Albacore tuna, Bigeye tuna, Blackfin tuna, Skipjack tuna, Yellowfin tuna

Thunnus alalunga, *Thunnus obesus*, *Thunnus atlanticus*, *Katsuwonus pelamis*, and *Thunnus albacares*

Image © Monterey Bay Aquarium

Atlantic

Purse Seine

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Disclaimer

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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.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed, that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

Based on this principle, Seafood Watch had developed four sustainability **criteria** for evaluating wild-catch fisheries for consumers and businesses. These criteria are:

- How does fishing affect the species under assessment?
- How does the fishing affect other, target and non-target species?
- How effective is the fishery's management?
- How does the fishing affect habitats and the stability of the ecosystem?

Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and **rating**

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color-coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

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

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

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

Summary

This report focuses on the associated and unassociated purse seine fisheries in the Atlantic Ocean. The target species for these reports are albacore (*Thunnus alalunga*), blackfin (*Thunnus atlanticus*), bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*), and yellowfin (*Thunnus albacares*) tuna.

Albacore tuna in both the North and South Atlantic are currently overfished, and are undergoing overfishing in the South Atlantic. There is some uncertainty surrounding the current status of yellowfin tuna populations in the Atlantic, but there is some indication that they are overfished and unsustainably fished. Bigeye tuna populations are fluctuating around healthy levels but have been below these levels in recent years, while skipjack tuna populations appear to be healthy. The status of blackfin tuna populations is unclear.

The International Commission for the Conservation of Atlantic Tunas (ICCAT) manages these species in the Atlantic Ocean. Management measures are in place for most of these species, and there are some measures specific to purse seine gears in place as well.

Purse seine gears typically have little contact with bottom habitats, although fish aggregating devices (FADs) can be anchored to the bottom. However, the incidental capture of ecologically important species may be a concern, particularly in the associated fishery.

Table of Conservation Concerns and Overall Recommendations

Stock / Fishery	Impacts on the Stock	Impacts on other Spp.	Management	Habitat and Ecosystem	Overall Recommendation
Bigeye tuna Atlantic - Purse Seine, Unassociated	Yellow (2.64)	Red (1.92)	Yellow (3.00)	Green (3.87)	**Good Alternative (2.770)**
Yellowfin tuna Atlantic - Purse Seine, Unassociated	Red (2.16)	Red (1.92)	Yellow (3.00)	Green (3.87)	**Avoid (2.633)**
Skipjack tuna Atlantic - Purse Seine, Unassociated	Green (3.83)	Red (1.92)	Yellow (3.00)	Green (3.87)	**Good Alternative (3.039)**
Bigeye tuna Atlantic - Purse Seine, Floating object	Yellow (2.64)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.740)**
Skipjack tuna Atlantic - Purse Seine, Floating object	Green (3.83)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.909)**
Yellowfin tuna Atlantic - Purse Seine, Floating object	Red (2.16)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.654)**

Albacore tuna Atlantic - Purse Seine, Floating object	Yellow (3.16)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.819)**
Albacore tuna Atlantic - Purse Seine, Unassociated	Yellow (3.16)	Red (1.92)	Yellow (3.00)	Green (3.87)	**Good Alternative (2.897)**
Blackfin tuna Atlantic - Purse Seine, Floating object	Yellow (2.64)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.740)**
Albacore tuna South Atlantic - Purse Seine, Floating object	Red (1.41)	Red (1.00)	Red (1.73)	Red (2.00)	**Avoid (1.488)**
Albacore tuna South Atlantic - Purse Seine, Unassociated	Red (1.41)	Red (1.92)	Yellow (3.00)	Green (3.87)	**Avoid (2.369)**

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

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

- **Best Choice/Green** = Final Score >3.2, **and** no Red Criteria, **and** no Critical scores
- **Good Alternative/Yellow** = Final score >2.2, **and** neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern,[2] **and** no more than one Red Criterion, **and** no Critical scores, **and** does not meet the criteria for Best Choice (above)
- **Avoid/Red** = Final Score <=2.2, **or** either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern,[2] **or** two or more Red Criteria, **or** one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

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Introduction

Scope of the analysis and ensuing recommendation

This report focuses on the associated and unassociated purse seine fisheries in the Atlantic Ocean for albacore (*Thunnus alalunga*), blackfin (*Thunnus atlanticus*), bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*) tuna.

Overview of the species and management bodies

Albacore tuna is widely distributed in temperate and tropical waters in all oceans, including the Atlantic and the Mediterranean Sea. There are two populations in the Atlantic, North and South, and a third in the Mediterranean. These populations have been identified for management purposes. Biological information supports classifying these as separate populations, but also suggests that there are sub-populations within the North Atlantic and Mediterranean and that intermingling may occur between populations in the Indian Ocean and South Atlantic. It is suspected that environmental changes may affect albacore populations (ICCAT 2012a).

Blackfin tuna are only found in the Western Atlantic in pelagic waters from Massachusetts south to Trinidad and Brazil. Blackfin tuna are known to form mixed schools with skipjack tuna. Spawning seems to occur in offshore waters (Froese and Pauly 2013).

Bigeye, skipjack, and yellowfin tuna are found in tropical and subtropical waters of the Atlantic and Mediterranean (except for bigeye tuna) (ICCAT 2012a). There are four populations of bigeye and yellowfin and five of skipjack: Western and Central Pacific Ocean, Eastern Pacific Ocean, Atlantic Ocean (Eastern and Western for skipjack), and Indian Ocean. Juvenile yellowfin tuna and juvenile bigeye tuna tend to form schools with skipjack tuna that are mostly found in surface waters. Larger tunas are found in subsurface waters where they also form schools (ICCAT 2012a). Globally, longlines are the most common fishing gear used to capture bigeye tuna, while purse seines capture the majority of skipjack and yellowfin tuna (ISSF 2013b).

All five species are managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in international waters of the Atlantic Ocean.

Production Statistics

Purse seine fisheries catch a very small proportion of albacore tuna in the Atlantic Ocean. For example, the total amount of albacore caught by purse seines in the North Atlantic has ranged from 5 t to 348 t since 2000, and in the South Atlantic catches have ranged from 2 t to 437 t. Total catches of albacore tuna in the North Atlantic were 20,948 t in 2013 and 19,148 t in the South Atlantic during 2013 (ICCAT 2014).

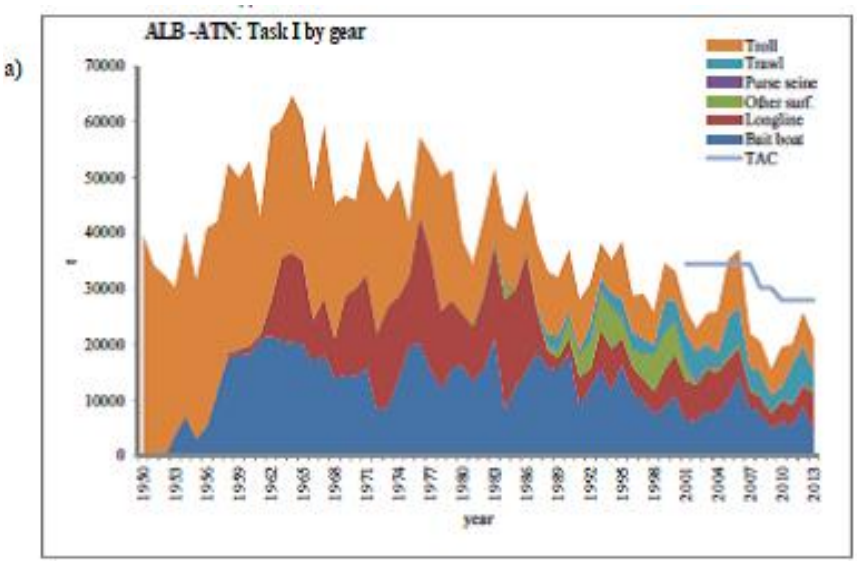


Figure 1. Albacore catches in the North Atlantic between 1950 and 2013 [ICCAT 2014].

Blackfin tuna catches (all gears combined) peaked during the mid-1990s at 4,488 t, and since 2003, catches have been below 2,000 t. The U.S. has reported between 200 t and 600 t since 1993 (ICCAT 2014).

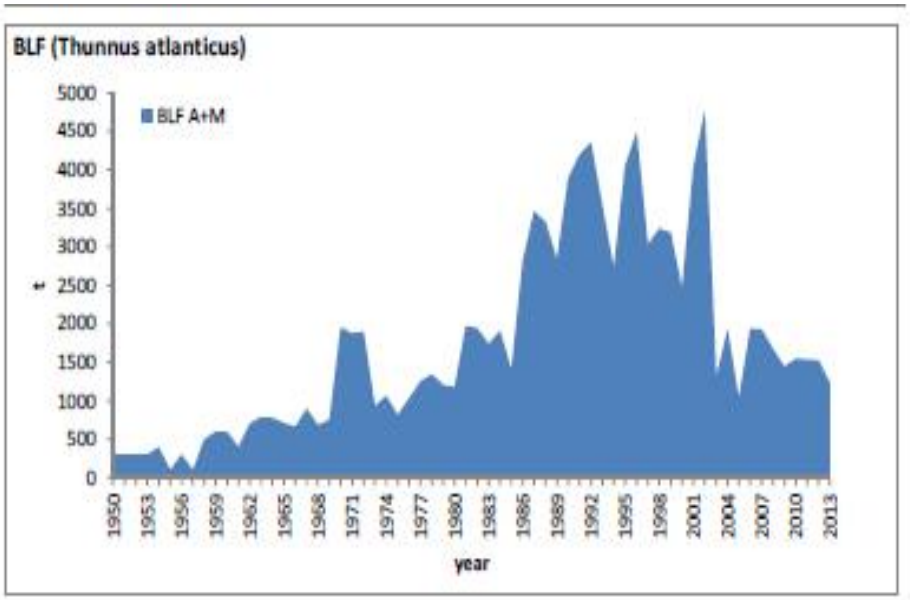
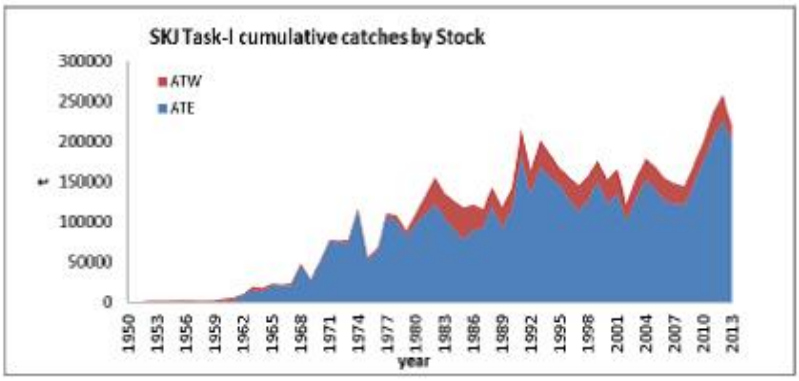


Figure 2. Blackfin tuna catches in the Atlantic Ocean between 1950 and 2013 [ICCAT 2014].

Bigeye tuna are principally caught by longlines but also purse seines and bait boat fisheries in the Atlantic Ocean. Bigeye tuna tend to be secondary target species in purse seine fisheries and are

primarily caught on floating object and fish aggregating device (FAD) sets. Purse seine catches in 2013 were 22,868 t, although unreported purse seine catches are large, as much as 20,000 t for bigeye, skipjack, and yellowfin tuna combined. Peak catches of bigeye tuna occurred in 2001 (100,000 t) and catches have been declining since, to 63,066 t in 2013 (ICCAT 2014).

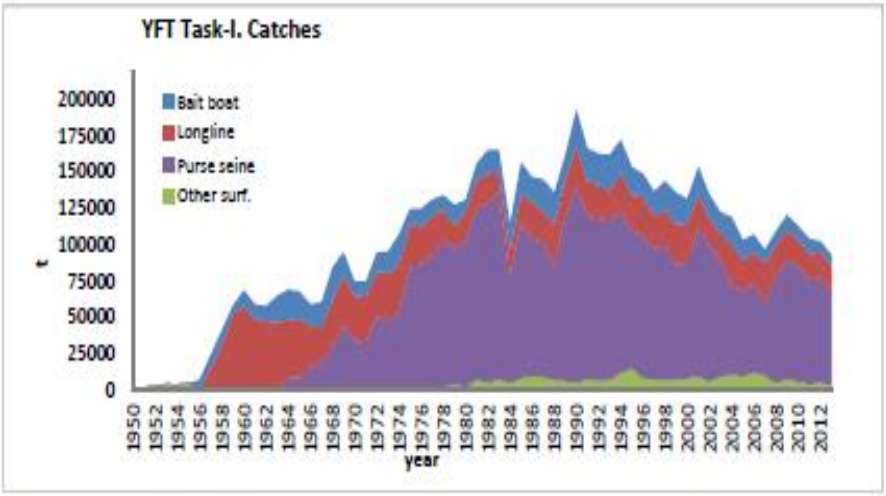
In the Eastern Atlantic, purse seines by far obtain the majority of the skipjack tuna catch. In the Western Atlantic, bait boats catch the majority; this fishery catches the second-highest amount of skipjack in the Eastern Atlantic. Purse seine catches in the Eastern Atlantic were 167,011 t in 2013 and 4,946 t in the Western Atlantic during 2013. Total catches of skipjack tuna in the Atlantic during 2013 were 221,628 t (ICCAT 2014).



SKJ-Figure 3. Total skipjack catches (t) in the Atlantic and by stock (East and West) between 1950 and 2013. Skipjack estimates in the *faux poissons* landed in Côte d'Ivoire were included in the skipjack trade catches in the eastern Atlantic. It is possible that skipjack catches taken in the eastern Atlantic in recent years were not reported or were under-estimated in the logbook correction of species composition based on multi-species sampling carried out at the ports. The 2013 figure is still preliminary, in particular for the East Atlantic.

Figure 3. Skipjack tuna catches in the Atlantic Ocean between 1950 and 2013 [ICCAT 2014].

The primary gears used to capture yellowfin tuna in the Atlantic are purse seines in the Eastern Atlantic and longlines in the Western Atlantic. Bait boat fisheries are also significant in the Eastern Atlantic. By 2007, catches of yellowfin tuna throughout the Atlantic had declined by nearly 50%, from 194,000 t in 1990 to 100,000 t. In recent years, catches have begun to increase. Purse seine catches in particular declined 60% in the Eastern Atlantic between 1990 and 2007 and 90% in the Western Atlantic between 1994 and 2009. Similar to Atlantic-wide catches, purse seine catches have since increased. In the Eastern Atlantic, purse seine catches were 58,014 t in 2013 and 7,903 t in the Western Atlantic during 2014 (ICCAT 2014).



YFT-Figure 2. Estimated annual catch (t) of Atlantic yellowfin tuna by fishing gear, 1950-2013.

Figure 4. Yellowfin tuna catches in the Atlantic Ocean between 1950 and 2013 [ICCAT 2014].

Importance to the U.S./North American market

The majority of albacore imported from the ICCAT Convention area by the United States came from Canada (57%), followed by Mexico (22%) (NMFS 2014).

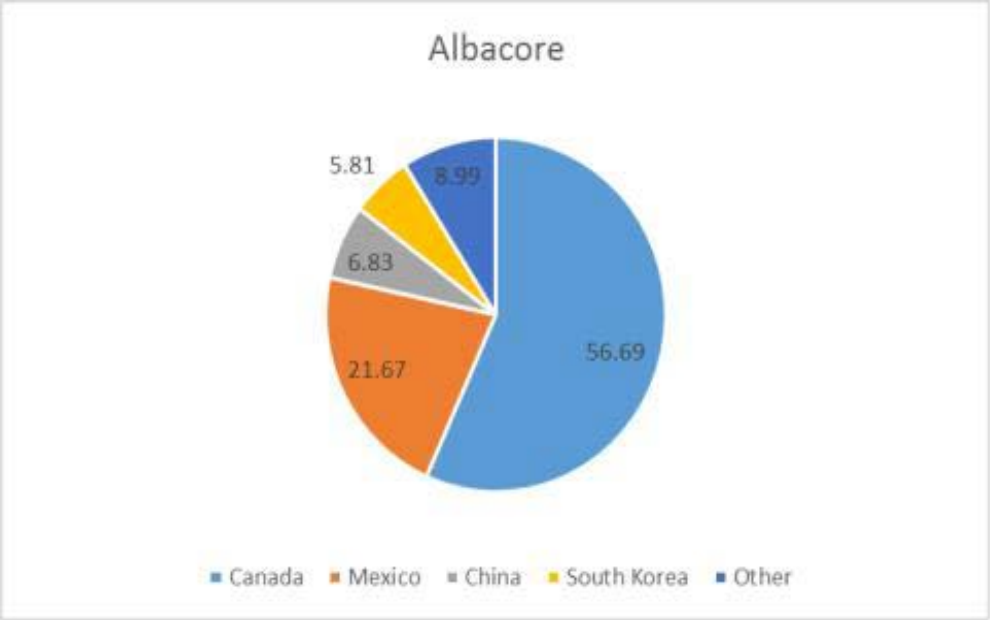


Figure 5. Major contributors to U.S. albacore tuna imports (%), ICCAT Convention Area (country of origin) [NMFS 2013].

Bigeye tuna were primarily imported from South Korea (32%), followed by Brazil (24%), in 2013 (NMFS 2014).

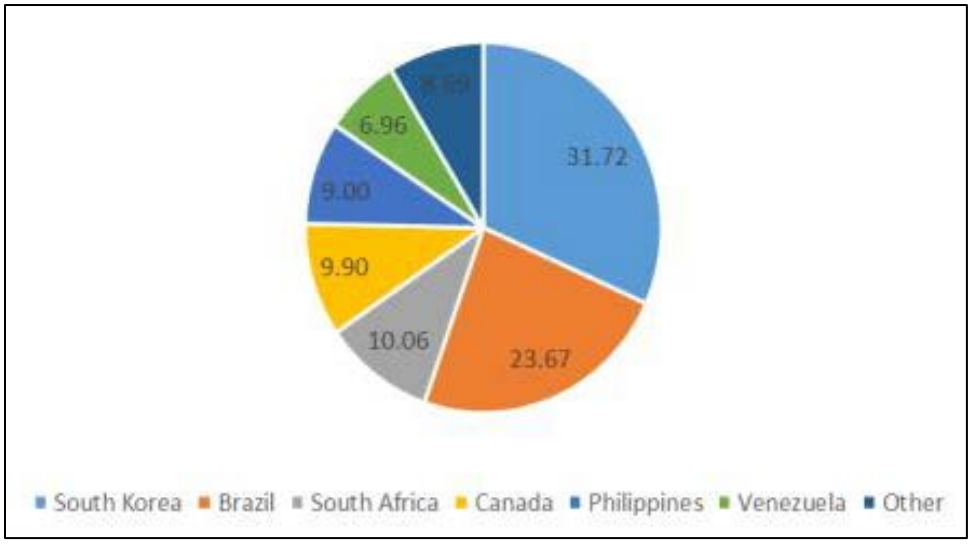


Figure 6. Major contributors to U.S. bigeye tuna imports (%), ICCAT Convention Area (country of origin) [NMFS 2014].

Skipjack tuna imports dropped from 24,128 t in 2011 to 17,635 in 2012. Nearly all (84%) of the skipjack tuna imported by the United States during 2012 came from Mexico (84%).

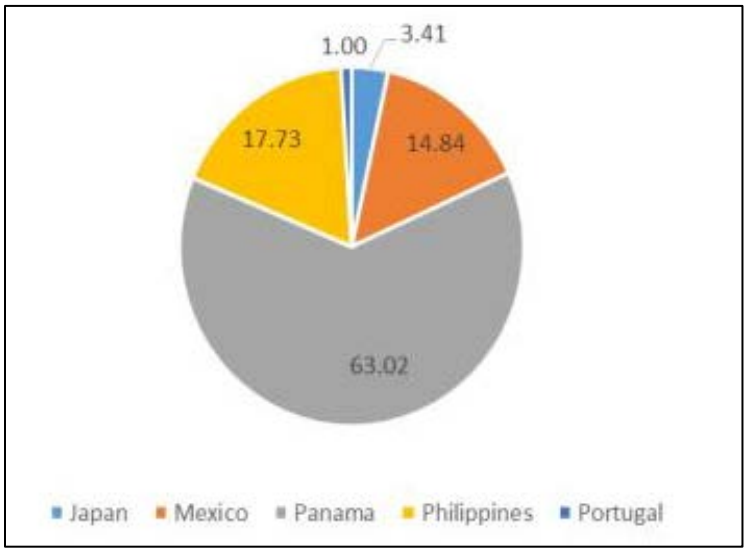


Figure 7. Major contributors to U.S. skipjack tuna imports (%), ICCAT Convention Area (country of origin) [NMFS 2014].

During 2013, yellowfin tuna were primarily imported from the Philippines (24%), followed by Trinidad and Tobago (18%) (NFMS 2014).

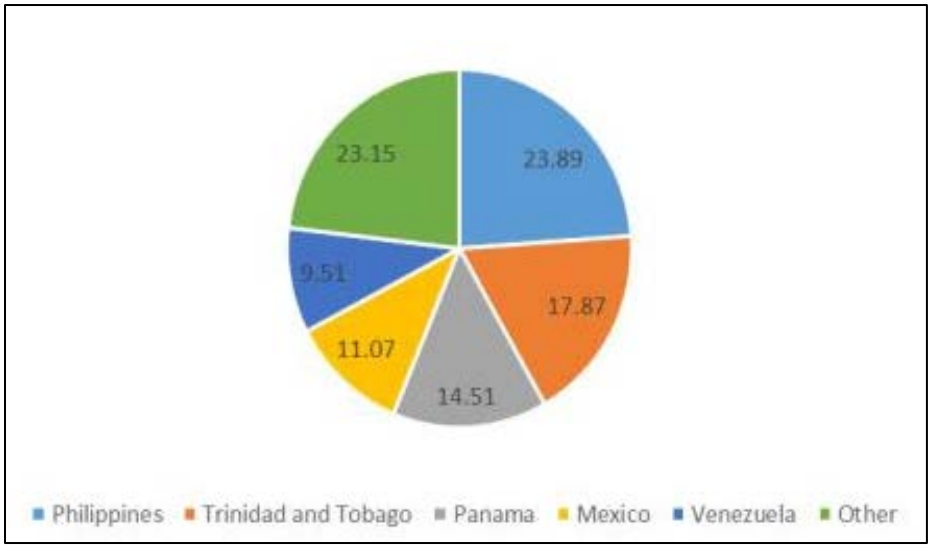


Figure 8. Major contributors to U.S. yellowfin tuna imports (%), ICCAT Convention Area (country of origin) [NMFS 2014].

Common and market names

Albacore tuna is also known as germon, longfinned tuna, albecore, and T. germo. Skipjack tuna are also known as ocean bonito and lesser tuna. In Hawaii, bigeye and yellowfin tuna are known as Ahi, and skipjack is known as Aku. Blackfin tuna does not have any other accepted names.

Primary product forms

These species are sold fresh and frozen and for the sashimi and sushi market.

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Criteria for Fisheries, available at http://www.seafoodwatch.org.

Criterion 1: Stock for which you want a recommendation

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. The inherent vulnerability to fishing rating influences how abundance is scored, when abundance is unknown. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*
  Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical.

Criterion 1 Summary

ALBACORE TUNA				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Atlantic Purse Seine, Floating object	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	**Yellow (3.162)**
Atlantic Purse Seine, Unassociated	2.00:Medium	2.00:High Concern	5.00:Very Low Concern	**Yellow (3.162)**
South Atlantic Purse Seine, Floating object	2.00:Medium	2.00:High Concern	1.00:High Concern	**Red (1.414)**
South Atlantic Purse Seine, Unassociated	2.00:Medium	2.00:High Concern	1.00:High Concern	**Red (1.414)**

BIGEYE TUNA				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
Atlantic Purse Seine, Floating object	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**
Atlantic Purse Seine, Unassociated	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**

BLACKFIN TUNA				
Region / Method	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore

Atlantic Purse Seine, Floating object	2.00:Medium	3.00:Moderate Concern	2.33:Moderate Concern	**Yellow (2.644)**

SKIPJACK TUNA				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Atlantic Purse Seine, Floating object	2.00:Medium	4.00:Low Concern	3.67:Low Concern	**Green (3.831)**
Atlantic Purse Seine, Unassociated	2.00:Medium	4.00:Low Concern	3.67:Low Concern	**Green (3.831)**

YELLOWFIN TUNA				
Region / Method	**Inherent Vulnerability**	**Stock Status**	**Fishing Mortality**	**Subscore**
Atlantic Purse Seine, Floating object	2.00:Medium	2.00:High Concern	2.33:Moderate Concern	**Red (2.159)**
Atlantic Purse Seine, Unassociated	2.00:Medium	2.00:High Concern	2.33:Moderate Concern	**Red (2.159)**

Albacore tuna in both the south and north Atlantic Ocean are currently overfished and are undergoing overfishing in the south but not north Atlantic. There is some uncertainty surrounding the current status of yellowfin tuna populations in the Atlantic, but there is some indication that they may be close to overfished and unsustainably fished. Bigeye tuna populations are fluctuating around healthy levels but have been below these levels in recent years. However, skipjack tuna populations appear to be healthy. The status of blackfin tuna populations is unclear.

Criterion 1 Assessment

<u>ALBACORE TUNA</u>

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*

- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a high vulnerability score of 58 out of 100 (Froese and Pauly 2013). However, the life-history characteristics of albacore suggest only a medium vulnerability to fishing. For example, albacore reach sexual maturity between 5 and 6 years of age and reach a maximum age of 15 years (ISCAWG 2011). They are broadcast spawners and top predators (Froese and Pauly 2013). These life history characteristics result in a “medium” vulnerability.

Factor 1.2 - Stock Status

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

High Concern

The population of albacore tuna in the North Atlantic has been below the level needed to produce the maximum sustainable yield (B_{MSY}) since the mid-1980s, but has improved from the lowest levels in the late 1990s. There is considerable uncertainty surrounding the status of albacore tuna in the North Atlantic, as evidenced by the wide array of model results. However, the ratio of the current spawning stock biomass to the maximum sustainable yield ($SSB_{current}/SSB_{MSY}$) is estimated to be 0.94 (0.74–1.14). There is a 0.2% probability that the population is overfished and undergoing overfishing; a 27.4% probability that the population is neither overfished nor undergoing overfishing; and a 72.4% probability that the population is either overfished or that overfishing is occurring, but not both (ICCAT 20013). So this results in a "high" concern score.

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

High Concern

The 2013 assessment of albacore tuna in the South Atlantic provided a wide range of results. Based on all scenarios included in the assessment, there is a 57% probability that the population of albacore tuna is overfished and undergoing overfishing; a 13% probability that the population is overfished or undergoing overfishing, but not both; and a 30% probability that the biomass is above and that fishing mortality is below Convention objectives (ICCAT 2013a). The ratio of the current biomass to one that would produce the maximum sustainable yield (B/B_{MSY}) is 0.92 (0.71–1.26). Because both populations are overfished, this is scored as "high" concern.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*

- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Very Low Concern

The maximum sustainable yield (MSY) of albacore tuna in the North Atlantic is estimated to be 31,680 t. Fishing mortality rates from the 1960s to mid-2000s were above the levels needed to produce the maximum sustainable yield (F_{MSY}). But F_{2012}/F_{MSY} = 0.72 (0.55–0.89) and the population is no longer undergoing overfishing (ICCAT 2013a), so it is scored as “very low” concern.

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

High Concern

According to the last assessment (2013) conducted for the South Atlantic population, the median maximum sustainable yield (MSY) value was 25,228 t (19,109–28,360 t) in 2012, and the median ratio of current fishing mortality rates to those that produce the maximum sustainable yield (F/F_{MSY}) was 1.04 (0.38–1.32). The status is difficult to determine from this large degree of uncertainty, but it is likely that overfishing is occurring, with a 57% chance that the population is overfished and that overfishing is occurring (ICCAT 2013a). There are management measures in place but they have failed to maintain the population, so it is scored as “high” concern.

BIGEYE TUNA

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*

- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a high to very high vulnerability of 72 out of 100 (Froese and Pauly 2013). However, bigeye tuna's life-history characteristics suggest a medium vulnerability to fishing. For example, bigeye tuna reach sexual maturity around the time they reach a size of 100–125 cm; they reach a maximum size of 200 cm and live around 11 years (Davies et al. 2011) (Froese et al. 2013). They are broadcast spawners and top predators (Froese and Pauly 2013). These life-history characteristics result in a "medium" vulnerability.

Factor 1.2 - Stock Status

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Moderate Concern

Bigeye tuna in the Atlantic was last assessed in 2010. Large declines in abundance occurred during the mid-1990s, but over the past 5 to 6 years, abundance appears to have increased. In 2010, the biomass was estimated between 72% and 134% of the biomass at maximum sustainable levels (B_{MSY}) (median = 101%), whereas median estimates of B/B_{MSY} from the late 1990s to 2008/09 were below 1. The 2010 assessment contained uncertainty surrounding the best method to represent the dynamics of the stock, and the indices of abundance and the calculation of model inputs were very large in this assessment (ICCAT 2010a). Because the biomass is fluctuating around B_{MSY} and bigeye tuna has a moderate vulnerability to fishing, this factor is scored as "moderate" concern.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Moderate Concern

Bigeye tuna in the Atlantic were last assessed in 2010. The maximum sustainable yield (MSY) was

estimated between 78,700 t and 101,600 t, with a median value of 92,000 t. Fishing mortality has historically been high, particularly during the mid-1990s when fishing mortality was higher than F_{MSY}. In recent years, fishing mortality rates have declined; currently, they are estimated between 65% and 155% of F_{MSY}, with the median value at 95% (ICCAT 2010a). Because F appears to be fluctuating around F_{MSY}, this is scored as "moderate" concern.

BLACKFIN TUNA

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Atlantic, Purse Seine, Floating object

Medium

FishBase assigned a moderate vulnerability score of 41 out of 100 (Froese and Pauly 2013). Blackfin tuna is a small tuna species that reaches sexual maturity by 50 cm length and 3 years of age. The maximum length attained is around 108 cm and they live to around 5 years. Blackfin tuna are broadcast spawners and high-level predators in the ecosystem (Froese and Pauly 2014). These life-history characteristics also suggest a "medium" vulnerability.

Factor 1.2 - Stock Status

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Atlantic, Purse Seine, Floating object

Moderate Concern

In Atlantic waters, blackfin tuna are assessed along with 13 other "small tuna" species. Currently, there is not enough information to conduct a full assessment of this group (ICCAT 2012a). According to the International Union for Conservation of Nature (IUCN), blackfin tuna is a species of Least Concern, with a stable population trend, and is considered one of the most common tuna species in the western Atlantic (Collette et al. 2011a). This is scored as "moderate" concern because information on their status is unknown and they have a moderate vulnerability to fishing pressure.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*

- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Atlantic, Purse Seine, Floating object

Moderate Concern

Blackfin tuna makes up a small proportion of "small tuna" catches in the Atlantic Ocean. No assessment has been conducted due to a lack of data. Landings have been variable over the years, peaking in the early 1990s but showing no consistent trend over time (ICCAT 2012a). They are caught by a variety of gears but there is no indication that overfishing is occurring (Collette et al. 2011a). Because information on fishing mortality is not available, this is scored as "moderate" concern.

SKIPJACK TUNA

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing, (e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).*
- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a moderate vulnerability score of 39 out of 100 (Froese and Pauly 2013). Skipjack life-history characteristics support this score. Sexual maturity is reached around 45 cm length or 2 years old, and they can reach a maximum size of 110 cm and age of 12 years. They are broadcast spawners and have a high trophic level (Froese and Pauly 2013).

Factor 1.2 - Stock Status

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Low Concern

Stock assessments for skipjack tuna are difficult to employ due to its biology and fishery characteristics. In the Atlantic Ocean, eastern and western stocks of skipjack tuna are assessed. According to the most recent assessment conducted in 2014, the biomass in the eastern region is likely above target levels (biomass needed to produce the maximum sustainable yield, B_{MSY}) and the biomass in the western region is “probably” 30% above the level needed to produce the maximum sustainable yield (B_{2013}/B_{MSY} = 1.3). Both populations are not overfished (ICCAT 2014). The high level of uncertainty associated with this assessment precludes a score of very low concern, so this factor rates as “low” concern.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target*

species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).

- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Low Concern

Stock assessments for skipjack tuna are difficult to conduct based on their life history and the fishery characteristics. The last assessment in the Atlantic was conducted in 2014 for eastern and western populations. The assessment determined that the fishing mortality rate (F_{2013}) in the Eastern Atlantic was likely below the level needed to produce the maximum sustainable yield (F_{MSY}), and the rate in the Western Atlantic was likely 30% below F_{MSY} (F_{2013}/F_{MSY} = 0.70) (ICCAT 2014). Because the populations appear to be sustainably fished but there is some uncertainty surrounding the results, this factor scores as “low” concern rather than very low concern.

YELLOWFIN TUNA

Factor 1.1 - Inherent Vulnerability

Scoring Guidelines

- *Low—The FishBase vulnerability score for species is 0-35, OR species exhibits life history characteristics that make it resilient to fishing, (e.g., early maturing (*
- *Medium—The FishBase vulnerability score for species is 36-55, OR species exhibits life history characteristics that make it neither particularly vulnerable nor resilient to fishing,*

(e.g., moderate age at sexual maturity (5-15 years), moderate maximum age (10-25 years), moderate maximum size, and middle of food chain).

- *High—The FishBase vulnerability score for species is 56-100, OR species exhibits life history characteristics that make is particularly vulnerable to fishing, (e.g., long-lived (>25 years), late maturing (>15 years), low reproduction rate, large body size, and top-predator).*
  Note: The FishBase vulnerability scores is an index of the inherent vulnerability of marine fishes to fishing based on life history parameters: maximum length, age at first maturity, longevity, growth rate, natural mortality rate, fecundity, spatial behaviors (e.g., schooling, aggregating for breeding, or consistently returning to the same sites for feeding or reproduction) and geographic range.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a moderate vulnerability score of 46 out of 100 (Froese and Pauly 2013). Yellowfin tuna reaches sexual maturity around 100 cm in length and 2–5 years of age. A maximum length of 140–150 cm can be attained and they can live 8–9 years. They are broadcast spawners and high-level predators in the ecosystem (Froese and Pauly 2014) (ICCAT 2014). These life-history characteristics also support a “medium” level of vulnerability.

Factor 1.2 - Stock Status

Scoring Guidelines

- *5 (Very Low Concern)—Strong evidence exists that the population is above target abundance level (e.g., biomass at maximum sustainable yield, BMSY) or near virgin biomass.*
- *4 (Low Concern)—Population may be below target abundance level, but it is considered not overfished*
- *3 (Moderate Concern) —Abundance level is unknown and the species has a low or medium inherent vulnerability to fishing.*
- *2 (High Concern)—Population is overfished, depleted, or a species of concern, OR abundance is unknown and the species has a high inherent vulnerability to fishing.*
- *1 (Very High Concern)—Population is listed as threatened or endangered.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

High Concern

Yellowfin tuna in the Atlantic Ocean was last assessed in 2011. There was some degree of uncertainty with the two models, which indicated opposite results (i.e., one showed an increasing abundance trend and the other showed a decreasing trend). The population is currently estimated to be 15% below Convention objectives (B_{2010}/B_{MSY} = 0.85 (0.61–1.12)) and therefore overfished (ICCAT 2011d). This rates as "high" concern because the population is considered overfished.

Factor 1.3 - Fishing Mortality

Scoring Guidelines

- *5 (Very Low Concern)—Highly likely that fishing mortality is below a sustainable level (e.g., below fishing mortality at maximum sustainable yield, FMSY), OR fishery does not target species and its contribution to the mortality of species is negligible (≤ 5% of a sustainable level of fishing mortality).*
- *3.67 (Low Concern)—Probable (>50%) chance that fishing mortality is at or below a sustainable level, but some uncertainty exists, OR fishery does not target species and does not adversely affect species, but its contribution to mortality is not negligible, OR fishing mortality is unknown, but the population is healthy and the species has a low susceptibility to the fishery (low chance of being caught).*
- *2.33 (Moderate Concern)—Fishing mortality is fluctuating around sustainable levels, OR fishing mortality is unknown and species has a moderate-high susceptibility to the fishery and, if species is depleted, reasonable management is in place.*
- *1 (High Concern)—Overfishing is occurring, but management is in place to curtail overfishing, OR fishing mortality is unknown, species is depleted, and no management is in place.*
- *0 (Critical)—Overfishing is known to be occurring and no reasonable management is in place to curtail overfishing.*

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

Moderate Concern

The current fishing mortality rate is estimated to be 13% below F_{MSY} ($F_{current}/F_{MSY}$ = 0.87 (0.68–1.40)) and the maximum sustainable yield (MSY) is estimated at 144,600 t (ICCAT 2011d). This suggests that fishing mortality rates are sustainable. However, the assessment had some degree of uncertainty surrounding the results, with two models indicating opposite trends. One model estimated that fishing mortality rates were not sustainable, while the other estimated they were sustainable (ICCAT 2011d). In addition, the fishing mortality reference point used in the base case model (F_{max}, the fishing level that produces

the largest yield per catch from the fishery) may not be suitable, because some studies have indicated that F_{max} is likely greater than F_{MSY} (Gabriel and Mace 1999). Therefore, if a more conservative reference points were used, it may have actually indicated that overfishing is occurring (ICCAT 2011k). This precludes a score of low concern and instead rates as “moderate” concern.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated in the same way as the species under assessment were evaluated in Criterion 1. Seafood Watch® defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard rate score (ranges from 0-1), which evaluates the amount of non-retained catch (discards) and bait use relative to the retained catch. The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*
  Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical.

Criterion 2 Summary

Albacore tuna: Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
BLUE MARLIN	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
TRIGGERFISH SPP.	Medium	3.00: Moderate	2.33: Moderate	**2.644**

		Concern	Concern	
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
WAHOO	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Albacore tuna: Atlantic, Purse Seine, Unassociated

Subscore:: **1.916** **Discard Rate:** **1.00** **C2 Rate:** **1.916**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
ATLANTIC SAILFISH	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Albacore tuna: South Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
ALBACORE TUNA	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**

YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
TRIGGERFISH SPP.	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLUE MARLIN	Medium	2.00: High Concern	3.67: Low Concern	**2.709**
WAHOO	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Albacore tuna: South Atlantic, Purse Seine, Unassociated

Subscore:: **1.916** **Discard Rate:** **1.00** **C2 Rate:** **1.916**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
ALBACORE TUNA	Medium	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
ATLANTIC SAILFISH	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Bigeye tuna: Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
BLUE MARLIN	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
TRIGGERFISH SPP.	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
WAHOO	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Bigeye tuna: Atlantic, Purse Seine, Unassociated

Subscore:: **1.916** **Discard Rate:** **1.00** **C2 Rate:** **1.916**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
TURTLES	High	1.00: Very	3.67: Low	**1.916**

		High Concern	Concern	
ATLANTIC SAILFISH	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Blackfin tuna: Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
BLUE MARLIN	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
TRIGGERFISH SPP.	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
WAHOO	Medium	3.00:	3.67: Low	**3.318**

		Moderate Concern	Concern	
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Skipjack tuna: Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
BLUE MARLIN	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
TRIGGERFISH SPP.	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
WAHOO	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Skipjack tuna: Atlantic, Purse Seine, Unassociated

Subscore:: **1.916** **Discard Rate:** **1.00** **C2 Rate:** **1.916**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
ATLANTIC SAILFISH	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Yellowfin tuna: Atlantic, Purse Seine, Floating object

Subscore:: **1.000** **Discard Rate:** **1.00** **C2 Rate:** **1.000**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
OCEANIC WHITETIP SHARK	High	1.00: Very High Concern	1.00: High Concern	**1.000**
BLUE MARLIN	Medium	2.00: High Concern	1.00: High Concern	**1.414**
SILKY SHARK	High	2.00: High Concern	1.00: High Concern	**1.414**
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
BLACKFIN TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
RAINBOW RUNNER	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**

TRIGGERFISH SPP.	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
WAHOO	Medium	3.00: Moderate Concern	3.67: Low Concern	**3.318**
DOLPHINFISH (MAHI MAHI)	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Yellowfin tuna: Atlantic, Purse Seine, Unassociated

Subscore:: **1.916** **Discard Rate:** **1.00** **C2 Rate:** **1.916**

Species	Inherent Vulnerability	Stock Status	Fishing Mortality	Subscore
TURTLES	High	1.00: Very High Concern	3.67: Low Concern	**1.916**
ATLANTIC SAILFISH	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
YELLOWFIN TUNA	Medium	2.00: High Concern	2.33: Moderate Concern	**2.159**
BIGEYE TUNA	Medium	3.00: Moderate Concern	2.33: Moderate Concern	**2.644**
ALBACORE TUNA	Medium	2.00: High Concern	5.00: Very Low Concern	**3.162**
SKIPJACK TUNA	Medium	4.00: Low Concern	3.67: Low Concern	**3.831**

Bycatch levels are typically larger in associated vs. unassociated purse seine fisheries. The majority of information related to bycatch in Atlantic purse seine fisheries comes from European fleets (Hall and Martin 2013). The total bycatch rates in 2008 and 2009 were 13.4% and 19.4%, respectively, on associated fish aggregating device (FAD) sets in the French and Spanish purse seine fisheries (Amande et al. 2011). A variety of species, including tuna, billfish, sharks, and sea turtles, have been reported as bycatch in associated purse seine fisheries. Species that had high occurrence rates are included in this report as “main species” as well as some species whose vulnerability status qualifies them for inclusion (based on Seafood Watch criteria). The worst-scoring species in the associated fishery is the oceanic whitetip shark, based on its low abundance and high fishing mortality rates. In the unassociated fishery, turtles scored the worst due to their various International Union for the Conservation of Nature (IUCN) listings.

Floating object		
Species	Justification	Source
Blue marlin	11% occurrence per set (percentage animal occurred in the catch during a set), most significant in terms of weight and number	Chassot et al. 2008; Hall and Roman 2013
Dolphinfish	37% occurrence per set	Chassot et al. 2008
Oceanic whitetip shark	>5% (3% occurrence per set) but depleted	Chassot et al. 2008
Silky shark	14% occurrence per set	Chassot et al. 2008
Wahoo	53% occurrence per set	Chassot et al. 2008
Rainbow runner	53% occurrence per set	Chassot et al. 2008
Triggerfish	17%–22% occurrence per set	Chassot et al. 2008
Turtles	2% occurrence per set	Chassot et al. 2008

Unassociated		
Species	Justification	Source
Atlantic sailfish	22% observed catch (2005–2008)	Chassot et al. 2008; Hall and Roman 2013
Atlantic bluefin tuna	<5%, depleted	Chassot et al. 2008
Turtles	2% occurrence per set	Chassot et al. 2008

Criterion 2 Assessment

<u>ATLANTIC SAILFISH</u>

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a high vulnerability score of 65 out of 100 (Froese and Pauly 2013). Atlantic sailfish are broadcast spawners, reaching sexual maturity around 121–146 cm in length, and can reach a maximum length of 315 cm and live around 4 years. They have a high trophic level of 4.5 (Froese and Pauly 2013). According to these life-history characteristics, Atlantic sailfish has a “medium” vulnerability to fishing.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Unassociated

High Concern

Two populations of sailfish are assessed in the Atlantic: Eastern and Western. The last assessment was conducted in 2009 and there was a large amount of uncertainty surrounding the actual status of the two populations. There was evidence that the populations were overfished, particularly in the Eastern region. However, some model results indicated that the Western population is not overfished. Large declines in abundance of Atlantic sailfish occurred prior to 1990, but since 1990 estimates of abundance show different trends depending on the source (ICCAT 2009c). Because there is some indication the populations are overfished, this is scored as “high “concern score.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Unassociated

Moderate Concern

Atlantic sailfish are caught as bycatch in purse seine fisheries in the Atlantic and have been reported to be one of the more commonly caught bycatch species in unassociated sets (an occurrence level twice that of FAD sets) (Chassot et al. 2008). However, the majority of fishing mortality for this species comes from longline fisheries. The majority of sailfish are caught in the Eastern compared to the Western Atlantic. The last assessment conducted in 2009 was highly uncertain. The maximum sustainable yield

(MSY) was almost twice as high in the Eastern (1,250–1,950 t) as in the Western (600–1,100 t) Atlantic. Overfishing is likely occurring in the Eastern Atlantic and possibly occurring in the Western (ICCAT 2009c). Because purse seine fisheries are not the primary cause of fishing mortality for this species, this precludes a score of high concern. This is scored as “moderate” concern to account for the Eastern population likely undergoing overfishing.

South Atlantic, Purse Seine, Unassociated

Moderate Concern

Atlantic sailfish are caught as bycatch in purse seine fisheries in the Atlantic and have been reported to be one of the more commonly caught bycatch species in unassociated sets (an occurrence level twice that of FAD sets) (Chassot et al. 2008). However, the majority of fishing mortality for this species comes from longline fisheries. The majority of sailfish are caught in the Eastern compared to the Western Atlantic. The last assessment conducted in 2009 was highly uncertain. The maximum sustainable yield (MSY) was almost twice as high in the Eastern (1,250–1,950 t) as in the Western (600–1,100 t) Atlantic. Overfishing is likely occurring in the Eastern Atlantic and possibly occurring in the Western (ICCAT 2009c). Because purse seine fisheries are not the primary cause of fishing mortality for this species, this precludes a score of high concern. This is scored as “moderate” concern to account for the Eastern population likely undergoing overfishing.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

BIGEYE TUNA

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a high to very high vulnerability of 72 out of 100 (Froese and Pauly 2013). However, bigeye tuna's life-history characteristics suggest a medium vulnerability to fishing. For example, bigeye tuna reach sexual maturity around 100–125 cm, reach a maximum size of 200 cm, and live around 11 years (Davies et al. 2011) (Froese et al. 2013). They are broadcast spawners and top predators (Froese and Pauly 2013). These life-history characteristics result in a "medium" score.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderate Concern

Bigeye tuna in the Atlantic were last assessed in 2010. Large declines in abundance occurred during the mid-1990s, but over the past 5 to 6 years, there appears to have been an increase in abundance. In 2010 the biomass was estimated between 72% and 134% of the biomass at maximum sustainable levels (B_{MSY}) (median = 101%). However, median estimates of B/B_{MSY} from the late 1990s to 2008/09 were below 1. Uncertainties surrounding the best method to represent the dynamics of the stock, the indices of abundance, and the calculation of model inputs were very large in this assessment (ICCAT 2010a). Because the biomass is fluctuating around B_{MSY} and bigeye tuna has a moderate vulnerability to fishing, this results in a score of "moderate" concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderate Concern

Bigeye tuna in the Atlantic were last assessed in 2010. The maximum sustainable yield (MSY) was estimated between 78,700 t and 101,600 t, with a median value of 92,000 t. Fishing mortality has historically been high, particularly during the mid-1990s when fishing mortality was higher than F_{MSY}. In recent years, fishing mortality rates have declined and are currently estimated between 65% and 155% of F_{MSY}, with the median value being 95% (ICCAT 2010a). Because F appears to be fluctuating around F_{MSY}, this results in a score of "moderate" concern.

Factor 2.4 - Discard Rate

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

South Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

BLACKFIN TUNA

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

South Atlantic, Purse Seine, Floating object

Medium

FishBase assigned a moderate vulnerability score of 41 out of 100 (Froese and Pauly 2013). Blackfin tuna is a small tuna species that reaches sexual maturity by 50 cm and 3 years of age. The maximum length attained is around 108 cm and they live to around 5 years. Blackfin tuna are broadcast spawners and high-level predators in the ecosystem (Froese and Pauly 2014). These life-history characteristics also suggest a “medium” vulnerability level.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

South Atlantic, Purse Seine, Floating object

Moderate Concern

In Atlantic waters, blackfin tuna are assessed along with 13 other “small tuna” species. Currently there is not enough information to conduct a full assessment of this group (ICCAT 2012a). According to the International Union for Conservation of Nature (IUCN), blackfin tuna is a species of Least Concern, with a stable population trend, and is considered one of the most common tuna species in the Western Atlantic (Collette et al. 2011a). Because information on their status is unknown and they have a moderate vulnerability to fishing pressure, this factor is scored as “moderate” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

South Atlantic, Purse Seine, Floating object

Moderate Concern

Blackfin tuna make up a small proportion of “small tuna” catches in the Atlantic Ocean. No assessment has been conducted due to a lack of data. Landings have been variable over the years, peaking in the early 1990s but showing no consistent trend over time (ICCAT 2012a). They are caught by a variety of gears but there is no indication that overfishing is occurring (Collette et al. 2011a). This results in a

"moderate" concern score because information on fishing mortality is not available.

Factor 2.4 - Discard Rate

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

BLUE MARLIN

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Medium

FishBase assigned a moderate vulnerability score of 52 out of 100 (Froese and Pauly 2013). Blue marlin reach sexual maturity between 50 cm and 80 cm in length and can reach 500 cm. They are broadcast spawners and top predators in the ecosystem (Froese and Pauly 2014).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High Concern

Blue marlin in the Atlantic were last assessed in 2011. According to the assessment, the current biomass is well below the biomass that produces the maximum sustainable yield (B_{MSY}). There was conflicting information on the biomass trend, with some indices showing that biomass declines had stopped, while others indicated that the declines were continuing. The working group therefore suggested a possible stabilizing trend in abundance. Due to a lack of data, it was estimated that at least 4–5 years of additional data were needed to conduct another assessment (ICCAT 2011f). Blue marlin are also listed as Vulnerable by the International Union for the Conservation of Nature (IUCN) (Collette et al. 2011g). Because of the low abundance size and IUCN status, this is scored as “high” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

High Concern

Catches of blue marlin in purse seine fisheries operating around moored FADs are known to be high but underreported (Chassot et al. 2008) (Menard et al. 2000) (Amande et al. 2010). The maximum sustainable yield (MSY) is estimated to be around 2,000 t (1,000 t to 2,400 t), and current fishing mortality rates are higher than F_{MSY} but possibly smaller than $F_{replacement}$, which is the level of fishing mortality that would keep the biomass constant between years (ICCAT 2011f). This results in a score of “high” concern.

South Atlantic, Purse Seine, Floating object

Low Concern

The United States is not a major contributor to overall catches in the Atlantic. The greenstick pilot program only caught four bigeye tuna (<1% of the total catch) (NOAA 2012). Bigeye tuna in the Atlantic were last assessed in 2010. The maximum sustainable yield (MSY) was estimated to range between 78,700 t and 101,600 t, with a median value of 92,000 t. Fishing mortality has historically been high, particularly during the mid-1990s when fishing mortality was higher than F_{MSY}. In recent years, fishing mortality rates have declined; currently, they are estimated between 65% and 155% of F_{MSY}. The median value is 95% and therefore overfishing is not occurring (ICCAT 2010a).

Catches of blue marlin in purse seine fisheries operating around moored FADs are known to be high but underreported (Chassot et al. 2008) (Menard et al. 2000) (Amande et al. 2010). The maximum sustainable yield (MSY) is estimated to be around 2,000 t (1,000 t to 2,400 t), and current fishing mortality rates are higher than F_{MSY} but possibly smaller than $F_{replacement}$, which is the level of fishing

mortality that would keep the biomass constant between years (ICCAT 2011f). This results in a score of "high" concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

DOLPHINFISH (MAHI MAHI)

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Medium

FishBase assigned a moderate vulnerability score of 39 out of 100 (Froese and Pauly 2013). Dolphinfish reaches sexual maturity between 35 and 55 cm in length and within the first year of life. The maximum size and age reached is 210 cm and 4 years. They are broadcast spawners and high-level predators (Froese and Pauly 2014).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Low Concern

Dolphinfish is assessed along with 13 other “small tunas” in the Atlantic. Currently there is not enough information to conduct a full assessment of this group (ICCAT 2012a). A separate preliminary attempt at a stock assessment for dolphinfish in the Caribbean and for the U.S. fishery was conducted in 2006. The results suggested that catch rates had been fairly stable over the 10-year study period and that the population was likely near virgin levels in both areas (Parker et al. 2006). In addition, the International Union for Conservation of Nature (IUCN) considers dolphinfish a species of Least Concern. with a stable population trend. Due to the IUCN status and the results of the preliminary assessment indicating the population was likely near virgin levels, this is scored as “low” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Low Concern

Dolphinfish makes up a small proportion of “small tuna” catches in the Atlantic Ocean. No assessment has been conducted due to a lack of data (ICCAT 2012a). Dolphinfish are caught by a variety of gears (Collette et al. 2011d). In the Atlantic, catches have increased considerably since the 1950s but have begun to decrease in recent years (FAO 2013). Fisheries are not considered to be a major threat to this species (Collette et al. 2011d) but they are a reported bycatch species in purse seine fisheries (Menard et al. 2000). For example, they made up around 3% (in terms of numbers of fish) of “other fish” species in French and Spanish purse seine fisheries between 2003 and 2007 (Amande et al. 2010). Because they are a non-target species and fisheries are not considered to be a major threat, this is scored as “low” concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

OCEANIC WHITETIP SHARK

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High

FishBase assigned a very high vulnerability score of 75 out of 100 (Froese and Pauly 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Very High Concern

Stock assessments for oceanic whitetip sharks throughout the Atlantic Ocean have not been conducted. They have been assessed via an Ecological Risk Assessment in 2008 and 2012, at which point they ranked 13th out of 20 in terms of productivity, indicating that they are more productive than other species (ICCAT 2012h). However, according to the International Union for Conservation of Nature (IUCN), oceanic whitetip sharks are assessed as Critically Endangered, due to radical declines in population sizes over time (Baum et al. 2006). Published estimates of declines range from 70%–90% but the methods used in those studies have been questioned (Burgess et al. 2007). Based on the IUCN status, this is scored as “very high” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High Concern

Information on fishing mortality rates for oceanic whitetip sharks in the Atlantic Ocean is not available (Baum et al. 2006). This is due to a general lack of data, and makes stock assessments very difficult. An Ecological Risk Assessment was conducted in 2012 and oceanic whitetip sharks ranked sixth out of 20 species in terms of susceptibility to longline capture (Cortes et al. 2012). Fishing mortality rates are unknown; and even though purse seine fisheries do not catch the majority of oceanic whitetip, the associated fishery's contribution is considered substantial due in part to the potential for ghost fishing mortality (e.g., (Filmalter et al. 2013)); and effective management is not fully implemented, so this is scored as "high" concern. Although retention is prohibited, this does not ensure that post-release survival rates are high.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

RAINBOW RUNNER

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Medium

FishBase assigned a moderate vulnerability score of 41 out of 100 (Froese and Pauly 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Moderate Concern

No assessments have been conducted in the Atlantic Ocean and so their status is unknown; this results in a “moderate” concern score.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Moderate Concern

Although information on fishing mortality rates is not available for this species in the Atlantic, it is reported to be one of the most common bycatch species in the European purse seine fishery, having a 53% occurrence rate per set (Chassot et al. 2008). Rainbow runner are also reported as common bycatch in other FAD purse seine fisheries in the Northeast Atlantic (Menard et al. 2000), and made up 18% (in terms of number of fish) of the total “other bony fish” catch between 2003 and 2005 in the French and Spanish purse seine fisheries (Amande et al. 2010). Due to their unknown status and high

incidental capture rates in this fishery, this is scored as “moderate” concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

SILKY SHARK

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High

FishBase assigned a very high vulnerability score of 79 out of 100 (Froese and Pauly 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High Concern

A stock-wide population assessment of silky sharks in the Atlantic Ocean has not been conducted. The International Union for Conservation of Nature (IUCN) has listed silky sharks as Vulnerable in the Northwest Atlantic and Western Central Atlantic Ocean, and Near Threatened in the Southwest Atlantic Ocean. Some analysis of catch rate series in the Northwest and Central Atlantic Ocean has indicated large declines in population size (Baum et al. 2003) (Cortes et al. 2007). However, there are significant issues with species identification and an overall lack of reporting for this species (Bonfil et al. 2009). Based on the IUCN status, this is scored as “high” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

High Concern

Silky sharks are caught as bycatch in several fisheries in the Atlantic, particularly purse seine fisheries (Bonfil et al. 2009). They have been reported as one of the most common bycatch species in European purse seine fisheries on FADs (Menard et al. 2000), and made up 72% of all shark species observed caught between 2003 and 2007 in the Spanish and French fisheries (Amande et al. 2010). The incidental mortality from fisheries is thought to be a contributing factor to silky shark population declines (Bonfil et al. 2009). However, in the Atlantic, silky sharks are prohibited from being retained (ICCAT 2011i), so this results in a score of “high” concern rather than critical concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine

fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

SKIPJACK TUNA

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a moderate vulnerability score of 39 out of 100 (Froese and Pauly 2013). Skipjack life-history characteristics support this score. Sexual maturity is reached around 45 cm length or 2 years old, and skipjack can reach a maximum size of 110 cm and age of 12 years. They are broadcast spawners and have a high trophic level (Froese and Pauly 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Low Concern

Stock assessments for skipjack tuna are difficult to employ due to its biology and fishery characteristics. In the Atlantic Ocean, eastern and western stocks of skipjack tuna are assessed. According to the most recent assessment conducted in 2014, the biomass in the eastern region is likely above target levels (biomass needed to produce the maximum sustainable yield (B_{MSY}) and the biomass in the western region is “probably” 30% above the level needed to produce the maximum sustainable yield (B_{2013}/B_{MSY} = 1.3). Both populations are not overfished (ICCAT 2014). The high level of uncertainty associated with this assessment precludes a score of very low concern, so this rates as “low” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Low Concern

Stock assessments for skipjack tuna are difficult to conduct based on their life history and the fishery characteristics. The last assessment in the Atlantic was conducted in 2014 for eastern and western populations. The assessment determined that the fishing mortality rate (F_{2013}) in the Eastern Atlantic was likely below the level needed to produce the maximum sustainable yield (F_{MSY}), and the rate in the Western Atlantic was likely 30% below F_{MSY} ($F_{2013}/F_{MSY} = 0.70$) (ICCAT 2014). Because the populations appear to be sustainably fished but there is some uncertainty surrounding the results, this factor scores as “low” concern rather than very low concern.

Factor 2.4 - Discard Rate

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

South Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile

skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

TRIGGERFISH SPP.

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Medium

Triggerfish have low to moderate vulnerability scores (32–44 out of 100) (Froese et al. 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Moderate Concern

Several species of triggerfish have been assessed by the International Union for Conservation of Nature (IUCN) and have all been assigned a Least Concern status (IUCN 2013). Because no assessment has been conducted but they are listed as Least Concern by the IUCN, and because they have a moderate level of vulnerability to fishing, this is scored as “moderate” concern.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Moderate Concern

Several species of triggerfish, including grey and bluespotted, are reported as common bycatch species in purse seine fisheries. They can make up as much as 12% of the total catch (Menard et al. 2000) and 59% of "other fish" total catch (Amande et al. 2010). Other information suggests occurrence rates per set of 16% (Chassot et al. 2008). However, fishing mortality rates are unknown for these species, so this is scored as "moderate" concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

TURTLES

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

High

Sea turtles have a high level of vulnerability (Seafood Watch 2013).

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Very High Concern

Several species of sea turtles—green, hawksbill, Kemp's ridley, leatherback, loggerhead, and olive ridley—have been reported as incidentally captured in purse seine fisheries operating in the Atlantic Ocean. Several of these species are listed as Endangered by the International Union for Conservation of Nature (IUCN), have decreasing population sizes, and are listed on the U.S. Endangered Species Act (ESA) or on the Convention on International Trade in Endangered Species (CITES) Appendix 1. This results in a "very high" concern score.

Rationale:
Green: The IUCN has classified green sea turtles as Endangered with a decreasing population trend. Green sea turtles have been listed on CITES since 1975 and are currently listed on CITES Appendix 1, meaning that they are threatened with extinction and that international trade is prohibited. The mean annual number of nesting turtles worldwide has decreased by 48% to 67% over the past 100 to 150 years (Seminoff 2004). In the Atlantic, 4 populations have shown declines of around 80%–90%, while 11 populations have shown increases in population sizes of up to 113%. The largest increases in population sizes have occurred in the Western Atlantic region (Masion et al. 2010).

Hawksbill: The IUCN has classified hawksbill turtles as Critically Endangered with a decreasing population trend (Mortimer and Donnelly 2008). Hawksbill turtles have been listed on CITES since 1977 and are currently listed on CITES Appendix 1, meaning that they threatened with extinction and that international trade is prohibited. In the Atlantic Ocean, there has been a population decrease of 80.5% over the past three generations (Mortimer and Donnelly 2008).

Leatherback: Leatherback sea turtles have been listed as Endangered by the U.S. Endangered Species Act (ESA) since 1970 (NMFS 2012). The International Union for Conservation of Nature (IUCN) classified leatherback turtles as Critically Endangered, with a decreasing population trend, in 2000 (Martinez 2000). Leatherback turtles have been listed on CITES since 1975 and are currently listed on CITES Appendix 1, meaning that they are threatened with extinction and that international trade is prohibited. In the North Atlantic, the population size is estimated between 34,000 and 94,000 (TEWG 2007).

Loggerhead: The International Union for Conservation of Nature (IUCN) classified loggerhead turtles as

Endangered in 1996, although it has been suggested that this needs to be updated (MTSG 2006). Loggerheads are listed on Appendix 1 of CITES. There are an estimated 2,280 to 2,787 loggerhead turtles nesting annually in the Mediterranean (Broderick et al. 2002). The majority of turtles nest in Greece and Turkey, which have decreasing trends (although Greece may be stable) (NMFS 2009).

Olive ridley: The IUCN considers olive ridley sea turtles to be Vulnerable with a decreasing population trend. Olive ridley turtles have been listed as Threatened on the U.S. Endangered Species Act (ESA) since 1978 (NMFS 2012a) and are listed on CITES Appendix 1. The arribada rookeries have decreased by 97%–99% while the non-arribada rookeries have increased 364% over time (Abreu-Grobois and Plotkin 2008).

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Low Concern

Although capture rates of turtles in purse seine fisheries are small compared those in longlines, gillnets, and trawls, bycatch occurs in purse seine fisheries as well. There is evidence from other regions that the accidental entanglement of turtles in fish aggregating devices (FADs) is a major concern (Gilman 2011). Some management measures are in place in this region to protect incidentally captured sea turtles, and there are initiatives to design ecological FADs that reduce incidental interactions (ICCAT 2013d), but implementation of these measures may not be 100%. This precludes a score of very low concern and results instead in a score of low concern.

Rationale:
Green sea turtle: Only two occurrences of green sea turtles were reported in the Eastern Atlantic FAD fishery between 1991 and 1997 (Menard et al. 2000). Between 2003 and 2007, nine turtles were observed caught in the French and Spanish FAD fisheries (Amande et al. 2010). The occurrence rate per set in the French fishery (2005-2008) was 1.52 (Chassot et al. 2008). The observer rate for this cited study (Chassot et al. 2008) was around 3% of all fishing trips.

Kemp's ridley: A total of three Kemp's ridleys were observed caught in the French and Spanish FAD fisheries between 2003 and 2007 (Amande et al. 2010). The occurrence rate per set in the French FAD fishery was 1.52 between 2005 and 2008 (Chassot et al. 2008).

Leatherback: Five leatherback sea turtles were reported incidentally captured in the French and Spanish FAD fishery between 2003 and 2007 (Amande et al. 2010).

Loggerhead: Between 1991 and 1997, three loggerhead turtles were observed caught in the Eastern Atlantic (Menard et al. 2000) and five were reported captured between 2003 and 2007 in the French and Spanish FAD fishery (Amande et al. 2010).

Olive ridley: Only three olive ridley turtles were reported captured in the Spanish and French FAD fishery between 2003 and 2007 (Amande et al. 2000) and their occurrence rate per set in the French FAD fishery was 1.52 between 2006 and 2007 (Chassot et al. 2008).

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

South Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

WAHOO

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Medium

Fishbase assigned a moderate to high vulnerability score of 46 out of 100. Wahoo reach sexual maturity around 99 cm in length and one year of age. The maximum length attained is 250 cm and they can live to around 9 years of age. Wahoo are broadcast spawners and considered top predators {Froese and

Pauly 2014}. These life history characteristics also suggest a moderate level of vulnerability.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Moderate Concern

In the Atlantic, wahoo are assessed along with 13 other "small tuna" species. Currently, there is not enough information to conduct a full assessment of this group (ICCAT 2012a). The International Union for Conservation of Nature (IUCN) considers the Atlantic population a population of Least Concern, indicating that there is no evidence to suggest populations are declining overall, although local decreases in abundance might have occurred. An assessment conducted in the Caribbean suggested stable populations between 1996 and 2006 (Collette et al. 2011f). This is scored as "moderate" concern because a stock assessment has not been completed, although they are listed as Least Concern by the IUCN and they have a moderate vulnerability level.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

Low Concern

Wahoo make up a small proportion of "small tuna" catches in the Atlantic Ocean. No assessment has been conducted due to a lack of data (ICCAT 2012a). Catches of wahoo in the Atlantic have been variable over time. Wahoo are a reported bycatch species in purse seine fisheries (Menard et al. 2000), making up around 6% (in terms of number of fish) of the "other fish" catch in the French and Spanish purse seine fisheries between 2003 and 2007 (Amande et al. 2010). In the European purse seine fishery, they had a per set occurrence rate of 53% between 2006 and 2007 (Chassot et al. 2008). Fishing is not thought to have negatively impacted wahoo populations in the Atlantic Ocean, although increased fishing on FADs has lead to increased fishing and bycatch mortality rates (Collette et al. 2011f). Because fishing mortality does not appear to adversely affect the population, this is scored as "low" concern.

Factor 2.4 - Discard Rate

Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

YELLOWFIN TUNA

Factor 2.1 - Inherent Vulnerability

Scoring Guidelines (same as Factor 1.1 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Medium

FishBase assigned a moderate vulnerability score of 46 out of 100 (Froese and Pauly 2013). Yellowfin tuna reaches sexual maturity around 100 cm in length and 2–5 years of age. A maximum length of 140–150 cm can be attained and they can live 8–9 years. They are broadcast spawners and high-level predators in the ecosystem (Froese and Pauly 2014) (ICCAT 2014). These life-history characteristics also support a “medium” level of vulnerability.

Factor 2.2 - Stock Status

Scoring Guidelines (same as Factor 1.2 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

High Concern

Yellowfin tuna in the Atlantic Ocean was last assessed in 2011. There was some degree of uncertainty with the two models, which indicated opposite results (i.e., one showed an increasing abundance trend and the other showed a decreasing trend). The population is currently estimated to be 15% below Convention objectives (B_{2010}/B_{MSY} = 0.85 (0.61–1.12)) and therefore overfished (ICCAT 2011d). This rates as a "high" concern because the population is considered overfished.

Factor 2.3 - Fishing Mortality

Scoring Guidelines (same as Factor 1.3 above)

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderate Concern

The current fishing mortality rate is estimated to be 13% below F_{MSY} ($F_{current}/F_{MSY}$ = 0.87 (0.68–1.40)) and the maximum sustainable yield (MSY) is estimated at 144,600 t (ICCAT 2011d). This suggests that fishing mortality rates are sustainable. However, the assessment had some degree of uncertainty surrounding the results, with two models indicating opposite trends. One model estimated that fishing mortality rates were not sustainable, while the other estimated they were sustainable (ICCAT 2011d). In addition, the fishing mortality reference point used in the base case model (F_{max}, which is the fishing level that produces the largest yield per catch from the fishery) may not be suitable, because some studies have indicated that F_{max} is likely greater than F_{MSY} (Gabriel and Mace 1999). Therefore, if a more conservative reference point were used, it may have actually indicated that overfishing is occurring (ICCAT 2011k). This precludes a score of low concern and instead rates as "moderate" concern.

Factor 2.4 - Discard Rate

South Atlantic, Purse Seine, Floating object

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are

typically higher in purse seine sets made on FADs than unassociated sets. In the French purse seine fishery, 97% of discards were made on FAD sets, with spotted tuna and skipjack making up 50% and 46% of those discards, respectively (Chassot et al. 2008). In this fishery, tuna discard rates on FAD sets ranged from 0%–4% during 2007.

South Atlantic, Purse Seine, Unassociated

< 20%

Purse seine fisheries have an average discard rate of 5%, although in the Atlantic this rate is slightly less at 4.1% (Kelleher 2005). Discard rates in the combined purse seine fisheries (associated and unassociated) for France and Spain mainly comprise tunas (79% and 83%), rays (89% and 90%), bony fish (47% and 26%), sharks (31% and 45%), and billfish (1% and 15%). In these purse seine fisheries, juvenile skipjack made up the majority of discarded tuna bycatch (Amande et al. 2011). Discard rates are typically higher in purse seine sets made on FADs than unassociated sets. For example, no tuna discards were observed from French unassociated purse seine sets during 2007 (Chassot et al. 2008).

Criterion 3: Management effectiveness

Management is separated into management of retained species (harvest strategy) and management of non-retained species (bycatch strategy).

The final score for this criterion is the geometric mean of the two scores. The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2 or either the Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern = Red or High Concern*
  Rating is Critical if either or both of Harvest Strategy (Factor 3.1) and Bycatch Management Strategy (Factor 3.2) ratings are Critical.

Criterion 3 Summary

Region / Method	Management of Retained Species	Management of Non-Retained Species	Overall Recommendation
Atlantic Purse Seine, Floating object	3.000	1.000	Red(1.732)
Atlantic Purse Seine, Unassociated	3.000	3.000	Yellow(3.000)
South Atlantic Purse Seine, Floating object	3.000	1.000	Red(1.732)
South Atlantic Purse Seine, Unassociated	3.000	3.000	Yellow(3.000)

Factor 3.1: Harvest Strategy

Scoring Guidelines

Seven subfactors are evaluated: Management Strategy, Recovery of Species of Concern, Scientific Research/Monitoring, Following of Scientific Advice, Enforcement of Regulations, Management Track Record, and Inclusion of Stakeholders. Each is rated as 'ineffective,' 'moderately effective,' or 'highly effective.'

- *5 (Very Low Concern)—Rated as 'highly effective' for all seven subfactors considered.*
- *4 (Low Concern)—Management Strategy and Recovery of Species of Concern rated 'highly effective' and all other subfactors rated at least 'moderately effective.'*
- *3 (Moderate Concern)—All subfactors rated at least 'moderately effective.'*

- *2 (High Concern)—At minimum, meets standards for 'moderately effective' for Management Strategy and Recovery of Species of Concern, but at least one other subfactor rated 'ineffective.'*
- *1 (Very High Concern)—Management exists, but Management Strategy and/or Recovery of Species of Concern rated 'ineffective.'*
- *0 (Critical)—No management exists when there is a clear need for management (i.e., fishery catches threatened, endangered, or high concern species), OR there is a high level of Illegal, unregulated, and unreported fishing occurring.*

Factor 3.1 Summary

Factor 3.1: Management of fishing impacts on retained species							
Region / Method	**Strategy**	**Recovery**	**Research**	**Advice**	**Enforce**	**Track**	**Inclusion**
Atlantic Purse Seine, Floating object	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
Atlantic Purse Seine, Unassociated	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
South Atlantic Purse Seine, Floating object	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective
South Atlantic Purse Seine, Unassociated	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective

The United Nations Law of the Sea agreement (1995) indicated that the management of straddling and highly migratory fish stocks should be carried out through Regional Fisheries Management Organizations (RFMOs). RFMOs are the only legally mandated fishery management bodies on the high seas. There are currently 18 RFMOs (www.fao.org) that cover nearly all of the world's high seas. Member countries must abide by the management measures set forth by individual RFMOs in order to fish in their waters (Cullis-Suzuki and Pauly 2010). Some RFMOs manage all marine living resources within their authority (e.g., General Fisheries Commission for the Mediterranean (GFCM)), while others manage a group of species such as tunas (e.g., International Commission for the Conservation of Atlantic Tunas (ICCAT)). This report focuses on purse seine fisheries in international waters within the Atlantic Ocean, and these fisheries are managed by ICCAT (see below for member countries). This section of the report has scored for ICCAT's management of these fisheries.

ICCAT Contracting Parties: United States, Japan, South Africa, Ghana, Canada, France, Brazil, Morocco, Republic of Korea, Cote d'Ivoire, Angola, Russia, Gabon, Cabo Verde, Uruguay, Sao Tome E Principe, Venezuela, Equatorial Guinea, Guinea, United Kingdom, Libya, China, European Union, Tunisia, Panama,

Trinidad and Tobago, Namibia, Barbados, Honduras, Algeria, Mexico, Vanuatu, Iceland, Turkey, Philippines, Norway, Nicaragua, Guatemala, Senegal, Belize, Syria, St. Vincent and the Grenadines, Nigeria, Egypt, Albania, Sierra Leone, Curacao, Liberia, El Salvador, and Mauritania.

Subfactor 3.1.1 – Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? To achieve a highly effective rating, there must be appropriate management goals, and evidence that the measures in place have been successful at maintaining/rebuilding species.

Atlantic, Purse Seine, Floating object

Moderately Effective

There are no management measures specific to skipjack tuna, but the establishment of a time/area closure in the surface fishery to protect juvenile bigeye tuna also provided some protection to skipjack and yellowfin tuna. In addition, area closures to fish aggregating device (FAD) fishing during January and February (2013) will likely have an impact on skipjack tuna (ICCAT 2012a). There is a TAC for yellowfin tuna, and there are limits on the number of vessels allowed to target them (ICCAT 2012a). Albacore tuna in the North Atlantic are managed through a total allowable catch (TAC) (28,000 t for 2012 and 2013) as well as effort restrictions from 1998 that limit the fishing capacity to the average from 1993–1997 (ICCAT 2012a). Bigeye tuna are managed through a TAC (ICCAT 2011c). There are catch restrictions for blue marlin (which may be retained) based on limiting catches to 50% of 1996 or 1999 landings (ICCAT 2012a). There are no management measures in place for blackfin tuna either domestically or internationally (NOAA 2012) (ICCAT 2012a).

ICCAT does not have formally accepted reference points, but does have an “implied” target reference point (i.e., maximum sustainable yield). There is a framework for a harvest control rule, but none is currently used (ISSF 2013a). Because ICCAT has implemented some measures for these species but management still needs to be improved, this rates a “moderately effective” score.

Atlantic, Purse Seine, Unassociated

Moderately Effective

There are no management measures specific to skipjack tuna, but the establishment of a time/area closure in the surface fishery to protect juvenile bigeye tuna also provided some protection to skipjack and yellowfin tuna. In addition, area closures to fish aggregating device (FAD) fishing during January and February (2013) will likely have an impact on skipjack tuna (ICCAT 2012a). There is a total allowable catch (TAC) for yellowfin tuna, and there are limits on the number of vessels (ICCAT 2012a). Albacore tuna in the North Atlantic are managed through a TAC (28,000 t for 2012 and 2013) as well as effort

restrictions from 1998 that limit the fishing capacity to the average from 1993–1997 (ICCAT 2012a). Bigeye tuna are managed through a TAC (ICCAT 2011c). Atlantic sailfish are not managed.

ICCAT does not have formally accepted reference points, but does have an “implied” target reference point (i.e., maximum sustainable yield). There is a framework for a harvest control rule, but none is currently used (ISSF 2013a). Because the ICCAT has implemented some measures for these species but management still needs to be improved, this rates a “moderately effective” score.

South Atlantic, Purse Seine, Floating object

Moderately Effective

There are no management measures specific to skipjack tuna, but the establishment of a time/area closure in the surface fishery to protect juvenile bigeye tuna also provided some protection to skipjack and yellowfin tuna. In addition, area closures to fish aggregating device (FAD) fishing during January and February (2013) will likely have an impact on skipjack tuna (ICCAT 2012a). There is a TAC for yellowfin tuna, and there are limits on the number of vessels allowed to target them (ICCAT 2012a). Albacore tuna in the North Atlantic are managed through a total allowable catch (TAC) (28,000 t for 2012 and 2013) as well as effort restrictions from 1998 that limit the fishing capacity to the average from 1993–1997 (ICCAT 2012a). Bigeye tuna are managed through a TAC (ICCAT 2011c). There are catch restrictions for blue marlin (which may be retained) based on limiting catches to 50% of 1996 or 1999 landings (ICCAT 2012a). There are no management measures in place for blackfin tuna either domestically or internationally (NOAA 2012) (ICCAT 2012a).

ICCAT does not have formally accepted reference points, but does have an “implied” target reference point (i.e., maximum sustainable yield). There is a framework for a harvest control rule, but none is currently used (ISSF 2013a). Because ICCAT has implemented some measures for these species but management still needs to be improved, this rates a “moderately effective” score.

South Atlantic, Purse Seine, Unassociated

Moderately Effective

There are no management measures specific to skipjack tuna, but the establishment of a time/area closure in the surface fishery to protect juvenile bigeye tuna also provided some protection to skipjack and yellowfin tuna. In addition, area closures to fish aggregating device (FAD) fishing during January and February (2013) will likely have an impact on skipjack tuna (ICCAT 2012a). There is a total allowable catch (TAC) for yellowfin tuna, and there are limits on the number of vessels (ICCAT 2012a). Albacore tuna in the North Atlantic are managed through a TAC (28,000 t for 2012 and 2013) as well as effort restrictions from 1998 that limit the fishing capacity to the average from 1993–1997 (ICCAT 2012a).

Bigeye tuna are managed through a TAC (ICCAT 2011c). Atlantic sailfish are not managed.

ICCAT does not have formally accepted reference points, but does have an "implied" target reference point (i.e., maximum sustainable yield). There is a framework for a harvest control rule, but none is currently used (ISSF 2013a). Because ICCAT has implemented some measures for these species but management still needs to be improved, this rates a "moderately effective" score.

Subfactor 3.1.2 – Recovery of Species of Concern

Considerations: When needed, are recovery strategies/management measures in place to rebuild overfished/threatened/ endangered species or to limit fishery's impact on these species and what is their likelihood of success? To achieve a rating of Highly Effective, rebuilding strategies that have a high likelihood of success in an appropriate timeframe must be in place when needed, as well as measures to minimize mortality for any overfished/threatened/endangered species.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderately Effective

Within the Atlantic Ocean, yellowfin tuna and albacore are overfished or close to overfished. In addition, blue marlin are overfished. The current multi-year Atlantic tuna conservation and management program, which was initiated in 2009, was amended in 2011 to include yellowfin tuna. Included in this plan are capacity limitations, vessel authorization to fish, catch limits for bigeye, and a TAC for yellowfin (ICCAT 2011c) (ICCAT 2013c). North Atlantic albacore tuna are currently under a rebuilding program that was initiated in 2009 and last updated in 2013 (ICCAT 2011e) (ICCAT 2013c). According to the most recent assessment, there is a 53% probability that the population will rebuild by 2019 (thus meeting Convention objectives) if the total allowable catch (TAC) is attained, and a 75% probability if catches are lower. In addition, the biomass has been increasing over time and are now below Convention objectives. However, fishing mortality rates are still above Convention objectives (ICCAT 2013a). Blue marlin have been under a rebuilding plan since 2000 (ICCAT 2012a). Because recovery plans have not been in place long enough to judge their success for all species, this is rated as "moderately effective."

Subfactor 3.1.3 – Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the health of the population and the fishery's impact on the species? To achieve a Highly Effective rating, population assessments must be conducted regularly and they must be robust enough to reliably determine the population status.

Atlantic, Purse Seine, Floating object

Moderately Effective

Stock assessments for albacore, bigeye, skipjack, and yellowfin tuna are conducted every 4–6 years and include catch and effort data from both fishery-dependent and independent sources, along with biological information and other data sets. Blue marlin are also assessed but dolphinfish and other species have not been assessed throughout the Atlantic (ICCAT 2012a). The last assessment of blackfin tuna was attempted in 2008 and there are no plans currently to update it. Some information on catch and effort and size data was included in the assessment (ICCAT 2012a). However, there is uncertainty surrounding the results of these assessments and there are issues with reporting catch data for some species. This results in a score of "moderately effective."

Atlantic, Purse Seine, Unassociated

Moderately Effective

Stock assessments for albacore, bigeye, skipjack, and yellowfin tuna are conducted every 4–6 years and include catch and effort data from both fishery-dependent and independent sources, along with biological information and other data sets (ICCAT 2012a). Assessments for Atlantic sailfish have also been conducted. However, there is uncertainty surrounding the results of these assessments and there are issues with reporting catch data for some species. This results in a score of "moderately effective."

South Atlantic, Purse Seine, Floating object

Moderately Effective

Stock assessments for albacore, bigeye, skipjack, and yellowfin tuna are conducted every 4–6 years and include catch and effort data from both fishery-dependent and independent sources, along with biological information and other data sets. Blue marlin are also assessed but dolphinfish and other species have not been assessed throughout the Atlantic (ICCAT 2012a). The last assessment of blackfin tuna was attempted in 2008 and there are no plans currently to update it. Some information on catch and effort and size data was included in the assessment (ICCAT 2012a). However, there is uncertainty surrounding the results of these assessments and there are issues with reporting catch data for some

species. This results in a score of “moderately effective.”

South Atlantic, Purse Seine, Unassociated

Moderately Effective

Stock assessments for albacore, bigeye, skipjack, and yellowfin tuna are conducted every 4–6 years and include catch and effort data from both fishery-dependent and independent sources, along with biological information and other data sets (ICCAT 2012a). Assessments for Atlantic sailfish have also been conducted. However, there is uncertainty surrounding the results of these assessments and there are issues with reporting catch data for some species. This results in a score of “moderately effective.”

Subfactor 3.1.4 – Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g. do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Atlantic, Purse Seine, Floating object

Moderately Effective

Atlantic, Purse Seine, Unassociated

Moderately Effective

No specific management recommendations have recently been made for skipjack tuna, other than to keep catches below MSY (ICCAT 2012a). It has been suggested that maintaining yellowfin tuna catches at current levels (110,000 t) should lead to the biomass being above B_{MSY} by 2016. The TAC was set at this level starting in 2012 (ICCAT 2012a). The Commission has followed advice and set the TAC for albacore tuna in the North Atlantic at 28,000 t for 2012 and 2013. The current assessment indicates that if catches remain at the current TAC level, the population will rebuild (53% probability) by 2019, which abides by the 2011 recovery plan. However, if catches are lowered, recovery would occur more quickly. The current management measure for North Atlantic albacore tuna allows for potential overages by allowing excess catch (not included in the total TAC) to be caught by countries with no allocated TAC (ICCAT 2013a). Bigeye tuna catches were advised to be kept at 85,000 t or less to allow for population growth, and the TAC was lowered to this level in 2009 (ICCAT 2012a). Because management advice has not always been followed, this is scored as “moderately effective.”

South Atlantic, Purse Seine, Floating object

Moderately Effective

No specific management recommendations have recently been made for skipjack tuna, other than to keep catches below MSY (ICCAT 2014). It has been suggested that maintaining yellowfin tuna catches at current levels (110,000 t) should lead to the biomass being above B_{MSY} by 2016. The TAC was set at this level starting in 2012 (ICCAT 2012a). It was also advised that measures to reduce FAD-related and other fishing mortality on small yellowfin tuna should be implemented, and this has not yet been done (ICCAT 2012a). The Commission has followed advice and set the TAC for albacore tuna in the North Atlantic at 28,000 t for 2012 and 2013. The current assessment indicates that if catches remain at the current TAC level, the population will rebuild (53% probability) by 2019, which abides by the 2011 recovery plan. However, if catches are lowered, recovery would occur more quickly. The current management measure for North Atlantic albacore tuna allows for potential overages by allowing excess catch (not included in the total TAC) (ICCAT 2013a). Bigeye tuna catches were advised to be kept at 85,000 t or less to allow for population growth, and the TAC was lowered to this level in 2009 (ICCAT 2012a). The Billfish Working Group advised that, at a minimum, current management measures for blue marlin should be continued. In addition, fishery information needs to be improved, including information on discards and survival, and mortality should be reduced (ICCAT 2012a). No scientific advice for blackfin tuna has been provided and there is currently no set TAC (ICCAT 2012a). Because advice is sometimes but not always followed, this is scored as “moderately effective.”

South Atlantic, Purse Seine, Unassociated

Moderately Effective

No specific management recommendations have recently been made for skipjack tuna, other than to keep catches below MSY (ICCAT 2012a). It has been suggested that maintaining yellowfin tuna catches at current levels (110,000 t) should lead to the biomass being above B_{MSY} by 2016. The TAC was set at this level starting in 2012 (ICCAT 2012a). The Commission has followed advice and set the TAC for albacore tuna in the North Atlantic at 28,000 t for 2012 and 2013. The current assessment indicates that if catches remain at the current TAC level, the population will rebuild (53% probability) by 2019, which abides by the 2011 recovery plan. However, if catches are lowered, recovery would occur more quickly. The current management measure for North Atlantic albacore tuna allows for potential overages by allowing excess catch (not included in the total TAC) to be caught by countries with no allocated TAC (ICCAT 2013a). Bigeye tuna catches were advised to be kept at 85,000 t or less to allow for population growth, and the TAC was lowered to this level in 2009 (ICCAT 2012a). Because management advice has not always been followed, this is scored as “moderately effective.”

Subfactor 3.1.5 – Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

Atlantic, Purse Seine, Floating object

Moderately Effective

In terms of compliance among member countries with management measures, ICCAT has one of the best practices of reviewing, assessing, and addressing compliance issues (Koehler 2013). Countries are required to provide information on catch, catch at size, location, and month of captures for other tuna species (ICCAT 2012a). Vessel monitoring systems (VMS) are required on all vessels longer than 20 m (ICCAT 2003). A total allowable catch (TAC) for yellowfin tuna was implemented in 2012, but it is too early to determine if catches were below this level. There is the ability to subtract overages from subsequent years if catches of yellowfin tuna exceed TAC levels (ICCAT 2012a). Bigeye catches have been below TAC levels from 2005 to 2011, and if they ever exceed the TAC, there are measures in place to adjust the following years' country quotas (ICCAT 2012a). There is no TAC for skipjack tuna (ICCAT 2012a). Because there does not appear to be an issue with catches going over TAC levels, this is scored as "moderately effective."

Atlantic, Purse Seine, Unassociated

Moderately Effective

In terms of compliance among member countries with management measures, ICCAT has one of the best practices of reviewing, assessing, and addressing compliance issues (Koehler 2013). Countries are required to provide information on catch, catch at size, location, and month of captures for tuna (ICCAT 2012a). Vessel monitoring systems (VMS) are required on all vessels longer than 20 m (ICCAT 2003). Catch and effort data is required to be reported to the Secretariat. A total allowable catch (TAC) for yellowfin tuna was implemented in 2012, but it is too early to determine if catches were below this level. There is the ability to subtract overages from subsequent years should catches of yellowfin tuna exceed TAC levels (ICCAT 2012a). Bigeye catches have been below TAC levels from 2005 to 2011, and if they ever exceed the TAC, there are measures in place to adjust the following years' country quotas (ICCAT 2012a). There is no TAC for skipjack tuna (ICCAT 2012a). Because there does not appear to be an issue with catches going over TAC levels, this is scored as "moderately effective."

South Atlantic, Purse Seine, Floating object

Moderately Effective

In terms of compliance among member countries with management measures, ICCAT has one of the best practices of reviewing, assessing, and addressing compliance issues (Koehler 2013). Countries are required to provide information on catch, catch at size, location, and month of captures for other tuna species (ICCAT 2012a). Vessel monitoring systems (VMS) are required on all vessels longer than 20 m (ICCAT 2003). A total allowable catch (TAC) for yellowfin tuna was implemented in 2012, but it is too early to determine if catches were below this level. There is the ability to subtract overages from subsequent years if catches of yellowfin tuna exceed TAC levels (ICCAT 2012a). Bigeye catches have been below TAC levels from 2005 to 2011, and if they ever exceed the TAC, there are measures in place to adjust the following years' country quotas (ICCAT 2012a). There is no TAC for skipjack tuna (ICCAT 2012a). Because there does not appear to be an issue with catches going over TAC levels, this is scored as "moderately effective."

South Atlantic, Purse Seine, Unassociated

Moderately Effective

In terms of compliance among member countries with management measures, ICCAT has one of the best practices of reviewing, assessing, and addressing compliance issues (Koehler 2013). Countries are required to provide information on catch, catch at size, location, and month of captures for tuna (ICCAT 2012a). Vessel monitoring systems (VMS) are required on all vessels longer than 20 m (ICCAT 2003). Catch and effort data is required to be reported to the Secretariat. A total allowable catch (TAC) for yellowfin tuna was implemented in 2012, but it is too early to determine if catches were below this level. There is the ability to subtract overages from subsequent years if catches of yellowfin tuna exceed TAC levels (ICCAT 2012a). Bigeye catches have been below TAC levels from 2005 to 2011, and if they ever exceed the TAC, there are measures in place to adjust the following years' country quotas (ICCAT 2012a). There is no TAC for skipjack tuna (ICCAT 2012a). Because there does not appear to be an issue with catches going over TAC levels, this is scored as "moderately effective."

Subfactor 3.1.6 – Management Track Record

Considerations: Does management have a history of successfully maintaining populations at sustainable levels or a history of failing to maintain populations at sustainable levels? A Highly Effective rating is given if measures enacted by management have been shown to result in the long-term maintenance of species overtime.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderately Effective

Management measures have been able to sustain or allow recovery of some species (such as albacore tuna), while the success of other measures (for example, those in place to protect yellowfin tuna) is less certain (ICCAT 2014). Because recovery plans have not always been successful for species included in this report, this is scored as "moderately effective."

Subfactor 3.1.7 – Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent and includes stakeholder input.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Highly Effective

The International Commission for the Conservation of Atlantic Tunas (ICCAT) has attempted to include stakeholder input in the management and conservation of some species (e.g., Atlantic bluefin) (ICCAT 2008b). Observers are allowed at scientific and commission meetings but may not vote on individual management measures. This results in a score of "highly effective" to account for the inclusion of stakeholder input, transparency of management process through meeting reports, and the ability of non-delegates to attend and participate in meetings.

Bycatch Strategy

Factor 3.2: Management of fishing impacts on bycatch species						
Region / Method	**All Kept**	**Critical**	**Strategy**	**Research**	**Advice**	**Enforce**
Atlantic Purse Seine, Floating object	No	No	Ineffective	Moderately Effective	Moderately Effective	Moderately Effective
Atlantic Purse Seine, Unassociated	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective
South Atlantic Purse Seine, Floating object	No	No	Ineffective	Moderately Effective	Moderately Effective	Moderately Effective
South Atlantic Purse Seine, Unassociated	No	No	Moderately Effective	Moderately Effective	Moderately Effective	Moderately Effective

Subfactor 3.2.1 – Management Strategy and Implementation

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and how successful are these management measures? To achieve a Highly Effective rating, the primary bycatch species must be known and there must be clear goals and measures in place to minimize the impacts on bycatch species (e.g., catch limits, use of proven mitigation measures, etc.).

Atlantic, Purse Seine, Floating object

Ineffective

The International Commission for the Conservation of Atlantic Tunas (ICCAT) has implemented a few management measures specific to bycatch in the purse seine fishery. Member countries are required to collect information on bycatch and discards, and report that information to the Secretariat. Countries are also encouraged to provide identification guides for sharks, sea birds, sea turtles, and marine mammals to vessels fishing in the Convention area (ICCAT 2011g). Several species of sharks, such as silky, oceanic whitetip, and hammerhead, are prohibited from being retained if incidentally captured (ICCAT 2011i) (ICCAT 2010e) (ICCAT 2010f). In addition, purse seine vessels must avoid encircling sea turtles, release those incidentally caught, and report any interactions, and safe handling techniques must be used (ICCAT 2013c) (ICCAT 2010g). Management measures for other bycatch species, such as dolphinfish, wahoo, rainbow runner, and triggerfish, are not in place. Individual countries are required to report on the implementation and compliance with several of these measures, including for sea turtles and sharks (ICCAT 2010g) (ICCAT 2012i). There are no bycatch catch limits in place, and best practices for bycatch mitigation are not being employed (Gilman 2011). In addition, it is unknown if current measures have been sufficient in maintaining the health of bycatch species populations. The potential for population-level impacts of bycatch using associated purse seine is considerable, due to the potential for the FADs to entangle sharks and other species of concern, as well as bycatch of juvenile bigeye and yellowfin tuna. The management in place to reduce bycatch is considered insufficient given

these potential impacts of the fishery. This results in a score of “ineffective.”

Atlantic, Purse Seine, Unassociated

Moderately Effective

Bycatch in the unassociated purse seine fishery is typically less than in the floating object fishery. The International Commission for the Conservation of Atlantic Tunas (ICCAT) has implemented a few management measures specific to bycatch in the purse seine fishery. Member countries are required to collect information on bycatch and discards and report that information to the Secretariat. Countries are also encouraged to provide identification guides for sharks, sea birds, sea turtles, and marine mammals to vessels fishing in the Convention area (ICCAT 2011g). Several species of sharks, such as silky, oceanic whitetip, and hammerhead, are prohibited from being landed (ICCAT 2011i) (ICCAT 2010e) (ICCAT 2010f). In addition, purse seine vessels must avoid encircling sea turtles, release those incidentally caught, and report any interactions (ICCAT 2010g). There are no management measures in place for Atlantic sailfish, despite the advice that catches should be reduced from current levels (ICCAT 2009c). Individual countries are required to report on the implementation and compliance with several of these measures, including for sea turtles and sharks (ICCAT 2010g) (ICCAT 2012i). There are no bycatch cap or catch limits in place. It is unknown if current measures have been sufficient to maintain the health of bycatch species populations. In addition, a review of bycatch governance in tuna RFMOs found that ICCAT had an average score of 20%, with criterion dealing with bycatch conservation and management measures scoring the worst (Gilman et al. 2013). Seafood Watch defines ineffective management as “insufficient given the potential impacts of the fishery,” so a greater level of management is expected to be in place for fisheries with less selective gear or a higher potential to impact vulnerable species. The measures in place in the tuna purse seine fishery are considered to be sufficient given that the fishery’s method is fairly selective, without great potential for population level impacts. However, best practices are not fully implemented. This results in a score of “moderately effective.”

South Atlantic, Purse Seine, Floating object

Ineffective

The International Commission for the Conservation of Atlantic Tunas (ICCAT) has implemented a few management measures specific to bycatch in the purse seine fishery. Member countries are required to collect information on bycatch and discards, and report that information to the Secretariat. Countries are also encouraged to provide identification guides for sharks, sea birds, sea turtles, and marine mammals to vessels fishing in the Convention area (ICCAT 2011g). Several species of sharks, such as silky, oceanic whitetip, and hammerhead, are prohibited from being retained if incidentally captured (ICCAT 2011i) (ICCAT 2010e) (ICCAT 2010f). In addition, purse seine vessels must avoid encircling sea turtles, release those incidentally caught, and report any interactions, and safe handling techniques

must be used (ICCAT 2013c) (ICCAT 2010g). Management measures for other bycatch species, such as dolphinfish, wahoo, rainbow runner, and triggerfish, are not in place. Individual countries are required to report on the implementation and compliance with several of these measures, including for sea turtles and sharks (ICCAT 2010g) (ICCAT 2012i). There are no bycatch catch limits in place, and best practices for bycatch mitigation are not being employed (Gilman 2011). In addition, it is unknown if current measures have been sufficient in maintaining the health of bycatch species populations. The potential for population-level impacts of bycatch using associated purse seine is considerable, due to the potential for the FADs to entangle sharks and other species of concern, as well as bycatch of juvenile bigeye and yellowfin tuna. The management in place to reduce bycatch is considered insufficient given these potential impacts of the fishery. This results in a score of "ineffective."

South Atlantic, Purse Seine, Unassociated

Moderately Effective

Bycatch in the unassociated purse seine fishery is typically less than in the floating object fishery. The International Commission for the Conservation of Atlantic Tunas (ICCAT) has implemented a few management measures specific to bycatch in the purse seine fishery. Member countries are required to collect information on bycatch and discards, and report that information to the Secretariat. Countries are also encouraged to provide identification guides for sharks, sea birds, sea turtles, and marine mammals to vessels fishing in the Convention area (ICCAT 2011g). Several species of sharks, such as silky, oceanic whitetip, and hammerhead are prohibited from being landed (ICCAT 2011i) (ICCAT 2010e) (ICCAT 2010f). In addition, purse seine vessels must avoid encircling sea turtles, release those incidentally caught, and report any interactions (ICCAT 2010g). There are no management measures in place for Atlantic sailfish, despite the advice that catches should be reduced from current levels (ICCAT 2009c). Individual countries are required to report on the implementation and compliance with several of these measures, including for sea turtles and sharks (ICCAT 2010g) (ICCAT 2012i). There are no bycatch cap or catch limits in place. It is unknown if current measures have been sufficient to maintain the health of bycatch species populations. In addition, a review of bycatch governance in tuna RFMOs found ICCAT had an average score of 20%, with criterion dealing with bycatch conservation and management measures scoring the worst (Gilman et al. 2013). Seafood Watch defines ineffective management as "insufficient given the potential impacts of the fishery," so a greater level of management is expected to be in place for fisheries with less selective gear or a higher potential to impact vulnerable species. The measures in place in the tuna purse seine fishery are considered to be sufficient given that the fishery's method is fairly selective, without great potential for population level impacts. However, best practices are not fully implemented. This is scored as "moderately effective."

Subfactor 3.2.2 – Scientific Research and Monitoring

Considerations: Is bycatch in the fishery recorded/documented and is there adequate monitoring of bycatch to measure fishery's impact on bycatch species? To achieve a Highly Effective rating, assessments must be conducted to determine the impact of the fishery on species of concern, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are being met.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderately Effective

The International Commission for the Conservation of Atlantic Tunas (ICCAT) requires member countries to have observer programs in place that provide a minimum of 5% coverage, although the implementation success of this measure by all countries is unknown. Observers record information on fishing effort, total target and bycatch catches, size, and disposition, and can collect biological samples (ICCAT 2010i). In addition, vessels 20 m in length or greater must carry an observer while targeting bigeye or yellowfin tuna in the time/area closure designated to protect juvenile fish around Fish Aggregating Devices (FADs) (ICCAT 2013c).

Subfactor 3.2.3 – Management Record of Following Scientific Advice

Considerations: How often (always, sometimes, rarely) do managers of the fishery follow scientific recommendations/advice (e.g., do they set catch limits at recommended levels)? A Highly Effective rating is given if managers nearly always follow scientific advice.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderately Effective

See subfactor 3.1.4 in the Harvest Strategy section for detailed information.

Subfactor 3.2.4 – Enforcement of Management Regulations

Considerations: Is there a monitoring/enforcement system in place to ensure fishermen follow management regulations and what is the level of fishermen's compliance with regulations? To achieve a Highly Effective rating, there must be consistent enforcement of regulations and verification of compliance.

Atlantic, Purse Seine, Floating object

Atlantic, Purse Seine, Unassociated

South Atlantic, Purse Seine, Floating object

South Atlantic, Purse Seine, Unassociated

Moderately Effective

See subfactor 3.1.5 in the Harvest Strategy section for detailed information.

Criterion 4: Impacts on the habitat and ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment.

The final score is the geometric mean of the impact of fishing gear on habitat score (plus the mitigation of gear impacts score) and the Ecosystem Based Fishery Management score. The Criterion 2 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and <=3.2=Yellow or Moderate Concern*
- *Score <=2.2=Red or High Concern*
  Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region / Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Overall Recomm.
Atlantic Purse Seine, Floating object	4.00:Very Low Concern	0.00:Not Applicable	1.00:Very High Concern	**Red (2.000)**
Atlantic Purse Seine, Unassociated	5.00:None	0.00:Not Applicable	3.00:Moderate Concern	**Green (3.873)**
South Atlantic Purse Seine, Floating object	4.00:Very Low Concern	0.00:Not Applicable	1.00:Very High Concern	**Red (2.000)**
South Atlantic Purse Seine, Unassociated	5.00:None	0.00:Not Applicable	3.00:Moderate Concern	**Green (3.873)**

Purse seine fisheries tend to have minimal contact with the bottom habitat, although FADs can be anchored to the bottom. However, they do incidentally capture some ecologically important species and the impact of this on the ecosystem is not known. In addition, the impact this fishery has on the ecosystem is not factored into current management efforts.

Justification of Ranking

Factor 4.1 – Impact of Fishing Gear on the Habitat/Substrate

Scoring Guidelines

- *5 (None)—Fishing gear does not contact the bottom*
- *4 (Very Low)—Vertical line gear*

- *3 (Low)—Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Bottom seine on resilient mud/sand habitats. Midwater trawl that is known to contact bottom occasionally (*
- *2 (Moderate)—Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Bottom seine except on mud/sand*
- *1 (High)—Hydraulic clam dredge. Dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
- *0 (Very High)—Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.

Atlantic, Purse Seine, Floating object

Very Low Concern

Although purse seine fishing typically does not result in the nets coming in contact with the bottom, anchored FADs could result in contact with the bottom (Beverly et al. 2012) (Seafood Watch 2013).

Atlantic, Purse Seine, Unassociated

None

Unassociated purse seines do not come in contact with bottom habitats (Seafood Watch 2013).

South Atlantic, Purse Seine, Floating object

Very Low Concern

Although purse seine fishing typically does not result in the nets coming in contact with the bottom, anchored FADs could result in contact with the bottom (Beverly et al. 2012) (Seafood Watch 2013).

South Atlantic, Purse Seine, Unassociated

None

Unassociated purse seines do not come in contact with bottom habitats (Seafood Watch 2013).

Factor 4.2 – Mitigation of Gear Impacts

Scoring Guidelines

- *+1 (Strong Mitigation)—Examples include large proportion of habitat protected from fishing (>50%) with gear, fishing intensity low/limited, gear specifically modified to reduce damage to seafloor and modifications shown to be effective at reducing damage, or an effective combination of 'moderate' mitigation measures.*
- *+0.5 (Moderate Mitigation)—20% of habitat protected from fishing with gear or other measures in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing.*
- *+0.25 (Low Mitigation)—A few measures are in place (e.g., vulnerable habitats protected but other habitats not protected); there are some limits on fishing effort/intensity, but not actively being reduced.*
- *0 (No Mitigation)—No effective measures are in place to limit gear impacts on habitats.*

Atlantic, Purse Seine, Floating object
Atlantic, Purse Seine, Unassociated
South Atlantic, Purse Seine, Floating object
South Atlantic, Purse Seine, Unassociated
Not Applicable

Factor 4.3 – Ecosystem-Based Fisheries Management

Scoring Guidelines

- *5 (Very Low Concern)—Substantial efforts have been made to protect species' ecological roles and ensure fishing practices do not have negative ecological effects (e.g., large proportion of fishery area is protected with marine reserves, and abundance is maintained at sufficient levels to provide food to predators).*
- *4 (Low Concern)—Studies are underway to assess the ecological role of species and measures are in place to protect the ecological role of any species that plays an exceptionally large role in the ecosystem. Measures are in place to minimize potentially negative ecological effect if hatchery supplementation or fish aggregating devices (FADs) are used.*

- *3 (Moderate Concern)—Fishery does not catch species that play an exceptionally large role in the ecosystem, or if it does, studies are underway to determine how to protect the ecological role of these species, OR negative ecological effects from hatchery supplementation or FADs are possible and management is not place to mitigate these impacts.*
- *2 (High Concern)—Fishery catches species that play an exceptionally large role in the ecosystem and no efforts are being made to incorporate their ecological role into management.*
- *1 (Very High Concern)—Use of hatchery supplementation or fish aggregating devices (FADs) in the fishery is having serious negative ecological or genetic consequences, OR fishery has resulted in trophic cascades or other detrimental impacts to the food web.*

Atlantic, Purse Seine, Floating object

Very High Concern

Purse seine fisheries in the Atlantic Ocean catch several ecologically important groups, including other tunas and sharks. In particular, sharks are considered top predators in many ecosystems and play a critical role in how these ecosystems are structured and function (Piraino et al. 2002) (Stevens et al. 2000). The loss of these predators can cause many changes, such as to prey abundances, that can lead to a cascade of other effects (Myers et al. 2007) (Duffy 2003) (Ferretti et al. 2010) (Schindler et al. 2002) and behavioral changes (Heithaus et al. 2007).

The use of FADs can also affect the surrounding ecosystems. Smaller tuna, specifically bigeye and yellowfin, are often associated with FADs, and this could lead to growth and recruitment overfishing (Freon and Dagorn 2000). In addition, behavioral changes in tunas could be associated with the introduction of FADs into the Pacific region. These include increases in the biomass of tunas under FADs, reduced free-school abundance, changes in school movement patterns and structure, and differences between the age and size of free- and FAD-associated schools (Fonteneau 1991) (Menard et al. 2000a) (Menard et al. 2000b) (Josse et al. 1999) (Josse et al. 2000). The negative long-term impacts of FAD fishing are difficult to evaluate due to insufficient qualitative data (Fonteneau et al. 2000), so additional research (including monitoring the number of FADs being used) should be undertaken to determine the potential effects of FADs on the ecosystem (Dagorn et al. 2012).

ICCAT has assessed several species of sharks and conducted ecological risk assessments for other bycatch species. Though ecosystem impacts are not currently included in management plans, ICCAT has adopted management measures to protect bycatch species, and conducts ecological risk assessments. In addition, ICCAT has investigated prohibiting the use of FADs, currently requires the collection of some information on FAD fishing (deployment of FADs, visiting FADs, and loss of FADs), and requires the use of FAD logbooks (Morgan 2011) (ICCAT 3013c). In addition, there is a Sub-Committee on Ecosystems within ICCAT that is investigating the role of Ecosystem-Based Management within ICCAT fisheries (ICCAT 2013b).

Because there is a potential for negative ecological impacts from FADs and management is not designed to avoid these impacts, this is scored as "very high" concern.

Atlantic, Purse Seine, Unassociated

Moderate Concern

The Atlantic unassociated purse seine fishery does not catch as many "exceptional species" as the associated fishery, but there are no ecosystem-based management plans in place; this results in a score of "moderate" concern. However, it should be noted that there is a Sub-Committee on Ecosystems within ICCAT that is investigating the role of Ecosystem-Based Management within ICCAT fisheries (ICCAT 2013b).

South Atlantic, Purse Seine, Floating object

Very High Concern

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