
M5	Secondary	1.00	0.10	6.00	0.58	7.0	0.7	0.097	≥2%	0.13%	M
M6	Secondary	-	-	1.00	0.41	1.0	0.4	0.410	≥2%	0.08%	M
M7	Secondary	-	-	2.00	0.18	2.0	0.2	0.090	≥2%	0.03%	M
M8	Secondary	-	-	4.00	0.09	4.0	0.1	0.023	≥2%	0.02%	M
E1	Secondary	-	-	17.00	0.79	17.0	0.8	0.046	≥2%	0.15%	M
E2	Secondary	-	-	5.00	0.19	5.0	0.2	0.038	≥2%	0.04%	M
E4	Secondary	-	-	1.00	0.04	1.0	0.0	0.040	≥2%	0.01%	M
O1	Secondary	-	-	60.00	0.14	60.0	0.1	0.002	≥2%	0.03%	M

Data Rembang

			% Total Catch	
Total Weight of BSC Catch	940.20	kg	76%	
Total Weight of Retained Bycatch	265.66	kg	21%	
Total Weight of Discarded Bycatch	36.77	kg	3%	
Total Non Target Species	302.43	kg	24%	
Total Catch	1,242.63	kg		

SLN	RBF Category	Retained		Discarded		Total			RBF Threshold	Actual % Catch	RBF
		No.	kg	No.	kg	No.	kg	Av. Kg			
F1	Secondary	71.00	9.18	1.00	0.08	72.0	9.3	0.129	≥2%	0.75%	M
F2	Secondary	18.00	1.15	-	-	18.0	1.2	0.064	≥2%	0.09%	M
F3	Secondary	6.00	1.22	2.00	0.12	8.0	1.3	0.168	≥2%	0.11%	M
F4	Secondary	33.00	3.70	4.00	0.33	37.0	4.0	0.109	≥2%	0.32%	M

F5	Secondary	5.00	0.45	1.00	0.07	6.0	0.5	0.087	≥2%	0.04%	M
F6	Secondary	1.00	0.30	-	-	1.0	0.3	0.300	≥2%	0.02%	M
F7	Secondary	4.00	0.30	1.00	0.11	5.0	0.4	0.082	≥2%	0.03%	M
F8	Secondary	5.00	0.52	-	-	5.0	0.5	0.104	≥2%	0.04%	M
F9	Secondary	1.00	0.22	-	-	1.0	0.2	0.220	≥2%	0.02%	M
F10	Secondary	-	-	2.00	0.07	2.0	0.1	0.036	≥2%	0.01%	M
F11	Secondary	37.00	2.58	-	-	37.0	2.6	0.070	≥2%	0.21%	M
F12	Secondary	29.00	6.98	1.00	0.34	30.0	7.3	0.244	≥2%	0.59%	M
F13	Secondary	4.00	0.29	-	-	4.0	0.3	0.073	≥2%	0.02%	M
F14	Secondary	4.00	0.18	1.00	0.04	5.0	0.2	0.043	≥2%	0.02%	M
F15	Secondary	4.00	1.00	-	-	4.0	1.0	0.250	≥2%	0.08%	M
F16	Secondary	3.00	0.29	1.00	0.12	4.0	0.4	0.102	≥2%	0.03%	M
F17	Secondary	3.00	5.15	-	-	3.0	5.2	1.717	≥2%	0.41%	M
F18	Secondary	2.00	0.70	-	-	2.0	0.7	0.350	≥2%	0.06%	M
F19	Secondary	3.00	0.39	1.00	0.01	4.0	0.4	0.100	≥2%	0.03%	M
F20	Secondary	10.00	2.69	-	-	10.0	2.7	0.269	≥2%	0.22%	M
F21	Secondary	1.00	0.80	-	-	1.0	0.8	0.800	≥2%	0.06%	M
F22	Secondary	1.00	0.06	-	-	1.0	0.1	0.055	≥2%	0.00%	M
F23	Secondary	2.00	0.08	-	-	2.0	0.1	0.040	≥2%	0.01%	M
F24	Secondary	1.00	0.02	-	-	1.0	0.0	0.020	≥2%	0.00%	M
F25	Secondary	-	-	1.00	0.02	1.0	0.0	0.020	≥2%	0.00%	M
F26	Secondary	1.00	0.06	-	-	1.0	0.1	0.060	≥2%	0.00%	M
C1	Secondary	349.72	82.18	1.00	0.20	350.7	82.4	0.235	≥2%	6.63%	M
C2	Secondary	280.00	24.43	288.00	22.68	568.0	47.1	0.083	≥2%	3.79%	M
C3	Secondary	51.00	2.37	44.00	2.34	95.0	4.7	0.050	≥2%	0.38%	M
C4	Secondary	10.00	0.25	3.00	0.07	13.0	0.3	0.024	≥2%	0.03%	M
C5	Secondary	117.00	1.96	52.00	0.84	169.0	2.8	0.017	≥2%	0.23%	M
C6	Secondary	11.00	0.70	15.00	1.41	26.0	2.1	0.081	≥2%	0.17%	M
C7	Secondary	31.00	4.09	38.00	1.99	69.0	6.1	0.088	≥2%	0.49%	M
C8	Secondary	10.00	0.55	-	-	10.0	0.6	0.055	≥2%	0.04%	M
C9	Secondary	15.00	0.43	3.00	0.13	18.0	0.6	0.031	≥2%	0.05%	M
C10	Secondary	-	-	1.00	0.09	1.0	0.1	0.090	≥2%	0.01%	M

C11	Secondary	8.00	0.98	-	-	8.0	1.0	0.122	≥2%	0.08%	M
C12	Secondary	13.00	0.31	-	-	13.0	0.3	0.024	≥2%	0.03%	M
M1	Secondary	6,752.00	82.70	-	-	6,752.0	82.7	0.012	≥2%	6.66%	M
M2	Secondary	2,034.00	22.80	360.00	3.83	2,394.0	26.6	0.011	≥2%	2.14%	M
M3	Secondary	49.00	2.28	53.00	1.12	102.0	3.4	0.033	≥2%	0.27%	M
M4	Secondary	-	-	6.00	0.12	6.0	0.1	0.019	≥2%	0.01%	M
M5	Secondary	3.00	0.79	-	-	3.0	0.8	0.263	≥2%	0.06%	M
E1	Secondary	-	-	7.00	0.01	7.0	0.0	0.001	≥2%	0.00%	M
E2	Secondary	8.00	0.34	12.00	0.24	20.0	0.6	0.029	≥2%	0.05%	M
E3	Secondary	2.00	0.20	5.00	0.40	7.0	0.6	0.086	≥2%	0.05%	M
E4	Secondary	-	-	1.00	0.01	1.0	0.0	0.005	≥2%	0.00%	M

Data Pamekasan

		% Total Catch	
Total Weight of BSC Catch	172.83 kg	71%	
Total Weight of Retained Bycatch	37.40 kg	15%	
Total Weight of Discarded Bycatch	34.02 kg	14%	
Total Non Target Species	71.42 kg	29%	
Total Catch	244.25 kg		

SLN	RBF Category	Retained		Discarded		Total			RBF Threshold	Actual % Catch	RBF
		No.	kg	No.	kg	No.	kg	Av. Kg			
F3	Secondary	-	-	7.00	0.96	7.0	1.0	0.137	≥2%	0.39%	M
F4	Secondary	15.00	1.18	9.00	0.82	24.0	2.0	0.083	≥2%	0.82%	M

F11	Secondary	3.00	0.46	2.00	0.26	5.0	0.7	0.144	≥2%	0.29%	M
F12	Secondary	1.00	0.84	-	-	1.0	0.8	0.840	≥2%	0.34%	M
F17	Secondary	-	-	1.00	0.06	1.0	0.1	0.060	≥2%	0.02%	M
F20	Secondary	2.00	2.26	1.00	0.10	3.0	2.4	0.787	≥2%	0.97%	M
F22	Secondary	-	-	5.00	0.24	5.0	0.2	0.048	≥2%	0.10%	M
F29	Secondary	1.00	0.20	3.00	0.27	4.0	0.5	0.118	≥2%	0.19%	M
F30	Secondary	7.00	1.64	-	-	7.0	1.6	0.234	≥2%	0.67%	M
F32	Secondary	-	-	1.00	0.02	1.0	0.0	0.020	≥2%	0.01%	M
F37	Secondary	-	-	1.00	0.02	1.0	0.0	0.020	≥2%	0.01%	M
F38	Secondary	2.00	0.48	3.00	0.49	5.0	1.0	0.194	≥2%	0.40%	M
F39	Secondary	5.00	0.38	2.00	0.08	7.0	0.5	0.066	≥2%	0.19%	M
F40	Secondary	-	-	1.00	0.08	1.0	0.1	0.080	≥2%	0.03%	M
F41	Secondary	1.00	0.88	-	-	1.0	0.9	0.880	≥2%	0.36%	M
F42	Secondary	1.00	0.48	-	-	1.0	0.5	0.480	≥2%	0.20%	M
F43	Secondary	2.00	0.28	1.00	0.08	3.0	0.4	0.120	≥2%	0.15%	M
C1	Secondary	20.00	4.59	1.00	0.50	21.0	5.1	0.242	≥2%	2.08%	M
C2	Secondary	-	-	45.00	21.63	45.0	21.6	0.481	≥2%	8.86%	M
C3	Secondary	-	-	5.00	0.20	5.0	0.2	0.040	≥2%	0.08%	M
C4	Secondary	2.00	0.12	4.00	0.25	6.0	0.4	0.062	≥2%	0.15%	M
C5	Secondary	-	-	53.00	1.00	53.0	1.0	0.019	≥2%	0.41%	M
C6	Secondary	-	-	1.00	0.01	1.0	0.0	0.010	≥2%	0.00%	M
C10	Secondary	4.00	0.05	14.00	0.62	18.0	0.7	0.037	≥2%	0.27%	M
C13	Secondary	-	-	2.00	0.10	2.0	0.1	0.050	≥2%	0.04%	M
C14	Secondary	-	-	1.00	0.08	1.0	0.1	0.080	≥2%	0.03%	M
C16	Secondary	-	-	1.00	0.01	1.0	0.0	0.010	≥2%	0.00%	M
C17	Secondary	8.00	0.50	18.00	0.97	26.0	1.5	0.057	≥2%	0.60%	M
C19	Secondary	-	-	3.00	0.03	3.0	0.0	0.010	≥2%	0.01%	M
C23	Secondary	19.00	12.52	3.00	1.36	22.0	13.9	0.631	≥2%	5.68%	M
C24	Secondary	-	-	36.00	0.70	36.0	0.7	0.019	≥2%	0.29%	M
C25	Secondary	113.00	5.08	-	-	113.0	5.1	0.045	≥2%	2.08%	M
M1	Secondary	242.00	2.92	11.00	0.16	253.0	3.1	0.012	≥2%	1.26%	M
M3	Secondary	2.00	0.64	-	-	2.0	0.6	0.320	≥2%	0.26%	M

M4	Secondary	-	-	19.00	0.51	19.0	0.5	0.027	≥2%	0.21%	M
M6	Secondary	7.00	1.90	12.00	1.24	19.0	3.1	0.165	≥2%	1.29%	M
M8	Secondary	-	-	24.00	0.47	24.0	0.5	0.020	≥2%	0.19%	M
M9	Secondary	-	-	5.00	0.07	5.0	0.1	0.014	≥2%	0.03%	M
M10	Secondary	-	-	14.00	0.27	14.0	0.3	0.019	≥2%	0.11%	M
E4	Secondary	-	-	8.00	0.36	8.0	0.4	0.045	≥2%	0.15%	M

Appendix 3. List of NTS process to PSA

NTS Code	Local Name I	Local Name II	Local Name II	Local Name (Madura)	Scientific Name	NTS Category
F1	Gerabah					Secondary
F2	Sembilah					Secondary
F3	Ngkoh	Buntal	Lepu		<i>Batrachus trispinosus</i>	Secondary
F4	Molen	Kerapu			<i>Epinephelus bleekeri</i>	Secondary
F5	Sadar	Baronang			<i>Siganus sp</i>	Secondary
F6	Uling	Moray			<i>Scuticaria okinawae</i>	Secondary
F7	Demang					Secondary
F8	Tambal				<i>Lutjanus lutjanus</i>	Secondary
F9	Tonang	Moray Total			<i>Gymnothorax undulatus</i>	Secondary
F10	Jambrung	Kerong-kerong			<i>Terapon jarbua</i>	Secondary
F11	Terumpah	Lidah			<i>Cynoglossus lingua</i>	Secondary
F12	Pitek				<i>Platycephalus indicus</i>	Secondary
F13	Kakap				<i>Lutjanus ehrenbergii</i>	Secondary
F14	Boso					Secondary
F15	Ikan Pe	Pari			<i>Himantura rai</i>	Secondary
F16	Siridoyo					Secondary
F17	Hiu	Cucut				Secondary
F18	Bukur				<i>Aluterus monoceros</i>	Secondary
F19	Kerok					Secondary
F20	Manyung	Keting			<i>Arius thalassinus</i>	Secondary
F21	Bentol					Secondary
F22	Kiper				<i>Scatophagus argus</i>	Secondary
F23	Bolet					Secondary
F24	Teri					Secondary
F25	Laronan					Secondary
F26	Abang					Secondary
F27	Takol					Secondary
F28	Kurisi					Secondary

F29	Layar			Secondary
F30	Kerong-kerong			Secondary
F31	Buntek			Secondary
F32	Semadar			Secondary
F33	Serabali			Secondary
F34	Lencam			Secondary
F35	Biji Nangka			Secondary
F36	Kuda Laut			Secondary
F37	Beseng			Secondary
F38	Kerapu Macan			Secondary
F39	Kereseh			Secondary
F40	Nir Kunir			Secondary
F41	Pari Tutul			Secondary
F42	Sebelah			Secondary
F43	Masader			Secondary
C1	Kepiting Bakau		<i>Scylla serrata</i>	Secondary
C2	Cakar Mojo		<i>Loxorhynchus grandis</i>	Secondary
C3	Pongo			Secondary
C4	Yuk-yuk Dang	Udang Matis	<i>Alima laevis</i>	Secondary
C5	Kroyo		<i>Parathelphusa maculata</i>	Secondary
C6	Krekeh			Secondary
C7	Kerang	Klomang	<i>Dardanus calidus</i>	Secondary
C8	Udang Galah		<i>Macrobrachium rosenbergi</i>	Secondary
C9	Udang Halus			Secondary
C10	Krekeh Sungut	Cangker	<i>Portunus convexus</i>	Secondary
C11	Udang Kipas		<i>Thenus sp</i>	Secondary
C12	Udang Batu		<i>Marsupenaeus japonicus</i>	Secondary
C13	Kepiting Batu 1			Secondary
C14	Kepiting Batu 2		<i>Euryozius buovieri</i>	Secondary
C15	Kepiting Batu 3		Family Trapeziidae	Secondary
C16	Kepiting Batu 4			Secondary
C17	Kepiting Cina	Mata Panjang	Kroyo	Secondary

C18	Kepiting Batu 5		Family Dromiidae	Secondary
C19	Kepiting Batu 6		<i>Cryptopodia fornicata</i>	Secondary
C20	Kepiting Batu 7			Secondary
C21	Kepiting Batu 8			Secondary
C22	Kepiting Batu 9			Secondary
C23	Mimi		<i>Limulus polyphemus</i>	Secondary
C24	Cangker 2			Secondary
C25	Rajungan Tiga Titik		<i>Portunus sanguinolentus</i>	Secondary
C26	Tong Butong			Secondary
C27	Kelomang 2	Cong-cong		Secondary
C28	Rajungan Tentara			Secondary
C29	Rajungan Salib		<i>Charybdis feriatus</i>	Secondary
M1	Keong Macan		<i>Babylonia spirata</i>	Secondary
M2	Sumpil			Secondary
M3	Cumi-cumi		<i>Sepia sp</i>	Secondary
M4	Keong			Secondary
M5	Kretan	Gurita		Secondary
M6	Keong 2	Bingah		Secondary
M7	Siput Laut			Secondary
M8	Siput Naga			Secondary
M9	Kerang Bulu			Secondary
M10	Siput Laut 2			Secondary
E1	Bintang Laut		<i>Archaster tipicus</i>	Secondary
E2	Entho-entho	Teripang	<i>Stichopus variegatus</i>	Secondary
E3	Welat			Secondary
E4	Tangkur			Secondary
E5	Bintang Laut 2			Secondary
O1	Telur Cumi			Secondary

Appendix 3. List of NTS process to PSA

NTS Code

C1



Scientific Name:

Scylla serrata

Average age maturity

Average max age

Up to 3 years.²⁾

Tekundity

1 to 6 million eggs.¹⁾

Average size maturity

123 mm in females, 92 mm in males.⁴⁾

Average max size

Up to 28 cm in males.¹⁾

Reproductive guild

Guarders, Brood hiders.⁵⁾

Trophic level

Trophic level 4.³⁾

Reference

- 1) http://www.fao.org/fishery/culturedspecies/Scylla_serrata/en
- 2) <http://www.sea-ex.com/fishphotos/crab,mud.htm>
- 3) <http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A208814>
- 4) <http://www.sciencedirect.com/science/article/pii/S0272771484710572>
- 5) <http://www.sealifebase.org/summary/Scylla-serrata.html>

NTS Code

C2



Scientific Name:

Loxorhynchus grandis

Average age maturity

Average max age

at least four years old.²⁾

Tekundity

125.000 to 500.000 eggs.¹⁾

Average size maturity

4.2 to 6.8 inches for Females. 4.2 to 9.6 inches for Males.²⁾

Average max size

Up to 4.5 inches in females, up to 6.5 inches in males.¹⁾

Reproductive guild

Bearer, External brooder.⁴⁾

Trophic level

Trophic level 3.³⁾

Reference

¹⁾<https://www.montereybayaquarium.org/animal-guide/invertebrates/sheep-crab>

²⁾[status2003sheepcraps.pdf](#)

³⁾<http://www.globalbioticinteractions.org/?sourceTaxon=WORMS%3A441602>

⁴⁾<http://www.sealifebase.org/summary/Loxorhynchus-grandis.html>

NTS Code

C3

Scientific Name:
Carcinoplax vestita



Average age maturity

Average max age

Tekundity

7800 to 57 000 mature oocytes per batch.¹⁾

Average size maturity

13.20–18.85 mm in males, 12.81–15.46 mm in females.¹⁾

Average max size

Reproductive

Bearers, External brooders.²⁾

Trophic level

Reference

¹⁾<http://onlinelibrary.wiley.com/wol1/doi/10.1111/j.1444-2906.2007.01339.x/abstract>

²⁾<http://www.sealifebase.org/>

NTS Code

C7



Scientific Name:
Dardanus sp.

Average age maturity

Average max age
20 to 62 months.²⁾

Tekundity

Average size maturity

Average max size
20 cm.¹⁾

Reproductive

Bearers, External brooders.¹⁾

Trophic level

Trophic level 3.¹⁾

Reference

¹⁾<http://www.sealifebase.org/>

²⁾[reference\Bronco\(2002\)hermitcrab.pdf](#)

NTS Code

C23



Scientific Name:

Carcinoscorpius rotundicauda

(not true crab, sub phylum chericerata)

Average age maturity

Up to 10 years.⁴⁾

Average max age

Tekundity

10,000 eggs.¹⁾

Average size maturity

8cm in males, 10cm in females.²⁾

Average max size

grow up to 40cm in length (inclusive of telson).¹⁾

Reproductive

Spawning, Eksternal brooders.³⁾

Trophic level

Trophic level 4.³⁾

Reference

¹⁾<http://taxo4254.wikispaces.com/Carcinoscorpius+rotundicauda>

²⁾[reference\Lesley\(2009\)horseshoe.pdf](reference\Lesley(2009)horseshoe.pdf)

³⁾<http://www.gbif.org/species/113222504>

⁴⁾<http://horseshoecrab.org/nh/life.html#>

NTS Code

C25



Scientific Name:

Portunus sanguinolentus

Average age maturity

Reach maturity in 6 months.²⁾

Average max age

2.5 years.²⁾

Tekundity

ranged from 405,375 to 2,438,645 (average 1,075,857).³⁾

Average size maturity

2.6 cm in females.¹⁾

Average max size

20 cm.¹⁾

Reproductive guild

Bearers, External brooders.¹⁾

Trophic level

Trophic level 3.¹⁾

Reference

¹⁾<http://www.sealifebase.org/summary/Portunus-sanguinolentus.html>

²⁾[reference\Dinesh\(2007\).pdf](#)

³⁾[reference\Lee\(2003\)threespotcrab.pdf](#)

NTS Code

M1

Scientific Name:
Babylonia spirata



Average age maturity

Average max age

Tekundity

21-28 capsule (1 capsule = 933 eggs).³⁾

Average size maturity

36.5mm in females, 32mm in males ((SH)Shell Height).²⁾

Average max size

47.2 cm.¹⁾

Reproductive

gonochoristic with internal fertilization.²⁾

Trophic level

Trophic level 1.⁴⁾

Reference

¹⁾<http://eol.org/pages/4817500/data>

²⁾[reference\mohan\(2007\)babylonia.pdf](#)

³⁾[reference\bernandis\(2001\)babylonia.pdf](#)

⁴⁾[reference\Collapse Appendix.pdf](#)

NTS Code

M2



Scientific Name:

Latisipho sp.

Average age maturity

Average max age

Tekundity

Average size maturity

Average max size

H(height of the shell) 35 mm, h(height of the last whorl) 25.5 mm, AL(aperture length) 18.5 mm.¹⁾

Reproductive

Trophic level

Reference

1)[reference\Kosyan\(2006\)latisipho.pdf](#)