SHRIMP – IMPORTED WILD CAUGHT

Mostly *Penaeus* and *Metapenaeus* species

Sometimes known as White Shrimp, Brown Shrimp, Pink Shrimp, Rock Shrimp, Royal Red Shrimp, Banana Shrimp, Tiger Shrimp, Endeavour Shrimp, Ebi

SUMMARY

The bottom trawls used to catch most imported Shrimp damage benthic (seafloor) habitat and result in large amounts of bycatch, including commercially important fish species and endangered sea turtles. Tropical Shrimp trawl fisheries lack adequate management and enforcement. Imported Shrimp species are short-lived and highly fecund (fertile), although information on their abundance is lacking. Chef Barton Seaver says, "There are some FANTASTIC shrimp out there that nearly no one knows about. Oregon Pink Shrimp or Maine Pinks are a delicious product that is very inexpensive and very convenient. Available all year round as a frozen product, these work well in soups, salads, cocktails, sandwiches, nearly every preparation you can imagine. They are smaller than the warm water shrimp but are clean and sweet in flavor and a real treat. There are some farm raised shrimp options available from U.S. producers which are great eating. They are only a little more expensive and you can eat well knowing that you are supporting not only eco-friendly practices but also helping to create jobs for Americans."

Criterion	Points
Life History	3.00
Abundance	2.00
Habitat Quality and Fishing Gear Impacts	0.25
Management	0.75
Bycatch	0.50
Final Score	**1.30**
Color	

Final Score	Color
2.40 - 4.00	
1.60 - 2.39	
0.00 - 1.59	

LIFE HISTORY

Core Points (only one selection allowed)

If a value for intrinsic rate of increase ('r') is known, assign the score below based on this value. If no r-value is available, assign the score below for the correct age at 50% maturity for females if specified, or for the correct value of growth rate ('k'). If no estimates of r, age at 50% maturity, or k are available, assign the score below based on maximum age.

1.00 Intrinsic rate of increase <0.05; OR age at 50% maturity >10 years; OR growth rate <0.15; OR maximum age >30 years.

2.00 Intrinsic rate of increase = 0.05-0.15; OR age at 50% maturity = 5-10 years; OR a growth rate = 0.16–0.30; OR maximum age = 11-30 years.

3.00 Intrinsic rate of increase >0.16; OR age at 50% maturity = 1-5 years; OR growth rate >0.30; OR maximum age <11 years.

Intrinsic rates of increase are unknown. Most Penaeid Shrimp species reach sexual maturity within 12 months and have a maximum life span of 24 months (GMFMC 2005; SAFMC 2004; Garcia 1985).

Points of Adjustment (multiple selections allowed)

-0.25 Species has special behaviors that make it especially vulnerable to fishing pressure (e.g., spawning aggregations; site fidelity; segregation by sex; migratory bottlenecks; unusual attraction to gear; etc.).

Most commercial fishing for Shrimp occurs within several miles of the coast and concentrates effort on adult Shrimp which have migrated from the estuaries and congregate offshore for spawning (Muncy 1984). Since various species of Shrimp enter the spawning grounds at different times during the year, several fisheries may successfully operate throughout the year (Larson et al. 1989).

-0.25 Species has a strategy for sexual development that makes it especially vulnerable to fishing pressure (e.g., age at 50% maturity >20 years; sequential hermaphrodites; extremely low fecundity).

-0.25 Species has a small or restricted range (e.g., endemism; numerous evolutionarily significant units; restricted to one coastline; e.g., American lobster; striped bass; endemic reef fishes).

-0.25 Species exhibits high natural population variability driven by broad-scale environmental change (e.g. El Nino; decadal oscillations).

Broad-scale environmental changes, such as El Nino events, can influence Penaeid Shrimp populations. During the 1998 El Nino, the commercial Shrimp fishery in Ecuador collapsed (U.S. Department of State 1999). In Bangladesh, annual catch rates for all Penaeid Shrimp species reflect year to year fluctuations (FAO 1997). El Nino events can also influence Shrimp populations positively; dramatic increases in rainfall during the 1982-83 El Nino in Ecuador and Peru resulted in flooded coastal estuaries and record-setting increases in Shrimp production (NOAA 2006; Forrester 1997).

+0.25 Species does not have special behaviors that increase ease or population consequences of capture OR has special behaviors that make it less vulnerable to fishing pressure (e.g., species is widely dispersed during spawning).

+0.25 Species has a strategy for sexual development that makes it especially resilient to fishing pressure (e.g., age at 50% maturity <1 year; extremely high fecundity).

Penaeid Shrimp species, which dominate imported Shrimp catches are highly fecund (SAFMC 2004; FAO 2001). This enables populations under favorable environmental conditions to rebound from very low abundance in one year to high abundances in the next (SAFMC 2004).

+0.25 Species is distributed over a very wide range (e.g., throughout an entire hemisphere or ocean basin; e.g., swordfish; tuna; Patagonian toothfish).

Although individual Shrimp species exhibit varying distributions throughout the world, commercially important Penaeid Shrimp inhabit temperate and tropical regions throughout the world. The Giant Tiger Prawn, a Penaeid shrimp of considerable commercial importance in Indonesia, Thailand, and Bangladesh, inhabits coastal waters throughout the Indo-West Pacific (including Southeast Asia), East and Southeast Africa, and Pakistan to Japan (FAO 2005). In other exporting countries, up to fifteen different species inhabit coastal waters and support important tropical Shrimp trawl fisheries (FAO 2001; 1997).

+0.25 Species does not exhibit high natural population variability driven by broad-scale environmental change (e.g., El Nino; decadal oscillations).

3.00 Points for Life History

ABUNDANCE

Core Points (only one selection allowed)

Compared to natural or un-fished level, the species population is:

1.00 Low: Abundance or biomass is <75% of BMSY or similar proxy (e.g., spawning potential ratio).

2.00 Medium: Abundance or biomass is 75-125% of BMSY or similar proxy; OR population is approaching or recovering from an overfished condition; OR adequate information on abundance or biomass is not available.

Because of their short-lived nature (they are essentially annual crops), BMSY, and similar proxies, are difficult to apply to Shrimp populations (Leard, pers. comm. 2006). Few, if any, surveys of Shrimp abundance have been conducted among tropical shrimp trawl fisheries (FAO 2001; FAO 1997). Since information on abundance levels is not available, a score of 2 is awarded.

3.00 High: Abundance or biomass is >125% of BMSY or similar proxy.

Points of Adjustment (multiple selections allowed)

-0.25 The population is declining over a generational time scale (as indicated by biomass estimates or standardized CPUE).

Although overall information on Shrimp abundances are lacking, fishery scientists have observed decreases in Shrimp populations in the offshore waters of Bangladesh which are said to possess the largest Shrimp grounds among the South Asian nations. Fishery biologists relate the decreases to increased competition in commercial Tiger Shrimp trawling (FAO 1997). Moreover, the destructive practice of shrimp fry collection (used to seed shrimp farms) throughout many exporting nations removes large amounts of juvenile Shrimp and finfish and threatens the abundance of future Shrimp populations (EJF 2004).

-0.25 Age, size or sex distribution is skewed relative to the natural condition (e.g., truncated size/age structure or anomalous sex distribution).

-0.25 Species is listed as "overfished" OR species is listed as "depleted", "endangered", or "threatened" by recognized national or international bodies.

-0.25 Current levels of abundance are likely to jeopardize the availability of food for other species or cause substantial change in the structure of the associated food web.

+0.25 The population is increasing over a generational time scale (as indicated by biomass estimates or standardized CPUE).

+0.25 Age, size or sex distribution is functionally normal.

Age, size and sex distribution among Penaeid Shrimps is functionally normal (GMFMC 2005; SAFMC 2004; Muncy 1984; Bielsa et al. 1983).

+0.25 Species is close to virgin biomass.

+0.25 Current levels of abundance provide adequate food for other predators or are not known to affect the structure of the associated food web.

2.00 Points for Abundance

HABITAT QUALITY AND FISHING GEAR IMPACTS

Core Points (only one selection allowed)

Select the option that most accurately describes the effect of the fishing method upon the habitat that it affects

1.00 The fishing method causes great damage to physical and biogenic habitats (e.g., cyanide; blasting; bottom trawling; dredging).

Although commercial fishers use a variety of gear to capture Shrimp, the otter trawl remains the dominant gear used in the fishery (FAO 2001). A pair of wooden 'otter' boards inside the otter trawl holds the mouth of the net open by exerting a downward and outward force at towing speed. A heavy mesh bag with 'wings' on each side funnels Shrimp and other captured organisms into the codend, or tail, of the net (GMFMC 2005; FAO 2001). To maximize efficiency, fishers typically operate two to four 40-foot trawls, which are pulled from each of two firmly constructed outriggers located on the port and starboard side of the vessel (FAO 1997).

Since trawling nets, and their attachments, are designed to maximize contact with the seafloor, Shrimp trawling can modify benthic, or seafloor, habitats and affect benthic fauna, diversity and community structure (FAO 2004; Morgan and Chuenpagdee 2003). Shrimp trawling can inflict substantial damage to the seafloor by crushing, burying and exposing marine organisms. Additionally, by disturbing and re-suspending sediment, Shrimp trawling releases nutrients into the water column, increasing the occurrence of algal blooms and decreasing seagrass production (SAFMC 2004). Shrimp trawling

frequently occurs in shallow coastal areas, which serve as nursery grounds for commercially important fish species, and destroys the structural diversity critical for a large array of marine life. Additionally, Shrimp trawling typically occurs over the same areas every year, leaving benthic environments little opportunity to recover (FAO 2001; Watling and Norse 1998).

2.00 The fishing method does moderate damage to physical and biogenic habitats (e.g., bottom gillnets; traps and pots; bottom longlines).

3.00 The fishing method does little damage to physical or biogenic habitats (e.g., hand picking; hand raking; hook and line; pelagic long lines; mid-water trawl or gillnet; purse seines).

Points of Adjustment (multiple selections allowed)

-0.25 Habitat for this species is so compromised from non-fishery impacts that the ability of the habitat to support this species is substantially reduced (e.g., dams; pollution; coastal development).

Worldwide, mangrove forests are under intensive pressure from harmful fishing practices and deliberate destruction for aquaculture, namely shrimp farming (Islam and Hague 2004; Cardenal 1997). The introduction and expansion of shrimp farming has severely impacted coastal resources around the world, degrading wide coastal areas, mangroves forests and other wetlands. Shrimp farming destroys critical habitat for commercially important fish and shellfish, including Shrimp (Naylor et al. 1998). Shrimp farms directly pollute coastal ecosystems by releasing biological wastes and pollutants (EJF 2004; Naylor et al. 1998).

Worldwide, shrimp farming has resulted in the loss of approximately 2.5 million acres of mangroves, particularly in Thailand and Ecuador, which lead the world in farmed shrimp production (EJF 2004; Cardenal 1997). Since mangroves provide critical nursery habitat for developing fish and Shrimp, direct relationships between declining mangroves and declining fish catches exist (Cardenal 1997). In Bangladesh, the destructive loss of mangroves has been linked to the continued decline in artisanal fishery catches (Islam and Hague 2004) and similar correlations have been observed in Australia, Indonesia, Malaysia, and the Philippines (EJF 2004). Since mangroves serve as natural filters for terrestrial pollutants and sediments, widespread mangrove loss can increase erosion, sedimentation and pollution, which can spread to coral reef and seagrass habitats (EJF 2004). Since approximately 99% of farmed shrimp production occurs in developing nations (EJF 2004), increased proliferation of shrimp farms throughout the developing world can severely impact coastal ecosystems and critical wild Shrimp habitat (EJF 2004; Cardenal 1997). Points are thus subtracted.

-0.25 Critical habitat areas (e.g., spawning areas) for this species are not protected by management using time/area closures, marine reserves, etc.

Information on critical habitat protection within tropical Shrimp trawl fisheries is limited. In Bangladesh, although managers established a closed season to facilitate the breeding of Shrimp and other species, the restrictions are not enforced and the result is indiscriminate Shrimp trawling throughout the year leading to the depletion of spawning adults (FAO 1997).

-0.25 No efforts are being made to minimize damage from existing gear types OR new or modified gear is increasing habitat damage (e.g., fitting trawls with roller rigs or rockhopping gear; more robust gear for deep-sea fisheries).

According to recent analyses, a serious lack of information exists on the effect of Shrimp trawling on living marine resources (FAO 2001; FAO 1997). Basic information, such as the presence of benthic organisms and potential damaging effects done to them by trawling in many regions is lacking, and has not been collected (FAO 1997). Furthermore, lack of proper surveillance and management in many exporting countries may enhance the adverse effects of Shrimp trawling on habitat and marine resources (FAO 1997).

In many tropical Shrimp trawling countries, fishers add heavy chains known as tickler chains, which attach to the bottom line of the mouth of the trawl net and are dragged over the seafloor to drive Shrimp into the trawl nets. Tickler chains destroy shellfish, sponges, sea urchins and other bottom-dwelling organisms (FAO 1997).

Twelve exporting countries, including Indonesia, the Philippines, Venezuela and Mexico, currently participate in a project funded by the Global Environmental Facility and implemented by the Food and Agriculture Organization of the United Nations to reduce environmental impact from tropical Shrimp trawling (FAO 2006). However, since these countries contribute only a small percentage of shrimp to the United States (NMFS 2006), we chose to subtract for this factor.

-0.25 If gear impacts are substantial, resilience of affected habitats is very slow (e.g., deep water corals; rocky bottoms).

+0.25 Habitat for this species remains robust and viable and is capable of supporting this species.

+0.25 Critical habitat areas (e.g., spawning areas) for this species are protected by management using time/area closures, marine reserves, etc.

+0.25 Gear innovations are being implemented over a majority of the fishing area to minimize damage from gear types OR no innovations necessary because gear effects are minimal.

+0.25 **If gear impacts are substantial, resilience of affected habitats is fast (e.g., mud or sandy bottoms) OR gear effects are minimal.**

Gear effects of Shrimp trawls on habitats can vary within and among Shrimp trawl fisheries. In Indonesia, fishing area conditions range from sandy and muddy mixtures to hard bottom, mangrove-rich regions (FAO 2001), while in other regions, fishing areas may include vulnerable reefs and seagrass beds (FAO 1997). Although Shrimp trawling can severely impact hard-bottom communities, its effects on soft bottom habitats are less severe and often minimal (FAO 2004).

Since the habitats and sediment types over which Shrimp trawling occurs vary widely between exporting nations, we chose to neither add nor subtract for this factor.

0.25 Points for Habitat Quality and Fishing Gear Impacts

MANAGEMENT

Core Points (only one selection allowed)

Select the option that most accurately describes the current management of the fisheries of this species.

1.00 Regulations are ineffective (e.g., illegal fishing or overfishing is occurring) OR the fishery is unregulated (i.e., no control rules are in effect).

The United States leads the world in global imports of Shrimp; approximately 88% of all Shrimp sold in the U.S. is imported (Josupeit 2004). Tropical Shrimp trawl fisheries in Thailand, Indonesia, Ecuador, China, Vietnam, India, Mexico, and Bangladesh supply the majority of Shrimp exported to the United States (NMFS 2006).

Adequate information on management within tropical Shrimp trawl fisheries is lacking. Regulatory measures and their enforcement can vary considerably between exporting countries, which include numerous underdeveloped countries which lack adequate funding for enforcement (FAO 2004; 2001). In Indonesia, fishery managers require licenses for all Shrimp trawl vessels and prohibit trawling without the use of Turtle Excluder Devices (TEDs) or Bycatch Reduction Devices (BRDs), although monitoring and control of implementation remains low (FAO 2001). In the Philippines, fishery managers require licenses for all shrimp vessels and implement a minimum mesh size of 25mm and partial or complete closures of certain trawl areas to counter declining catch rates (FAO 2001).

Given the limited knowledge of management within the tropical shrimp fisheries, we chose to award a score of 1.00 for this factor.

2.00 Management measures are in place over a major portion over the species' range but implementation has not met conservation goals OR management measures are in place but have not been in place long enough to determine if they are likely to achieve conservation and sustainability goals.

3.00 Substantial management measures are in place over a large portion of the species range and have demonstrated success in achieving conservation and sustainability goals.

Points of Adjustment (multiple selections allowed)

-0.25 There is inadequate scientific monitoring of stock status, catch or fishing effort.

Very few studies assessing the catch composition, population status, fishing effort and catch levels of tropical Shrimp fisheries exist (FAO 2004; FAO 2001; FAO 1997). The few studies which have been conducted conclude that serious problems of insufficient monitoring exist within the fishery (FAO 2001; FAO 1997).

-0.25 Management does not explicitly address fishery effects on habitat, food webs, and ecosystems.

Increased exploitation of Shrimp by trawling has resulted in a noticeable change in predator-prey relationships and catch composition in Bangladesh waters. Declines in populations of long-living commercially important fish species such as red snappers, groupers, and large croakers have been linked to the large, unregulated catch of juveniles by Shrimp trawlers (FAO 1997). Additionally, the destructive practice of shrimp fry collection (used to seed shrimp farms) throughout many exporting nations removes large amounts of juvenile Shrimp and finfish (EJF 2004). Wild shrimp fry collection can significantly impact wild Shrimp populations, which can have serious impacts on coastal biodiversity and commercial fishing practices (EJF 2004).

-0.25 This species is overfished and no recovery plan or an ineffective recovery plan is in place.

-0.25 **Management has failed to reduce excess capacity in this fishery or implements subsidies that result in excess capacity in this fishery.**

Information on the number of vessels in commercial Shrimp trawl fisheries is limited. In several exporting nations, fishing effort (ie. number of vessels) in the shrimp fishery has substantially increased, despite catch per unit effort (CPUE) remaining stable (FAO 2001). Given the lack of adequate information, we chose to neither subtract nor add for this factor.

+0.25 There is adequate scientific monitoring, analysis and interpretation of stock status, catch and fishing effort.

+0.25 Management explicitly and effectively addresses fishery effects on habitat, food webs, and ecosystems.

+0.25 This species is overfished and there is a recovery plan (including benchmarks, timetables and methods to evaluate success) in place that is showing signs of success OR recovery plan is not needed.

No recovery plan is needed.

+0.25 Management has taken action to control excess capacity or reduce subsidies that result in excess capacity OR no measures are necessary because fishery is not overcapitalized.

0.75 Points for Management

BYCATCH

Core Points (only one selection allowed)

Select the option that most accurately describes the current level of bycatch and the consequences that result from fishing this species. The term, "bycatch" used in this document excludes incidental catch of a species for which an adequate management framework exists. The terms, "endangered, threatened, or protected," used in this document refer to species status that is determined by national legislation such as the U.S. Endangered Species Act, the U.S. Marine Mammal Protection Act (or another nation's equivalent), the IUCN Red List, or a credible scientific body such as the American Fisheries Society.

1.00 Bycatch in this fishery is high (>100% of targeted landings), OR regularly includes a "threatened, endangered or protected species."

Worldwide, Shrimp trawl fisheries generate approximately 2% of the world's catch of fish in weight, but result in more than one third of the global bycatch total (Hall et al. 2000). Tropical Shrimp trawl fisheries alone have the highest discard rate of all fisheries and account for over 27% of estimated global bycatch totals (FAO 2004). Shrimp trawls produce bycatch/catch ratios (weight discarded per weight landed) between 3:1 and 15:1 (Hall et al. 2000). In Indonesia, one the leading exporters of Shrimp to the U.S., bycatch/catch ratios range from 8:1 to 15:1 (FAO 2001).

Finfish dominates the majority of the catch in many Shrimp fisheries. Throughout the world, Shrimp trawl fisheries routinely capture catfish, anchovy, herring, menhaden, shad, eel, flounder, snappers, groupers, mackerels, croakers, and jacks, many of which are commercially important (FAO 2001). Since Shrimp in tropical Shrimp fisheries overlap in size with many juvenile fish species, the size of fish caught in the fishery are generally small (20 cm) and often of similar size to the Shrimp (FAO 2001). Discards of undersized fish, are particularly problematic in having a negative impact on the health and future condition of marine resources (FAO 1997).

In many tropical Shrimp trawl fisheries, bycatch which was formerly discarded is now being utilized (Zeller and Pauly 2005; FAO 2001). Since many tropical Shrimp trawl fisheries occur adjacent to low-income, food deficient countries, local governments do not discourage the amount of bycatch being caught, but rather encourage its use once it is caught (FAO 2001). Most of the 1.8 million tones of bycatch produced by the Chinese Shrimp trawl fishery, for example, provide feed for the Chinese aquaculture industry (FAO 2001). In Southeast Asia, where exports supply the majority of Shrimp to the U.S, government agencies offer assistance in the move towards the use of bycatch species for the production of traditional food products and aquaculture feeds (FAO 2001). Although Shrimp trawl fisheries in Indonesia retain more and more edible fish, the discard rates of juvenile fish remains high (FAO 2001), and in Bangladesh, discard rates of up to 80% have been estimated (FAO 1997). Recent analyses also suggest a trend of increased utilization of bycatch amongst Central America and Caribbean countries. In Belize, Colombia, Costa Rica and Nicaragua, between 20 to 30% of bycatch produced by Shrimp trawl fisheries is now being utilized (FAO 2001).

2.00 Bycatch in this fishery is moderate (10-99% of targeted landings) AND does not regularly include "threatened, endangered or protected species" OR level of bycatch is unknown.

3.00 Bycatch in this fishery is low (<10% of targeted landings) and does not regularly include "threatened, endangered or protected species."

Points of Adjustment (multiple selections allowed)

-0.25 **Bycatch in this fishery is a contributing factor to the decline of "threatened, endangered, or protected species" and no effective measures are being taken to reduce it.**

Shrimp trawling has long been recognized as a significant source of sea turtle bycatch and mortality throughout the world. Six species of sea turtles (Leatherback, Green, Loggerhead, Kemp's Ridley, Hawksbill, Olive Ridley) appear on IUCN's Red List of Threatened Species as either 'endangered' or 'vulnerable', due largely to interactions with fisheries (IUCN 2006; Lewison et al. 2004; Crowder 2001; Hall et al. 2000).

Beginning in 1978, the U.S. National Marine Fisheries Service began developing Turtle

Excluder Devices (TEDs) to reduce the mortality of sea turtles in the Gulf of Mexico and South Atlantic trawl fisheries (GMFMC 2005; SAFMC 2004). A TED is a grid-like structure which directs turtles, and other large organisms, out of trawl nets through a hole above the grid (GMFMC 2005; SAFMC 2004; Crowder 2001; Salz 1998). TEDs have been largely successful in reducing sea turtle bycatch in the U.S. Shrimp trawl fishery (Brewer et al. 2006; GMFMC 2005; SAFMC 2004; Crowder 2001). Recent analysis of Australia's Northern Prawn trawl fishery indicates that nets equipped with a TED resulted in a 99% reduction in sea turtle bycatch (Brewer et al. 2006).

In other exporting countries such as Indonesia and Bangladesh, fishery managers require Shrimp trawls to use a Turtle Excluder Device (TED) or Bycatch Reduction Device (BRD) (FAO 2001; FAO 1997), however these restrictions remain largely unenforced (FAO 1997). Many fishers argue that TEDs and BRDs allow large commercially important fish to escape from the net and fishers are reluctant to use them (FAO 2001; FAO 1997).

Despite the introduction of these devices, the mortality of sea turtles in association with Shrimp trawling continues (Epperly and Teas 2002). Current TED openings do not allow larger turtles, such as leatherbacks and adult loggerheads, to escape the net, decreasing overall TED effectiveness for loggerheads in the Gulf of Mexico to only 25% (Epperly et al. 2002). Since haul duration of tropical Shrimp trawls typically range from 2 to 5 hours (FAO 2001), even trawl nets equipped with TEDs may continue to capture and interact with endangered and threatened sea turtles (Epperly and Teas, Epperly 2002).

In 1989, the United States began prohibiting the importation of Shrimp from countries whose sea turtle protections were not compatible with those in the U.S. (Salz 1998). As of May 2006, the U.S. Department of State certified 38 nations as meeting the requirements for continued importation of Shrimp into the U.S., including the use of TEDs or having fishing environments that do not pose a danger to sea turtles (U.S. Department of State 2006). Chief exporting Caribbean nations including Belize, Ecuador, Honduras, Mexico, Panama, Suriname, and Venezuela require TEDs and have received certification (U.S. Department of State 2006).

For these reasons, we chose to neither add nor subtract for this factor.

-0.25 Bycatch of targeted or non-targeted species (e.g., undersize individuals) in this fishery is high and no measures are being taken to reduce it.

Shrimp trawling in tropical regions around the world continues to capture significant numbers of non-targeted species (FAO 2001). Bycatch Reduction Devices (BRDs) allow the escape of commercially important species of finfish and can significantly reduce the incidental capture of non-targeted species (FAO 2001). BRDs, such as the Nordmore grate, reduce bycatch levels by seperating actively swimming fish, which will swim out of the net to avoid passing through the grate, from passive Shrimp which continue into the net (FAO 2001).

The use of BRDs in temperate Shrimp trawl fisheries has considerably reduced bycatch levels without substantial reduction in the catch of Shrimp (FAO 2001). Despite their success in temperate Shrimp fisheries, the use of BRDs in tropical Shrimp trawl fisheries is not as effective since Shrimp in these fisheries overlap in size with juvenile fish which need to be excluded from the net (FAO 2001). Continuing work involving the use of grids and other devices mounted into the top panel of tropical Shrimp trawls show some promise but remains incomplete (FAO 2001). Additionally, increased utilization of bycatch in many countries has reduced the demand for BRDs to those which exclude only the smallest of non-targeted species (Zeller and Pauly 2005; FAO 2001).

-0.25 Bycatch of this species (e.g., undersize individuals) in other fisheries is high OR bycatch of this species in other fisheries inhibits its recovery, and no measures are being taken to reduce it.

The practice of collecting wild shrimp fry (juveniles) to 'seed' shrimp farms has the potential to severely impact Shrimp and finfish populations. In Bangladesh, the removal of more than 2 billion Giant Tiger Prawn larvae results in approximately 200 billion other organisms, including other shrimp, finfish, and zooplankton. Here, shrimp fry fisheries remove up to 90% of the Giant Tiger Prawn population (EJF 2004). Shrimp fry fisheries, and the enormous bycatch they generate, threaten future populations of Shrimp and finfish and can severely impact coastal biodiversity and commercial fisheries (EJF 2004).

-0.25 The continued removal of the bycatch species contributes to its decline.

+0.25 Measures taken over a major portion of the species range have been shown to reduce bycatch of "threatened, endangered, or protected species" or bycatch rates are no longer deemed to affect the abundance of the "protected" bycatch species OR no measures needed because fishery is highly selective (e.g., harpoon; spear).

+0.25 There is bycatch of targeted (e.g., undersize individuals) or non-targeted species in this fishery and measures (e.g., gear modifications) have been implemented that have been shown to reduce bycatch over a large portion of the species range OR no measures are needed because fishery is highly selective (e.g., harpoon; spear).

+0.25 Bycatch of this species in other fisheries is low OR bycatch of this species in other fisheries inhibits its recovery, but effective measures are being taken to reduce it over a large portion of the range.

+0.25 The continued removal of the bycatch species in the targeted fishery has had or will likely have little or no impact on populations of the bycatch species OR there are no significant bycatch concerns because the fishery is highly selective (e.g., harpoon; spear).

0.50 Points for Bycatch

REFERENCES

Important note: This ranking focuses on the leading exporting countries to the United States based upon National Marine Fisheries Service imports data. Thailand and Ecuador, which ranked first and third in U.S. imports respectively, lead the world in farmed shrimp production. Although imported data does not differentiate between farmed and wild-caught species, farmed shrimp constitutes roughly one-quarter to one-half of U.S. shrimp imports (NMFS 2006; Cardenal 1997).

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