Seafood WATCH
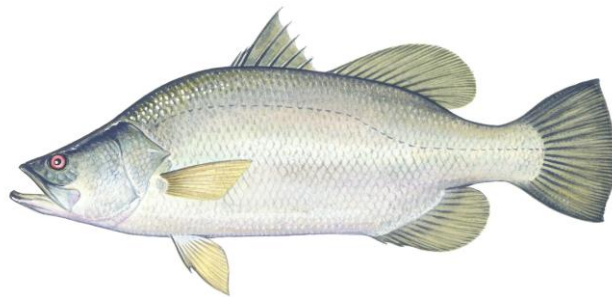
MONTEREY BAY AQUARIUM®

Barramundi

Lates calcarifer

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Eastern Indonesia

Gillnet, hook and line, pelagic longline

March 19, 2013
Johanna P Pierre, JPEC Ltd

Final Seafood Recommendation

Barramundi from eastern Indonesia is ranked as '**Avoid**' for gillnet, hook and line, and pelagic longline fishing methods.

Stock	Fishery	Impacts on the Stock Rank (Score)	Impacts on other Species Lowest scoring species Rank*, Subscore, Score	Manage-ment Rank Score	Habitat and Ecosystem Rank Score	Overall Recommendation Score
Barramundi	Barramundi hook and line	Red 2.16	Finfish Green, 3.32,3.32	Red 1	Green 3.87	AVOID 2.3
Barramundi	Barramundi midwater gillnet	Red 2.16	Finfish Red, 1.73,1.73	Red 1	Green 3.87	AVOID 1.95
Barramundi	Barramundi pelagic longline	Red 2.16	Finfish Yellow, 2.64,2.64	Red 1	Green 3.87	AVOID 2.17

Scoring note – scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

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Executive Summary

This report evaluates the status of wild barramundi (*Lates calcarifer*) caught in estuarine habitat by gillnet, hook and line, and pelagic longline fishing at West Papua Island, eastern Indonesia, in accordance with criteria developed by Seafood Watch®.

Barramundi from eastern Indonesia is ranked as 'Avoid' for gillnet, hook and line, and pelagic longline fishing methods.

Barramundi is classified as having high inherent vulnerability. There is no information on stock status or the level of fishing mortality available for the wild Indonesian stock, which leads to a high concern for stock status and a moderate concern for fishing pressure.

There was no specific information available on bycatch in the fisheries assessed here. Therefore, the unknown bycatch matrix from the Seafood Watch criteria was used and applied to estuarine habitats. Species that may be at risk in the fishery area were identified from the literature. The estuarine location of the fishery resulted in the exclusion of species such as marine mammals, sharks, and turtles from the assessment. Five species of birds (three cormorants and one pelican) were identified as potentially bycaught; all are classified by the IUCN as of least concern. Fishing mortality levels are unknown for barramundi fisheries in Indonesia, and were assessed using the unknown bycatch matrix. In general, the gillnet fishery represented the highest risks to potential bycatch species, followed by pelagic longline, and lastly, hook and line fisheries. Discard rates were drawn from reviews of fishing gears analogous to those used in barramundi fisheries but applied in different settings; all methods were estimated at less than 20% of catch landings.

Management of Indonesian fisheries is severely constrained by the lack of resources. This is evident in assessments of both retained species and bycatch. While some components of robust management are attempted (e.g., identification of sustainable harvest levels for some fished species), the quality of these efforts is compromised by lack of information or by inappropriate analytical approaches. No bycatch limits are in place but the need for them is unclear. Some stakeholder involvement is possible, and includes fishing and non-governmental organizations. Enforcement is compromised by resource availability; although preliminary work has been done to investigate observer programs, observer coverage does not appear to be in place. Information on track record relating to barramundi fisheries was not available.

Fishing methods used in the barramundi fisheries described do not contact the sea floor. No work is underway to examine the effects of barramundi fisheries on the supporting ecosystem. However, barramundi is not an 'exceptional species' as determined by Seafood Watch criteria.

Introduction

Scope of the analysis and ensuing recommendation
This report evaluates the status of wild barramundi (*Lates calcarifer*) caught by gillnet, hook and line and pelagic longline fishing at West Papua Island, in eastern Indonesia, in accordance with criteria developed by Seafood Watch®.

Overview of the species and management bodies
Barramundi is a ray-finned fish from the Latidae family. It has a wide distribution including Australia, Indonesia, Papua New Guinea, northward as far as the coasts of China and Japan, and westward including India and around islands in the Indian Ocean (Froese, Pauly 2012). It occurs in rivers, estuaries, and coastal waters. The species is catadromous and a broadcast spawner. Spawning occurs every three months in females, and all year round in males (Yue et al. 2009). Fish start life as males and some change to become female after reaching male sexual maturity at 3-4 years. The fecundity of barramundi is high relative to other teleost fish; adult females can produce 0.5–40.0 million eggs (Yue et al. 2009).

The fisheries assessed in this report occur within the Indonesian Exclusive Economic Zone and the responsible government body at this level is the Ministry for Marine Affairs and Fisheries. The Ministry's strategy identifies sustainable management of marine and fisheries resources as one of four key policies (http://www.kkp.go.id/en/index.php/archives/c/2569/Vision-Mission-and-Purpose-of-MMAF/?category_id=55). Local and regional governments also have roles in administrating areas to 12 nm offshore, including responsibilities for conservation and resource utilization (Dudley, Ghofar 2006?). With the exception of statistics on landings (Sabeni, Calderini 2012), recent information on Indonesian wild capture fisheries for barramundi is scarce. However, reported methods of capture have included gillnets, seines, hooks and lines, and trap nets (Sodikin 1987, Goldman pers. comm.). Gillnetting was the method thought to land the most catch, at least until 1984 (Sodikin 1987). Currently, hook and line catch is estimated to comprise one third, and pelagic longline catch two thirds of line-caught catch (Goldman, pers. comm.).

Production statistics
Indonesia reports, by far, the majority of landings of wild-caught barramundi. Other countries (Singapore, Thailand, Taiwan, Malaysia, Pakistan, the Philippines, Papua New Guinea, and Australia) report less than 1,500 tonnes of catch per year each (Figure 1, Sabeni, Calderini 2012).
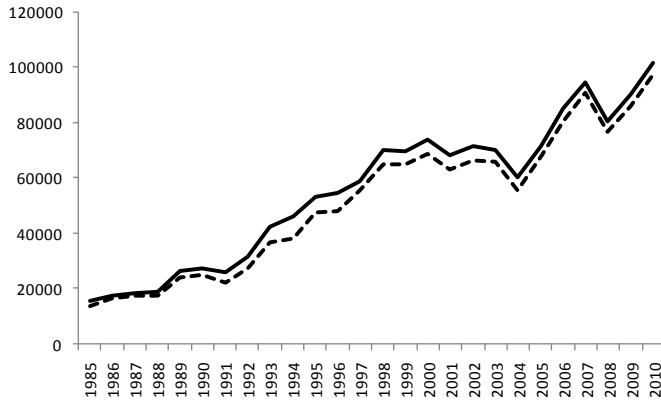
Figure 1. Barramundi catches (tonnes) in Indonesia (dashed line), and total global catch (solid line), 1985 – 2010. (Source: Sabeni, Calderini 2012).

Importance to the US/North American market
Barramundi imports to North America have not been reported in FAO or NOAA statistics. Consequently, importance of wild capture product to the North American market appears low at present.

Common and market names
Barramundi is known by a variety of different names, including Asian sea bass, Australian sea bass, barra, barramundi perch, giant (sea) perch, palmer, silver barramundi, and white sea bass.

Primary product forms.
Barramundi is sold fresh or frozen, as fillets (skin on or off, boneless), whole fish, or headed and gutted.

Analysis

Scoring guide

- All scores result in a zero to five final score for the criterion and the overall final rank. A zero score indicates poor performance, while a score of five indicates high performance.
- The full Seafood Watch Fisheries Criteria that the following scores relate to are available on our website at www.seafoodwatch.org.

Criterion 1: Stock for which you want a recommendation

Guiding principles

- The stock is healthy and abundant. Abundance, size, sex, age and genetic structure should be maintained at levels that do not impair the long-term productivity of the stock or fulfillment of its role in the ecosystem and food web.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given current abundance and inherent resilience to fishing while accounting for scientific uncertainty, management uncertainty, and non-fishery impacts such as habitat degradation.

Summary

Stock	Fishery	Inherent Vulnerability Rank	Stock Status Rank (Score)	Fishing Mortality Rank (Score)	Criterion 1 Rank (Score)
Barramundi	Barramundi hook and line	High	High Concern (2)	Moderate Concern (2.33)	Red (2.16)
Barramundi	Barramundi midwater gillnet	High	High Concern (2)	Moderate Concern (2.33)	Red (2.16)
Barramundi	Barramundi pelagic longline	High	High Concern (2)	Moderate Concern (2.33)	Red (2.16)

Monterey Bay Aquarium Seafood Watch®

Justification of Ranking

Barramundi

Factor 1.1 Inherent Vulnerability: High

Key relevant information:
The FishBase vulnerability score is 69

Factor 1.2 Stock status: High concern

Key relevant information:
There is no stock assessment available on wild barramundi caught in Indonesia; landings continue to increase (see Figure 1) although the locations of captures and landings are not reported. Landings from West Papua are considered to be decreasing as fishers move to harvest stocks of higher value (Sutjiamidjaja, pers. comm.). There is no evidence to suggest that stock is either above or below reference points. Further, the species' inherent vulnerability is high (Factor 1.1).Therefore, in accordance with the Seafood Watch criteria, stock status defaults to a high concern.

Factor 1.3 Fishing mortality: Moderate concern

All methods

Key relevant information:
There is no information available on levels of fishery mortality in this stock, although landings across Indonesia continue to increase (see Figure 1). The stock is susceptible to the fisheries, although it is not identified as a stock of special concern.

Criterion 2: Impacts on other retained and bycatch stocks

Guiding principles

- The fishery minimizes bycatch. Seafood Watch® defines bycatch as all fisheries-related mortality or injury other than the retained catch. Examples include discards, endangered or threatened species catch, pre-catch mortality and ghost fishing. All discards, including those released alive, are considered bycatch unless there is valid scientific evidence of high post-release survival and there is no documented evidence of negative impacts at the population level.
- Fishing mortality does not threaten populations or impede the ecological role of any marine life. Fishing mortality should be appropriate given each impacted species' abundance and productivity, accounting for scientific uncertainty, management uncertainty and non-fishery impacts such as habitat degradation.

Summary

Gillnet

Stock	Inherent Vulnerability Rank	Stock Status Rank (Score)	Fishing Mortality Rank (Score)	Subscore	Score (subscore*discard modifier)	Rank (based on subscore)
Finfish	Medium	Moderate Concern (3)	High Concern (1)	1.73	1.73	Red
Seabirds	High	High Concern (2)	Moderate Concern (2.33)	2.16	2.16	Red

Hook and line

Stock	Inherent Vulnerability Rank	Stock Status Rank (Score)	Fishing Mortality Rank (Score)	Subscore	Score (subscore*discard modifier)	Rank (based on subscore)
Finfish	Medium	Moderate Concern (3)	Low Concern (3.67)	3.32	3.32	Green
Seabirds	High	High Concern (2)	Very Low Concern (5)	3.16	3.16	Yellow

Pelagic longline

| Stock | Inherent Vulnerability

Rank | Stock Status

Rank (Score) | Fishing Mortality

Rank (Score) | Subscore | Score (subscore*discard modifier) | Rank (based on subscore) |
|---|---|---|---|---|---|---|
| Finfish | Medium | Moderate Concern (3) | Moderate Concern (2.33) | 2.64 | 2.64 | Yellow |
| Seabirds | High | High Concern (2) | Low Concern (3.67) | 2.71 | 2.71 | Yellow |

There was no specific information available on bycatch in the fisheries assessed here. Therefore the unknown bycatch matrix from the Seafood Watch criteria was used, and species that may be at risk in the fishery area were identified from the literature. The estuarine location of the fishery results in the exclusion of species such as marine mammals, sharks, and turtles from the assessment. Four species of birds (three cormorants and one pelican, see Appendix A) were identified as potentially bycaught; all are classified as of Least Concern (IUCN 2012). Fishing mortality levels are unknown for barramundi fisheries in Indonesia, and were also assessed using the unknown bycatch matrix. In general, the gillnet fishery represented the highest risks to potential bycatch species, followed by pelagic longline, and lastly, by hook and line fisheries. Discard rates were drawn from reviews of fishing gears analogous to those used in barramundi fisheries but applied in different settings; all methods were estimated at less than 20% of catch landings.

The summary table and text in this section contains a score and justification for only the lowest scoring species /stock in each fishery.

An initial assessment of all species caught in any fishery in this report is provided in Appendix A. This serves to identify the species for which additional assessment is required.

Justification of Ranking

Gillnet

Factor 2.1 Inherent Vulnerability: Seabirds–High vulnerability; Fish–Medium vulnerability

Key relevant information:
There is no information available on species bycaught in this fishery. Therefore, the 'unknown bycatch matrix' is used.

Seabirds: In accordance with the Seafood Watch criteria, these groups are categorized as having high inherent vulnerability.

Fish: In accordance with the Seafood Watch criteria, this group is categorized as having medium inherent vulnerability.

Factor 2.2 Stock status: Seabirds–High concern; Fish–Moderate concern

Key relevant information:
Seabirds: Diving seabirds may be at risk of capture in barramundi fisheries. Seabird species at bycatch risk that are likely to occur in the estuary habitat from which barramundi is reported to be harvested include three cormorants and one pelican (Burung-Nusantara.org 2013). These species are classified by IUCN as of least concern (IUCN 2012). Pole and line and longline fishing are expected to have less impact on the seabird species present than the gillnet method (Rowe 2010).

In accordance with the 'unknown bycatch matrix' applied to midwater gillnet fishing, stock status of seabirds as a group is categorized as a high concern due to their unknown status in combination with high vulnerability.

Finfish: In accordance with the 'unknown bycatch matrix,' stock status of bycaught fish species is assessed as a moderate concern.

Factor 2.3 Fishing mortality

Gillnet: Seabirds–Moderate concern; Finfish–High concern

Key relevant information:
Seabirds: Levels of fishery mortality are unknown. These species are classified by the IUCN as being of least concern. Here, though, they are assessed as a moderate concern, in accordance with the unknown bycatch matrix and Seafood Watch criteria.

Finfish: Fishing mortality of finfish species is classified as a high concern in accordance with the unknown bycatch matrix and Seafood Watch criteria.

Hook and line: Seabirds–Low concern; Finfish–Low concern

Key relevant information:
Seabirds: Fishing mortality of these species is classified as a very low concern in accordance with the unknown bycatch matrix and Seafood Watch criteria.

Finfish: Fishing mortality of these species is classified as a low concern in accordance with the unknown bycatch matrix and Seafood Watch criteria.

Pelagic longline: Seabirds–Low concern; Finfish–Moderate concern

Key relevant information:
Seabirds: Fishing mortality of seabird species is classified as a low concern in accordance with the unknown bycatch matrix and Seafood Watch criteria. However, the species most likely to occur in barramundi fishery habitat are unlikely to be caught on longlines.

Finfish: Fishing mortality of these groups is assessed as a moderate concern in accordance with the unknown bycatch matrix and Seafood Watch criteria.

Factor 2.4 Overall discard rate: 0%–20%

Gillnet

Key relevant information:
No information is available on the volume of discards relative to target catch in the gillnet fishery. However, the volume appears likely to be less than 20% given values for other fisheries using monofilament nets (Alverson et al. 1994; Kelleher 2005).

Hook and line

Key relevant information:
While not reported for this fishery specifically, the volume of discards appears likely to be less than 20% given data from other fisheries using hook and line gear (1.8% for hand line fisheries, Kelleher 2005).

Pelagic longline

Key relevant information:
Again, while no fishery-specific information is available, the volume of discards is likely to be less than 20% given statistics for other fisheries using pelagic longlines to catch fish species other than tuna (Kelleher 2005).

Criterion 3: Management effectiveness

Guiding principle

- The fishery is managed to sustain the long-term productivity of all impacted species. Management should be appropriate for the inherent resilience of affected marine life and should incorporate data sufficient to assess the affected species and manage fishing mortality to ensure little risk of depletion. Measures should be implemented and enforced to ensure that fishery mortality does not threaten the long-term productivity or ecological role of any species in the future.

Summary

Fishery	Management: Harvest Strategy Rank (Score)	Management: Bycatch Rank (Score)	Criterion 3 Rank (Score)
Barramundi midwater gillnet	Very High Concern (1)	Very High Concern (1)	Red (1)
Barramundi hook and line	Very High Concern (1)	Very High Concern (1)	Red (1)
Barramundi pelagic longline	Very High Concern (1)	Very High Concern (1)	Red (1)

Management of Indonesian fisheries is severely constrained by the lack of resources. This is evident in assessments of both retained species and bycatch. While some components of robust management are attempted (e.g., identification of sustainable harvest levels for some fished species), the quality of these efforts is compromised by lack of information or inappropriate analytical approaches. No bycatch limits are in place, although the need for them is unclear. Some stakeholder involvement is possible and includes fishing and non-governmental organizations. Enforcement is compromised by resource availability; although preliminary work has been done to investigate observer programs, observer coverage does not appear to be in place. Information on the track record related to barramundi fisheries was not available.

Justification of Ranking

All methods

Factor 3.1 Management of fishing impacts on retained species: Very high concern

Key relevant information:
While some components of robust fisheries management are attempted in Indonesia, resource constraints seriously compromise management efforts. The importance of sustainable utilization is recognized, and attempts are made to determine sustainable catch limits for some species. However, the paucity of data available, lack of data utilization when information is available, and general lack of robust analytical approaches are thought to render these attempts ineffective (Mous et al. 2005; Dudley, Ghofar 2006). Retained species other than the target species are unknown. Enforcement is also compromised by a lack of resourcing (Dudley, Ghofar 2006). Some governance bodies exist which provide for stakeholder involvement in Indonesian fisheries generally (see detail below; Dudley, Ghofar 2006).

Detailed rationale:
Management Strategy and Implementation: Ineffective
Indonesia's Ministry for Marine Affairs and Fisheries identifies sustainable management of marine and fisheries resources as one of four key policies. Management objectives for Indonesia's fisheries are set at 80% MSY (Mous et al. 2005). However, the specific application of this to barramundi fisheries is unknown. Issues with the availability and quality of fisheries data render assessing the application of management strategies problematic (Mous et al. 2005). The management strategy and implementation are evaluated as 'ineffective,' given that information is not available that relates to the fisheries considered here.

Scientific Research and Monitoring: Ineffective
Data on landings are available at a national level (Sabeni, Calderini 2012). However, fisheries data collection is reported to be problematic (e.g., due to resource constraints and lack of perceived value in data) (Mous et al. 2005; Dudley, Ghofar 2006), and the details of data collection are unknown, including data collected beyond landings. These factors lead to an evaluation of 'Ineffective' for this factor.

Scientific Advice: Ineffective
National fisheries management is based on maximum sustainable yields (Mous et al. 2005). However, through decentralization of fishery management, provincial and district governments are required to produce estimates of MSY for species in their areas. This means that these statistics can be misleading at best and nonsensical at worst, for stocks as a whole (Dudley, Ghofar 2006). When research information is available, this is received by the directorate for capture fisheries, where the information could be used for fishery management. However, overfishing is an ongoing issue in many fisheries, and resource constraints limit the ability to implement research findings in fishery management. In turn, the lack of utilization of

information that is collected reduces the perceived value of data collection in the first instance (Dudley, Ghofar 2006).

Thus, based on the information available, scientific advice does not appear to be specifically linked to the management of the fisheries considered here. An assessment of 'ineffective' is made in accordance with Seafood Watch criteria for this factor.

Enforcement: Ineffective
An extensive legislative framework has developed at the national level (FAO 2013). However, enforcement measures to the fisheries assessed in this report are unknown, and constrained by lack of resources for fisheries management (Dudley, Ghofar 2006). Observer programs are not implemented as standard practice, although a preliminary approach has been investigated (Anonymous 2005a in Dudley, Ghofar 2006). On occasion, data collection in some Indonesian fisheries has included on-board programs or specialized port sampling (Dudley, Ghofar 2006), however, the applicability of those programs to barramundi fisheries is unknown.

An assessment of 'ineffective' is made in accordance with Seafood Watch criteria for this factor.

Track Record: Moderately effective
There is no information available on track record. Therefore, the track record is uncertain and an assessment of 'moderate' is applied in accordance with the Seafood Watch criteria for this factor.

Stakeholder inclusion: Moderately effective
While specific information applicable to this fishery is not available, a diversity of organizations is involved in fishery management (Dudley, Ghofar 2006). Two bodies that are known to involve stakeholders outside the national and regional/local government agencies are the National Commission on Marine Conservation (Komisi Nasional Koservasi Laut, KOMNAS KOLAUT) and Indonesia's Fisheries Society (Masyarakat Perikanan Nusantara). KOMNAS KOLAUT involves the Ministries of Marine Affairs and Fisheries, and Forestry, as well as a number of non-governmental organizations. KOMNAS KOLAUT's function relates to marine conservation issues, including the exploitation of marine resources, protected areas and protected species. The main goal of the Fisheries Society is to progress sustainable fisheries utilization for the maximum benefit of people. This goal includes considerations such as stakeholder and community involvement in fisheries management (Dudley, Ghofar 2006).

Factor 3.2 Management of fishing impacts on bycatch species: Very high concern

All methods

Key relevant information:
As for retained species, management of fishery impacts on bycatch species appears to be compromised by a lack of resources. However, the need for management is also unknown. Bycatch limits and the nature of bycatch has not been reported on a fishery basis. No

information was available on management or research actions taken at the fishery level to alleviate or understand bycatch risks.

Detailed rationale:
Management Strategy and Implementation: Ineffective
Reports of the composition of bycatch are not available; however, some seabird bycatch is possible. Bycatch limits have not been reported. Fishery-level management of bycatch of any species is not apparent.

Scientific Research and Monitoring: Ineffective
There appears to be an absence of collection and analysis of bycatch data.

Scientific Advice: Ineffective
As seen in Criterion 3.1 above, this factor is assessed as 'ineffective.'

Enforcement: Ineffective
As seen in Criterion 3.1 above, this factor is evaluated as 'ineffective.'

Criterion 4: Impacts on the habitat and ecosystem

Guiding principles

- The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.
- Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity.

Summary

Fishery	Impact of gear on the substrate Rank (Score)	Mitigation of gear impacts Rank (Score)	EBFM Rank (Score)	Criterion 4 Rank (Score)
Barramundi midwater gillnet	None (5)	N/A	Moderate Concern (3)	Green (3.87)
Barramundi hook and line	None (5)	N/A	Moderate Concern (3)	Green (3.87)
Barramundi pelagic longline	None (5)	N/A	Moderate Concern (3)	Green (3.87)

Fishing methods used in the barramundi fisheries described do not contact the sea floor. No work is underway examining the effects of barramundi fisheries on the supporting ecosystem. However, barramundi is not an exceptional species as determined by Seafood Watch criteria.

Justification

All methods

Factor 4.1 Impact of the fishing gear on the substrate: None

Key relevant information:
None of the three gear types used touch the bottom.

Factor 4.2 Modifying factor: Mitigation of fishing gear impacts: N/A

Key relevant information:
N/A

Factor 4.3 Ecosystem and Food Web Considerations: Moderate concern

All methods

Key relevant information:
Barramundi is not classified as an 'exceptional species' by the Seafood Watch criteria. There is no work underway to assess the ecological impacts of fishing for barramundi (Dudley, Ghofar 2006).

Overall Recommendation

Final Score = geometric mean of the four scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

The overall recommendation is as follows:

- **Best Choice** = Final Score between 3.2 and 5, **and** no Red Criteria, **and** no Critical scores

- **Good Alternative** = Final score between 2.2 and 3.199, **and** Management is not Red, **and** no more than one Red Criterion other than Management, **and** no Critical scores

- **Avoid** = Final Score between 0 and 2.199, **or** Management is Red, **or** two or more Red Criteria, **or** one or more Critical scores

Stock	Fishery	Impacts on the Stock Rank (Score)	Impacts on other Species Lowest scoring species Rank*, Subscore, Score	Manage-ment Rank Score	Habitat and Ecosystem Rank Score	Overall Recommendation Score
Barramundi	Barramundi hook and line	Red 2.16	Finfish Green, 3.32,3.32	Red 1	Green 3.87	AVOID 2.3
Barramundi	Barramundi midwater gillnet	Red 2.16	Finfish Red, 1.73,1.73	Red 1	Green 3.87	AVOID 1.95
Barramundi	Barramundi pelagic longline	Red 2.16	Finfish Yellow, 2.64,2.64	Red 1	Green 3.87	AVOID 2.17

Acknowledgements

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Appendix A: Seabird species that may be at risk of bycatch in the assessed fisheries

Seabirds

Scientific name	Common name
Australian Pelican	*Pelecanus conspicillatus*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Great Cormorant	*Phalacrocorax carbo*
Little Pied Cormorant	*Phalacrocorax melanoleucos*

Appendix B: Review Schedule

The availability of information is a key limiting factor for this assessment. While the timeframe for the collection and release of any new information is unclear, prompt review is recommended when new information does become available.

About Seafood Watch®

Monterey Bay Aquarium's Seafood Watch® program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch® defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch® makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Report. Each report synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." The detailed evaluation methodology is available upon request. In producing the Seafood Reports, Seafood Watch® seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch® Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch®'s sustainability recommendations and the underlying Seafood Reports will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Reports in any way they find useful. For more information about Seafood Watch® and Seafood Reports, please contact the Seafood Watch® program at Monterey Bay Aquarium by calling 1-877-229-9990.

Disclaimer
Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch® program or its recommendations on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.

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Guiding Principles

Seafood Watch™ defines sustainable seafood as originating from sources, whether fished1 or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following **guiding principles** illustrate the qualities that capture fisheries must possess to be considered sustainable by the Seafood Watch program:

- *Stocks are healthy and abundant.*
- *Fishing mortality does not threaten populations or impede the ecological role of any marine life.*
- *The fishery minimizes bycatch.*
- *The fishery is managed to sustain long-term productivity of all impacted species.*
- *The fishery is conducted such that impacts on the seafloor are minimized and the ecological and functional roles of seafloor habitats are maintained.*
- *Fishing activities should not seriously reduce ecosystem services provided by any fished species or result in harmful changes such as trophic cascades, phase shifts, or reduction of genetic diversity.*

Based on these guiding principles, Seafood Watch has developed a set of four sustainability **criteria** to evaluate capture fisheries for the purpose of developing a seafood recommendation for consumers and businesses. These criteria are:

1. Impacts on the species/stock for which you want a recommendation
2. Impacts on other species
3. Effectiveness of management
4. Habitat and ecosystem impacts

Each criterion includes:
- Factors to evaluate and rank
- Evaluation guidelines to synthesize these factors and to produce a numerical score
- A resulting numerical score and **rank** for that criterion

Once a score and rank have been assigned to each criterion, an overall seafood recommendation is developed on additional evaluation guidelines. Criteria ranks and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide:

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1 "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates.

Best Choices/Green: Are well managed and caught or farmed in environmentally friendly ways.

Good Alternatives/Yellow: Buy, but be aware there are concerns with how they're caught or farmed.

Avoid/Red: Take a pass on these. These items are overfished or caught or farmed in ways that harm other marine life or the environment.