

Re-specifying Acceptable Biological Catches for the Crustaceans and Precious Corals Management Unit Species in the Western Pacific Region

*116th Meeting of the Scientific and Statistical Committee
June 17-19, 2014*

The SSC's Task

At its 116th meeting, the SSC will be reviewing the ABC for the Hawaii and Territories Crustaceans (Kona crab, deep water shrimp, spiny and slipper lobsters) and precious corals. There was no specific language in the previous specification that the ABCs apply for multiple years (unlike the coral reef MUS). Aside from the spiny lobster, slipper lobster, and kona crab there is no new information available to make significant revisions to the ABCs and subsequent ACL. The catch data for the Hawaii slipper lobsters and kona crab had been update to 2013 and ran the same control rule measure (75th percentile). The proxy method was also applied to the new 75th percentile values to derive the ABCs for the Territories. The SSC shall evaluate whether it will adopt the new values as the new ABCs.

For the spiny lobster the biomass augmented catch-MSY approach was used to determine the MSY (Sabater and Kleiber 2014). However, since there is no fishery independent source of biomass information available, the model resorted to the default catch-MSY mode as described by Martell and Froese (2012). The P* working group already evaluated and scored the assessment aspect and the uncertainty characterization of the biomass augmented catch-MSY model. The SSC needs to determine the appropriate stock status determination as well as the Productivity and Susceptibility Scores and derive the P* level from which the ABC will be based upon.

For precious corals, there are no new information available to could adjust the current ACLs. The fishery is currently inactive with only one permit issued and the information is confidential.

It is projected that there will be no significant new information that would be available for slipper lobsters, kona crab, and precious corals for the Territories in the next 4 years. It is also assumed that the precious corals in Hawaii would remain at low participation hence for a multiyear ABC and ACL specification can be considered for fishing year 2015-2018.

Current catch information in the Territories

There is no current harvest for Kona crab and deep water shrimp. There had been no commercial record of slipper lobster landing in the last fishing year except in American Samoa where it was reported at 5 lbs. Coutures (2003) indicated that slipper lobsters make up less than one percent of the total lobster landing in American Samoa. This was verified by the BioSampling Program where they estimated slipper lobster landing to be 0.9% of total lobster catch (Ochavillo Email Comm. 11/29/2011). Spiny lobster landings did not exceed the ACLs (AS = 1,973 lbs out of 2,300 lbs catch limit; GU = 611 lbs out of 1,900 lbs catch limit; CNMI = 0 lbs out of 5,500 lbs

catch limit). There is currently no active precious coral fishery in the Territories.

Current catch information in Hawaii

The Kona crab landing from last year was 7,423 lbs out of 27,600 lbs catch limit. Deepwater shrimp landing last year was at 13,254 lbs out of 250,773 lbs catch limit. The commercial landing for slipper lobsters was at 67 lbs out of 280 lbs catch limit. Spiny lobster landing was at 10,429 lbs which exceeded the ACL by 429 lbs. The precious coral fishery is currently inactive.

Summary of options

The table below shows the summary of options for the SSC:

| Management Unit Species | Most recent catch (2013) (lbs) | Option 1: Status quo/Roll over current ABCs (lbs) | Option 2: Adopt re-calculated ABCs using updated time series data (lbs) |
|-------------------------|--------------------------------|---|---|
| Deepwater shrimp | | | |
| • Hawaii | 13,254 | 250,773 | 250,773 (no new info) |
| • American Samoa | 0 | 80,000 | 80,000 (no new info) |
| • CNMI | 0 | 275,570 | 275,570 (no new info) |
| • Guam | 0 | 48,488 | 48,488 (no new info) |
| Spiny lobster | | | |
| • Hawaii | 10,429 | 10,000 | 15,800 |
| • American Samoa | | 2,300 | 5,100 |
| • CNMI | 1,420 | 5,500 | |
| • Guam | | 2,700 | 3,300 |
| Slipper lobster | | | |
| • Hawaii | 67 | 280 | 235 |
| • American Samoa | 0 | 30 | 27 |
| • CNMI | 0 | 60 | 54 |
| • Guam | 0 | 20 | 16 |
| Kona crab | | | |
| • Hawaii | 7,423 | 27,600 | 27,100 |
| • American Samoa | No fishery | 3,200 | 3,200 |
| • CNMI | No fishery | 6,300 | 6,200 |
| • Guam | No fishery | 1,900 | 1,900 |
| Black corals | | | |
| • Hawaii | Confidential data | 5,512 | 5,512 (no new info) |
| • American Samoa | No fishery | 790 | 790 (no new info) |

| | | | |
|--------------------------------------|------------|-------|---------------------|
| • CNMI | No fishery | 2,100 | 2,100 (no new info) |
| • Guam | No fishery | 700 | 700 (no new info) |
| Precious corals known beds in Hawaii | | | |
| • Makapuu | | | |
| ○ Pink | No fishery | 2,205 | 2,205 (no new info) |
| ○ Bamboo | No fishery | 551 | 551 (no new info) |
| • 180 Fathom | | | |
| ○ Pink | No fishery | 489 | 489 (no new info) |
| ○ Bamboo | No fishery | 123 | 123 (no new info) |
| • Brooks Bed | | | |
| ○ Pink | No fishery | 979 | 979 (no new info) |
| ○ Bamboo | No fishery | 245 | 245 (no new info) |
| • Kaena Point | | | |
| ○ Pink | No fishery | 148 | 148 (no new info) |
| ○ Bamboo | No fishery | 37 | 37 (no new info) |
| • Keahole Point | | | |
| ○ Pink | No fishery | 148 | 148 (no new info) |
| ○ Bamboo | No fishery | 37 | 37 (no new info) |
| • Exploratory areas | No fishery | 2,205 | 2,205 (no new info) |
| Precious corals in exploratory beds | | | |
| • American Samoa | No fishery | 2,205 | 2,205 (no new info) |
| • Guam | No fishery | 2,205 | 2,205 (no new info) |
| • CNMI | No fishery | 2,205 | 2,205 (no new info) |

Background Information

At the 108th meeting, the SSC made the initial ABC specification for all of the MUS in the Fishery Ecosystem Plans. The following are the information used to determine the ABC for the different MUS.

| | |
|--|----|
| CRUSTACEANS..... | 4 |
| Deepwater shrimp..... | 4 |
| HAWAII..... | 4 |
| AMERICAN SAMOA..... | 5 |
| COMMONWEALTH OF NORTHERN MARIANA ISLANDS..... | 5 |
| GUAM..... | 7 |
| Spiny lobsters: HAWAII, AMERICAN SAMOA, GUAM and CNMI..... | 7 |
| AMERICAN SAMOA..... | 11 |

| | |
|---|----|
| COMMONWEALTH OF NORTHERN MARIANA ISLANDS: | 12 |
| GUAM | 12 |
| Kona Crab | 13 |
| HAWAII | 13 |
| AMERICAN SAMOA..... | 14 |
| COMMONWEALTH OF NORTHERN MARIANA ISLANDS | 15 |
| GUAM | 15 |
| PRECIOUS CORALS | 16 |
| Black Coral in Auau Channel | 16 |
| HAWAII | 16 |
| AMERICAN SAMOA..... | 17 |
| COMMONWEALTH IN NORTHERN MARIANA ISLANDS | 17 |
| GUAM | 18 |
| Pink, Gold, Bamboo Coral in Established and Conditional Beds..... | 18 |
| HAWAII | 18 |
| Pink, Gold and Bamboo Corals in the Hawaii Exploratory Area..... | 22 |
| HAWAII | 22 |
| AMERICAN SAMOA..... | 23 |
| COMMONWEALTH OF NORTHERN MARIANA ISLANDS | 23 |
| GUAM | 23 |

CRUSTACEANS

Deepwater shrimp

There is currently no significant new information that would facilitate changes to the ABC. The specification for the deepwater shrimp in Hawaii and the Territories relied on specific studies that generated MSYs. No new studies have been conducted. The SSC may choose to roll over the ABC for the deepwater shrimp in Hawaii (250,773 lbs); American Samoa (80,000 lbs); CNMI (275,575 lbs); and Guam (48,488 lbs) for fishing year 2015-2018. In addition, the current catches for Hawaii has been below the current ABC/ACL and the fishery in the Territories are currently inactive.

HAWAII: The most current estimate of maximum sustainable yield (MSY) for the deepwater shrimp stock complex in Hawaii is 125 mt/yr or 275,575 lb/yr (Tagami and Ralston 1988). At 108th SSC meeting, the SSC determined that the Hawaii deep water shrimp stock complex can be regarded as Tier 4 because MSY is known, but there is no current harvest. Therefore, consistent with the Tier 4 ABC control rule described in the Hawaii FEP, the SSC recommended the ABC be set equal to 0.91*MSY. As explained in the Hawaii FEP, the application of this

control rule would result in a fishing mortality rate of 0.70 FMSY which would maximize yield while minimizing biomass impacts, and account for scientific uncertainty.

In calculating the ABC, the SSC applied the value for exploitable biomass (271.4 mt/yr or 598,328 lb) as estimated by Ralston and Tagami, (1992) instead of the MSY estimated by Tagami and Ralston (1988), and calculated an ABC of 544,479 lb which the SSC then rounded down to 544,000 lb. Because the SSC used the value for exploitable biomass in the Tier 4 ABC control rule calculation, the SSC-recommended ABC of 544,000 lb exceeds the MSY estimate of 125 mt or 275,575 lb/yr. Therefore, consistent with the intent of the SSC's recommendation, NMFS made a technical correction to the ABC calculation by applying the correct MSY value of 125 mt/ yr or 275,575 lb/yr into the Tier 4 ABC control rule which results in a corrected ABC of 250,773 lb.

AMERICAN SAMOA: At its 108th SSC, the SSC developed a proxy for estimating MSY for the American Samoa deepwater shrimp stock complex based on the product of an equilibrium sustainable yield estimate for deepwater shrimps and an estimate of the available deepwater shrimp habitat area of the seabed between 600 and 800 m.

Based on the trapping studies conducted in the Pacific Islands, King (1986) provides a potential equilibrium sustainable yield estimate for deepwater shrimps in the Pacific Islands of 200 kg/km² per year. The equilibrium yield is estimated as the ratio of yield-per-unexploited biomass (Y/Bo) multiplied by the unexploited biomass estimated from the depletion experiments described in King (1986). Additionally, King (1988) estimates American Samoa contains approximately 200 km² of available deepwater shrimp habitat area which includes substrates between 600 and 800 m in depth though this may be an underestimate because of the incomplete coverage in the depth range of interest and because some banks and seamounts have yet to be mapped sufficiently to provide an accurate area estimate (Michael Parke, NMFS PIFSC, pers. comm.; Robert O'Conner, NMFS PIRO, pers. comm.).

Multiplying the King (1986) equilibrium sustainable yield estimate of 200 kg/km² by the King (1988) estimate of 200 km² of deepwater shrimp habitat for the territory, the SSC calculated a potential MSY proxy for deepwater shrimp in American Samoa of 40,000 kg or approximately 88,000 lb. The SSC determined that American Samoa deep water shrimp can be regarded as Tier 4 because an MSY proxy can be calculated, but there is no current harvest. Therefore, consistent with the Tier 4 ABC control rule described in the American Samoa FEP which requires ABC be set equal to 0.91*MSY, the SSC calculated ABC to be 80,000 lb. As explained in the American Samoa FEP, the application of this control rule would result in a fishing mortality rate of 0.70 FMSY, which would maximize yield while minimizing fishery impacts to biomass, and account for scientific uncertainty.

COMMONWEALTH OF NORTHERN MARIANA ISLANDS: Based on an equilibrium yield assessment conducted by NMFS Southwest Fisheries Science Center in 1987, the most current estimate of maximum sustainable yield (MSY) for the deepwater shrimp stock complex in the Mariana Archipelago is 161.5 mt/yr (Moffitt and Polovina 1987). The assessment identified *Heterocarpus ensifer*, *Heterocarpus laevigatus*, and *Heterocarpus longirostris* as the

major components of catch in the Mariana Archipelago. The assessment also estimated yield for each individual island, bank and seamount in the archipelago (Table 4).

Table 4. Equilibrium yield for *Heterocarpus* shrimps in the Mariana Archipelago Bank Area (CNMI) Yield (mt/yr)

| Bank Area (CNMI) | Yield (mt/yr) |
|---|----------------------|
| Maug | 0.9 |
| Asuncion | 1.5 |
| Agrihan | 3.0 |
| Pagan | 4.3 |
| Alamagan | 3.0 |
| Guguan | 1.7 |
| Sarigan | 0.8 |
| Anatahan | 3.1 |
| 38 Fathom | 1.7 |
| Esmeralda | 0.3 |
| Farallon de Medinilla | 10.6 |
| Saipan | 54.1 |
| Tinian | 16.3 |
| Aguijan | 7.8 |
| Rota | 24.7 |
| Bank C | 0.7 |
| Bank D | 0.9 |
| Pathfinder | 0.9 |
| Arakane | 0.5 |
| Bank A | 0.6 |
| CNMI Total | 137.4 |
| Bank Area (Guam) | |
| Guam Island | 3.9 |
| Galvez and Santa Rosa | 20.2 |
| Guam Total | 24.1 |
| Archipelagic Total (CNMI + Guam) | 161.5 |

Source: Adapted from Moffitt and Polovina (1987)

At its 108th meeting, the SSC determined that the CNMI deep water shrimp stock complex can be regarded as a Tier 4 stock complex because an MSY is known, but there is no current harvest. Therefore, consistent with the Tier 4 ABC control rule described in the Mariana Archipelago FEP, the SSC recommended the $ABC = 0.91 * MSY$. As explained in the Mariana FEP, the application of this control rule would result in a fishing mortality rate of 0.70 FMSY, which would maximize yield while minimizing biomass impacts, and account for scientific uncertainty. Applying the Tier 4 ABC control rule to the CNMI deepwater shrimp MSY estimate of 137.4

mt/yr (302,830 lb), as provided for in Moffitt and Polovina (1987) and listed in Table 4, yields an ABC of 125 mt/yr or 275,570 lb¹.

GUAM: A small-scale fishery for deepwater shrimp occurred in the 1970s, but ended shortly thereafter. No fishing or landings have been reported since. There are currently no federal crustacean permits issued for deepwater shrimp harvest in Guam and no recent shrimp harvests have been reported. Based on an equilibrium yield assessment conducted by NMFS Southwest Fisheries Science Center in 1987 (Moffitt and Polovina 1987), the most current estimate of MSY for the deepwater shrimp stock complex in Guam, including the offshore banks of Galvez and Santa Rosa, is 24.1 mt/yr or 53,116 lb/yr (Table 4)².

At its 108th meeting, the SSC determined that the Guam deep water shrimp stock complex can be regarded as Tier 4 because an MSY is known, but there is no current harvest. Therefore, consistent with the Tier 4 ABC control rule described in the Mariana Archipelago FEP, the SSC recommended $ABC = 0.91 * MSY$. As explained in the Mariana FEP, the application of this ABC control rule would result in a fishing mortality rate of $0.70 F_{MSY}$, which would maximize yield while minimizing biomass impacts, and account for scientific uncertainty. Applying the Tier 4 ABC control rule to the MSY estimate of 24.1 mt/yr, as provided for in Moffitt and Polovina (1987) and listed in Table 4, yields an ABC of 22 mt/yr or 48,488 lb.

Spiny lobsters: HAWAII, AMERICAN SAMOA, GUAM and CNMI

MSY was estimated for the Hawaii spiny lobster using the catch-MSY approach originally developed by Martell and Froese (2012) where it implemented a Monte-Carlo simulation to generate a biomass project using a range value of rate of population increase, r , and carrying capacity, k , minus the catch at any step in the time series. This approach was augmented by adding biomass information as one of the priors (Sabater and Kleiber 2014). The augmented approach is useful if there is a biomass estimate. In the absence of the biomass estimate, the model defaults to running the original routine as described by Martell and Froese (2014).

The following MSYs were generated for Hawaii, American Samoa, Guam and CNMI

| Jurisdiction | MSY | sigma | mode | 5% | 95% |
|---------------|--------|-------|--------|--------|--------|
| Hawaii | 20,400 | 4,000 | 19,200 | 11,600 | 41,500 |
| Guam | 4,600 | 700 | 4,300 | 1,700 | 14,900 |

¹ Note that this is a corrected ABC. At its 108th meeting, the SSC applied an MSY estimate of 133.8 mt/yr (294,975 lb/yr) for CNMI deepwater shrimp, resulting in an ABC of 268,000 lb. However, the MSY estimate used by the SSC is the result of a technical error in the interpretation of Moffitt and Polovina (1987) who calculate the MSY for deepwater shrimp in the CNMI as 137.4 mt/yr as shown in Table 4.

² Note that this is a corrected ABC. At its 108th meeting, the SSC applied an MSY estimate of 27.7 mt/yr (61,067 lb/yr) for Guam deepwater shrimp, resulting in an ABC of 268,000 lb. However, the MSY estimate used by the SSC is the result of a technical error in the interpretation of Moffitt and Polovina (1987) who calculate the MSY for deepwater shrimp in Guam as 24.1 mt/yr as shown in Table 4.

| | | | | | |
|-----------------------|-------|-----|-------|-------|--------|
| CNMI | 9,600 | 800 | 9,000 | 3,200 | 28,800 |
| American Samoa | 7,300 | 700 | 7,100 | 2,500 | 24,400 |

At the 115th SSC Meeting and the 159th Council Meeting, the SSC and Council, respectively, heard the presentation on the final results of the P* Analysis conducted by the P* Working Group. This analysis covered the first two dimensions of the P* analysis with a total of 8 point deduction to the 50% risk of exceeding MSY. In order to specify the ABC, the SSC must deliberate the score for the stock status using the following rules:

| Description | Fishing level | Score |
|-------------------------|---------------------|-------|
| Lightly harvested | Catch \ll 1/3MSY | 0.0 |
| Moderately harvested | Catch $<$ MSY | 2.5 |
| Fully harvested | Catch \approx MSY | 5.0 |
| Over harvested | Catch $>$ MSY | 7.5 |
| Severely Over harvested | Catch $>$ 2x+MSY | 10.0 |

Once applied, the following scores were derived:

| Area | MSY | ACL | ave 3 yrs | 1/3 MSY | 2/3 MSY | 2x MSY | 3x MSY | 0 | 2.5 | 5 | 7.5 | 10 |
|----------------|--------|--------|-----------|---------|---------|--------|--------|---|-----|---|-----|----|
| Hawaii | 20,400 | 10,000 | 9,263 | 6,800 | 13,000 | 40,800 | 61,200 | F | 2.5 | F | F | F |
| Guam | 4,600 | 2,700 | 1,354 | 1,533 | 3,067 | 9,200 | 13,800 | 0 | F | F | F | F |
| American Samoa | 7,300 | 2,300 | 2,401 | 2,433 | 4,867 | 14,600 | 21,900 | 0 | F | F | F | F |
| CNMI | 9,600 | 5,500 | 490 | 3,200 | 6,400 | 19,200 | 27,200 | 0 | F | F | F | F |

Stock Status scores for spiny lobsters in Hawaii = 2.5

Stock Status scores for spiny lobsters in American Samoa = 0

Stock Status scores for spiny lobsters in Guam = 0

Stock Status scores for spiny lobsters in CNMI = 0

Regarding the productivity-susceptibility dimension, scores are given at 2.5 point reduction increment. A productivity score of 0 point reduction is given to stocks that are highly productive, 5 point reduction for medium productivity, and a score of 10 point reduction for low productivity stocks. For susceptibility, a score of 0 point reduction for stock that are not vulnerable or has high resilience, 5 point reduction for mid-level vulnerability, and a 10 point reduction score for species that are highly susceptible to overfishing or getting overfished. The PSAs are mostly based on the life history characteristics and the type of fishery the species are harvest.

Growth studies done on *Panulirus marginatus* at the Northwest Hawaiian Islands showed that there was a high degree of variation in growth rate on between sexes, location and years³. The

³ O'Malley, J.M. 2009. Spatial and temporal variability in growth of Hawaiian spiny lobsters in the Northwestern Hawaiian Islands. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 1:325-342

levels of variability are indicative on the uncertainties surrounding the stock and making general conclusions regarding the stocks at larger scales would be flawed. In addition, spiny lobsters release large number of eggs and the PLD is approximately 1 year. The level of recruitment can be considered low (Parrish per comm., May 24, 2014). One of the species in the spiny lobster complex in Hawaii is endemic. Therefore, with great uncertainties involving this stock and this life history characteristics, the PSA scores for Hawaii should be treated conservatively (Productivity = 7.5; Susceptibility =10)

Spiny lobsters in the Territories are not as developed as the Main Hawaiian Island. Majority of the harvest of lobsters are opportunistic and associated with the spear fishery. Utilizing the same productivity scores and adjusting the susceptibility scores based on the current fishing effort in the Territories the susceptibility can be scored as 2.5. This would result in the following scores for the spiny lobster in the PSA dimension:

PSA scores for spiny lobsters in Hawaii = 8.75

PSA scores for spiny lobsters in American Samoa = 5

PSA scores for spiny lobsters in Guam = 5

PSA scores for spiny lobsters in CNMI = 5

Summing all the dimension scores results in the following P* values:

| | Scientific Information | Uncertainty Characterization | Stock Status | PSA | Summ scores | P* |
|----------------|------------------------|------------------------------|--------------|------|-------------|------------|
| Hawaii | 3 | 5 | 2.5 | 8.75 | 19.25 | 30.75 ≈ 30 |
| American Samoa | 3 | 5 | 0 | 5 | 13 | 37 ≈ 35 |
| Guam | 3 | 5 | 0 | 5 | 13 | 37 ≈ 35 |
| CNMI | 3 | 5 | 0 | 5 | 13 | 37 ≈ 35 |

The risk tables generated by the Catch-MSY approach shows the catch level associated with the respective risk levels corresponding to the ABC:

| | P* | ABC (lbs) |
|----------------|------------|-----------|
| Hawaii | 30.75 ≈ 30 | 15,800 |
| American Samoa | 37 ≈ 35 | 5,100 |
| Guam | 37 ≈ 35 | 3,300 |
| CNMI | 37 ≈ 35 | 7,800 |

Slipper lobsters

Slipper lobsters are not adequately monitored in the existing creel survey in American Samoa, Guam, and CNMI. The commercial reporting systems has the highest potential of capturing this fishery information but are still inadequate to specify ABC or ACLs using the data poor methods described in the FEP. The best information available is still the initial ABC specification.

HAWAII: There is no MSY estimate for slipper lobsters in Hawaii.⁴ At the 108th SSC meeting, the SSC recommended that, for species with no MSY estimates, the ABC be set in accordance with the Tier 5 ABC control rule as described in the Hawaii FEP. See Section 1 for a description of the Council's default ABC control rule for Tier 5 data poor stocks.

In defining "Recent Catch" to apply in the ABC control rule, the SSC recommended using the 75th percentile of the long term catch history for MHI slipper lobster as the definition of "Recent Catch." The 75th percentile is the value of an array (in this case, the level of catch in terms of pounds) below which 75% of the observations may be found. This is a non-parametric approach, that is, a distribution-free method and does not rely on assumptions that the data are drawn from a given probability distribution. Referring to discussions at the 107th SSC meeting, the SSC noted that the insular fishery catch vs. time-series data usually display considerable inter-annual variability; therefore, non-parametric measures are a better way to summarize such data compared to averages (Chambers et al. 1983, Cleveland 1993).

The SSC noted that the inter-quartile range (25-75th percentile) is a standard non-parametric measure that may be used to summarize data with considerable inter-annual variability, and determined that using the 75th percentile of long-term catch for Tier 5 stocks was more appropriate than the median long-term catch (or 50th percentile) as described in the Tier 5 control rule because using the 50th percentile is likely to result in ABC being attained 50% of the time.

The SSC determined a multiplier of 1 was warranted in both calculations of ABC because there are numerous state regulations to conserve lobster populations in both the MHI and the NWHI, including size limits (Hawaii Administrative Rule Title 13, Subtitle 4, Chapter 89 §13-89-1), prohibitions on taking or killing of female slipper lobsters (Hawaii Revised Statutes §188-58.5) and numerous restricted fishing areas including Fishery Management Areas, Marine Life Conservation Districts, State Marine Refuges and Natural Area Reserves.

The initial ACL specification in 2011 utilized data from the Commercial Reports generated by DAR from 1966 to 2009. This time series was updated and the SSC applied the same control rule. Based on this approach and rationale, the ABC for slipper lobster in the MHI using 1 x the 75th percentile of the long term catch history was recalculated to be at **235 (±485) lbs** from a previous **280 (±508) lbs** level. It is notable that the slipper lobster landings in the recent 4 years fall within the range of landings in the past 2 decades. The difference between the recalculated and the previous ABC is merely 45 lbs. Given the standard deviation is an order of magnitude larger than the difference between the previous and the recalculated ABC and changes in the specification would be overall insignificant but will have repercussions in the calculation of the ABC for the Territories because it uses the Hawaii landings as the base for the catch-area proxies. The SSC may consider rolling over the 280 lbs as the ABC for fishing year 2015 to 2018 or respecify a new ABC at 235 lbs based on the updated catch time series.

⁴ Amendment 1 to the Fishery Management Plan for Crustacean Fisheries of the Western Pacific Region (WPFMC 1983) provides an estimate of optimum yield for MHI lobsters as being 15-30,000 lobsters annually. However, the basis for this estimate is unknown. Using an estimate of 2 lb/lobster (Kelly and Messer, 2005), an OY of 15-30,000 lobsters would yield between 30,000 and 60,000 pounds of lobsters annually. The SSC did not rely on this data in setting ABC.

AMERICAN SAMOA: There is no MSY estimate for **slipper lobsters** in American Samoa. Additionally, there is no catch information and, therefore, this precludes the use of the Tier 5 ABC control rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating an ABC for the American Samoa slipper lobster stock complex.

First, SSC recognized that essential fish habitat (EFH) designation for juvenile and adult slipper lobsters in American Samoa included all bottom habitat from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that American Samoa contains approximately 296 km² of lobster EFH as shown in Table 5. The SSC then developed an estimate of slipper lobster density based on the slipper lobster density estimated for Hawaii (the only area that has specifically documented harvesting of slipper lobster). To do this, the SSC applied the 75th percentile of slipper lobster catch from the MHI (which is 280 lb), and a MHI lobster EFH area of 2,535 km², and calculated that there are approximately 0.11 spiny lobsters per km² of EFH in the MHI. Using this spiny lobster density as a proxy for slipper lobsters, and applying the ratio of 0.11 lobsters per EFH area to American Samoa, the SSC calculated the ABC for American Samoa slipper lobster stock complex to be 33 lb, but rounded down to 30 lb.

American Samoa Slipper Lobster ABC Proxy Equation:

$$(280 \text{ lb lobsters} / 2,535 \text{ km}^2) * 296 \text{ km}^2 = 33 \text{ lbs}$$

Utilizing the new 75th percentile of the slipper lobster catch from the MHI (which is 235 lb), and applying the same calculation shown above, the new ABC for the American Samoa slipper lobster stock complex would be lower at 27 lbs.

American Samoa Slipper Lobster ABC Proxy Equation:

$$(235 \text{ lb lobsters} / 2,535 \text{ km}^2) * 296 \text{ km}^2 = 27 \text{ lbs}$$

Although the SSC expressed concern about undocumented slipper lobster landings, it did note that the species is a small proportion of total lobster landings. The SSC also noted that American Samoa regulations prohibit the harvest of berried females for both species (American Samoa Administrative Code, Title 24, Chapter 9, V. 24.0935 and 24.0936) and the extensive protected areas on Tutuila and in the Rose Atoll Monument. An additional regulation is the prohibition of the use of spears or snagging devices to harvest slipper lobsters (American Samoa Administrative Code, Title 24, Chapter 9, V. 24.0935). An additional regulation for spiny lobsters is a size restriction (American Samoa Administrative Code, Title 24, Chapter 9, V. 24.0936).

The SSC may consider rolling over the 30 lbs as the ABC for the American Samoa slipper lobsters for fishing year 2015 to 2018 or respecify a new ABC at 27 lbs based on the updated Hawaii catch time series and recalculated catch-area proxy.

COMMONWEALTH OF NORTHERN MARIANA ISLANDS: There is no MSY estimate for **slipper lobsters** in CNMI. Additionally, there are only three years of available catch information and, therefore, this precludes the use of the Tier 5 ABC control rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating an ABC for the CNMI slipper lobster stock complex.

First, SSC recognized that essential fish habitat (EFH) designation for juvenile and adult slipper lobsters in CNMI included all bottom habitat from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that CNMI contains approximately 579 km² of lobster EFH. The SSC then developed an estimate of slipper lobster density based on the slipper lobster density estimated for Hawaii (the only area that has specifically documented harvesting of slipper lobster). To do this, the SSC applied the 75th percentile of slipper lobster catch from the MHI (which is 280 lb), and a MHI lobster EFH area of 2,535 km², and calculated that there are approximately 0.11 spiny lobsters per km² of EFH in the MHI. Using this spiny lobster density as a proxy for slipper lobsters, and applying the ratio of 0.11 lobsters per EFH area to the CNMI, the SSC calculated the ABC for the CNMI slipper lobster stock complex to be 64 lb, but rounded the ABC downward to 60 lb.

CNMI Slipper Lobster ABC Proxy Equation:

$$(280 \text{ lb slipper lobsters} / 2,535 \text{ km}^2) * 579 \text{ km}^2 \text{ (estimated EFH)} = 64 \text{ lbs}$$

Utilizing the new 75th percentile of the slipper lobster catch from the MHI (which is 235 lb), and applying the same calculation shown above, the new ABC for the CNMI slipper lobster stock complex would be lower at 54 lbs.

CNMI Slipper Lobster ABC Proxy Equation:

$$(235 \text{ lb lobsters} / 2,535 \text{ km}^2) * 579 \text{ km}^2 \text{ (estimated EFH)} = 54 \text{ lbs}$$

For spiny lobsters in the CNMI, the SSC determined a multiplier of 1 was warranted because there is no evidence of a long-term trend toward depletion in 20 years of landings. Additional sources of assurance that overfishing is not occurring for both spiny and slipper lobsters in CNMI, there is a significant reservoir of biomass in the uninhabited islands and monument, a closed area of shallow reef off Farallon de Medinilla that provides habitat for lobsters, and territorial regulations that provide protection to lobsters less than 3 inches, berried females and unberried females, as well as prohibit any harvest mechanism other than by hand (DFW Fishing Regulations, Part 3, Section 50.1).

The SSC may consider rolling over the 60 lbs as the ABC for the CNMI slipper lobsters for fishing year 2015 to 2018 or respecify a new ABC at 54 lbs based on the updated Hawaii catch time series and recalculated catch-area proxy.

GUAM: There is no MSY estimate for **slipper lobsters** in Guam. Additionally, there is no catch information and, therefore, this precludes the use of the Tier 5 ABC control rule. Therefore, the

SSC at its 108th meeting developed a proxy for calculating the ABC for the Guam slipper lobster stock complex.

First, the SSC recognized that essential fish habitat (EFH) designation for juvenile and adult slipper lobsters in Guam included all bottom habitat from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that Guam contains approximately 179 km² of lobster EFH. The SSC then developed an estimate of slipper lobster density based on the slipper lobster density estimated for Hawaii (the only area that has specifically documented harvesting of slipper lobster). To do this, the SSC applied the 75th percentile of slipper lobster catch from the MHI (which is 280 lb), and a MHI lobster EFH area of 2,535 km², and calculated that there are approximately 0.11 spiny lobsters per km² of EFH in the MHI. Using this spiny lobster density as a proxy for slipper lobsters, and applying the ratio of 0.11 lobsters per EFH area in Guam, the SSC calculated the ABC for the Guam slipper lobster stock complex to be 20 lb.

Guam Slipper Lobster ABC Proxy Equation:

$$(280 \text{ lb slipper lobsters} / 2,535 \text{ km}^2 \text{ (EFH in Hawaii)}) * 179 \text{ km}^2 \text{ (EFH in Guam)} = 20 \text{ lbs}$$

Utilizing the new 75th percentile of the slipper lobster catch from the MHI (which is 235 lb), and applying the same calculation shown above, the new ABC for the Guam slipper lobster stock complex would be lower at 16 lbs.

Guam Slipper Lobster ABC Proxy Equation:

$$(235 \text{ lb lobsters} / 2,535 \text{ km}^2) * 179 \text{ km}^2 \text{ (estimated EFH in Guam)} = 16 \text{ lbs}$$

The SSC determined a multiplier of 1 was warranted for slipper lobsters because of the various Guam territorial laws that aid in maintaining the spiny and slipper lobster biomasses, including commercial harvest size restrictions and a prohibition on berried females, a ban on spiny lobster export, as well as gear restrictions (no puncturing of spiny lobster intended for sale) (9 G.A.R. §12401). Additionally, Guam implemented measures for personal harvest of spiny and slipper lobsters, including no taking of berried females, size restrictions, and gear restrictions (9 G.A.R. §12402).

The SSC may consider rolling over the 20 lbs as the ABC for the American Samoa slipper lobsters for fishing year 2015 to 2018 or respecify a new ABC at 16 lbs based on the updated Hawaii catch time series and recalculated catch-area proxy.

Kona Crab

HAWAII: There is no MSY estimate for Kona crab in Hawaii. At the 108th SSC meeting, the SSC recommended that, for species with no MSY estimates, the ABC be set in accordance with the Tier 5 ABC control rule as described in the Hawaii Archipelago FEP. See Section 1 for a description of the Council's default ABC control rule for Tier 5 data poor stocks.

In defining “Recent Catch” to apply in the ABC control rule, the SSC recommended using the 75th percentile of the entire catch history for Kona crab as the definition of “Recent Catch.” Based on this approach, the SSC recommended the ABC for the Kona crab fishery in Hawaii be set based on 1 x the 75th percentile of the long term catch history. Specifically, the SSC calculated the ABC for Kona crab to be 27,560 lb, but rounded ABC upward to 27,600 ± 13,440 lb.

The SSC determined a multiplier of 1 was warranted for Hawaii Kona crab because there is no long-term decline in harvest over the last 30 years and there are numerous Hawaii state regulations to conserve Kona crab resources including, , restrictions on taking of female Kona crab (Hawaii Revised Statutes §188-58.5), and minimum size restrictions, seasonal closures (May-August), and gear restrictions (e.g. no spearing Kona crab, minimum net mesh size) (Hawaii Administrative Rule Title 13, Subtitle 4, Chapter 89 §13-95-52).

At the 113rd meeting of the SSC, the catch data for the Kona Crab was updated to 2011 yielding 27,400 ± 13,307 lbs from the previous initial specification of 27,600 lbs. Updating the catch data further to 2013 resulted in a new potential ABC of 27,100 ± 13,237 lbs. The difference between the initial specification and the recalculated value is merely 500 lbs and is in 2 orders of magnitude of the standard deviation deeming it insignificant.

| |
|--|
| The SSC may consider rolling over the 27,400 lbs as the ABC for fishing year 2015 to 2018 or respecify a new ABC at 27,100 lbs based on the updated catch time series. |
|--|

AMERICAN SAMOA: There is no MSY estimate for Kona crab in American Samoa. Additionally, the lack of catch information precludes the use of the Tier 5 ABC control rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating the ABC for Kona crab in American Samoa.

First, the SSC recognized that the essential fish habitat (EFH) designation for juvenile and adult Kona crab in American Samoa includes all bottom habitats from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that American Samoa contains approximately 296 km² of Kona crab EFH. Applying the 75th percentile of Kona crab catch from the MHI (which is 27,600 lb), and using the MHI Kona crab estimated EFH area of 2,535 km², the SSC determined that this would result in 10.88 Kona crabs per km² of EFH in the MHI. Applying the ratio of 10.87 Kona crabs per EFH area in American Samoa, the SSC calculated the ABC for American Samoa Kona crab to be 3,222 lb, but rounded ABC downward to 3,200 lb.

American Samoa Kona Crab ABC Proxy Equation:

$$(27,600 \text{ lb Kona crab} / 2,535 \text{ km}^2 \text{ estimated Kona crab EFH in Hawaii}) * 296 \text{ km}^2 \text{ (estimated American Samoa Kona crab EFH)} = 3,222 \text{ lb}$$

Utilizing the new 75th percentile of the Kona crab catch from the MHI (which is 27,100 lb), and applying the same calculation shown above, the new ABC for the American Samoa stock complex would be lower at 3,164 lbs.

$$(27,100 \text{ lb Kona crab} / 2,535 \text{ km}^2 \text{ estimated Kona crab EFH in Hawaii}) * 296 \text{ km}^2 \text{ (estimated American Samoa Kona crab EFH)} = 3,164 \text{ lb}$$

The difference between the initial ABC of 3,222 lbs and the recalculated ABC of 3,164 lb is not significant. When rounded-off to the nearest hundreds would result in a similar value of 3,200 lb which is the current ABC. The SSC may choose to roll over the current ABC to fishing year 2015 to 2018 or respecify a different ABC outside the scope of the current analysis.

COMMONWEALTH OF NORTHERN MARIANA ISLANDS: There is no MSY estimate for Kona crab in the CNMI. Additionally, the lack of catch information precludes the use of the Tier 5 ABC control rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating the ABC for the Kona crab fishery in the CNMI.

First, the SSC recognized that essential fish habitat (EFH) designation for juvenile and adult Kona crab in the CNMI includes all bottom habitats from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that the CNMI contains approximately 579 km² of Kona crab EFH as shown in Table 5. Applying the 75th percentile of Kona crab catch from the MHI which is 27,600 lb, and an estimated MHI Kona crab EFH area of 2,535 km², the SSC determined that this would result in 10.88 Kona crabs per km² of EFH in the MHI. Applying the ratio of 10.88 Kona crabs per EFH area in the CNMI, the SSC calculated the ABC for the CNMI Kona crab to be 6,303 lb, but rounded the ABC downward to 6,300 lb.

CNMI Kona crab ABC Proxy Equation:

$$(27,600 \text{ lb Kona crab} / 2,535 \text{ km}^2 \text{ estimated Kona Crab EFH in Hawaii}) * 579 \text{ km}^2 \text{ (estimated Kona crab EFH in the CNMI)} = 6,303 \text{ lb}$$

Utilizing the new 75th percentile of the Kona crab catch from the MHI (which is 27,100 lb), and applying the same calculation shown above, the new ABC for the CNMI stock complex would be lower at 6,190 lbs.

$$(27,100 \text{ lb Kona crab} / 2,535 \text{ km}^2 \text{ estimated Kona crab EFH in Hawaii}) * 579 \text{ km}^2 \text{ (estimated CNMI Kona crab EFH)} = 6,190 \text{ lb}$$

The SSC may consider rolling over the 6,300 lbs as the ABC for Kona crabs in CNMI for fishing year 2015 to 2018 or respecify a new ABC at 6,190 lbs but rounded upwards 6,200 lbs based on the updated catch time series.

GUAM: There is no MSY estimate for Kona crab in Guam. Additionally, the lack of catch information precludes the use of the Tier 5 ABC control rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating the ABC for the Kona crab fishery.

First, SSC recognized that essential fish habitat (EFH) designation for juvenile and adult Kona crab in Guam included all bottom habitats from the shoreline to a depth of 100 m (see section 3.4 for EFH designations). Next, the SSC noted that Guam contains approximately 179 km² of Kona crab EFH as shown in Table 5. Applying the 75th percentile of Kona crab catch from the MHI which is 27,600 lb, and an estimated MHI Kona crab EFH area of 2,535 km², the SSC determined that this would result in 10.88 Kona crabs per km² of EFH in the MHI. Applying the ratio of 10.88 Kona crabs per EFH to the estimated Kona crab EFH area in Guam, the SSC calculated the ABC for the Guam Kona crab fishery to be 1,948 lb, but rounded ABC downward to 1,900 lb.

Guam Kona crab ABC Proxy Equation:

$$(27,600 \text{ lb Kona crab in Hawaii fishery} / 2,535 \text{ km}^2 \text{ estimated Hawaii Kona crab EFH}) * 179 \text{ km}^2 \text{ (estimated Guam Kona crab EFH)} = 1,948 \text{ lb}$$

Utilizing the new 75th percentile of the Kona crab catch from the MHI (which is 27,100 lb), and applying the same calculation shown above, the new ABC for the Guam stock complex would be lower at x lbs.

$$(27,100 \text{ lb Kona crab} / 2,535 \text{ km}^2 \text{ estimated Kona crab EFH in Hawaii}) * 179 \text{ km}^2 \text{ (estimated Guam Kona crab EFH)} = 1,914 \text{ lb}$$

The difference between the initial ABC of 1,948 lbs and the recalculated ABC of 1,914 lb is not significant. When rounded-off to the nearest hundreds would result in a similar value of 1,900 lb which is the current ABC. The SSC may choose to roll over the current ABC to fishing year 2015 to 2018 or respecify a different ABC outside the scope of the current analysis.

PRECIOUS CORALS

There is currently no significant new information that would facilitate changes to the ABC. The specification for the black and precious corals in Hawaii relied on specific studies that generated MSYs and quotas. No new studies have been conducted. The SSC may choose to roll over the ABC for the Hawaii black and precious coral at the exploratory and identified beds. In addition, the current catches for Hawaii have been confidential due to less than three fishers and overall the fishery in Hawaii had been inactive.

Black Coral in Auau Channel

HAWAII: The most current estimate of MSY for black coral in the Auau Channel is provided by Grigg (2004) which is 3,750 kg/yr (8,250 lb/yr). Based on this estimate, the current harvest quota for black coral in the Auau Channel is 5,000 kg (11,000 lb) which may be taken during any part of a two year fishing year cycle.

At 108th SSC meeting, the SSC considered the MSY estimate provided by Grigg (2004) including the current status of participation in the fishery, and average annual landings for 2000-2010 relative to the existing biennial harvest quota of 5,000 kg (11,000 lb). The SSC determined

that the black coral fishery in the MHI can be regarded as Tier 4 because MSY is known, but there is little harvest. Therefore, consistent with the Tier 4 ABC control rule described in the Hawaii FEP which requires the ABC be set equal to $0.91 * MSY$, the SSC calculated ABC to be 3,413 kg/yr (7,508 lb/yr) and rounded the ABC downward to 7,500 lb/yr. As explained in the Hawaii FEP, the application of this control rule would result in a fishing mortality rate of $0.70 F_{MSY}$, which would maximize yield while minimizing biomass impacts, and account for scientific uncertainty.

AMERICAN SAMOA: There is no estimate of MSY for black coral in American Samoa. Additionally, there is no catch information available which precludes the use of the Tier 5 Control Rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating ABC for American Samoa black coral.

The MSY proxy was based on comparing available black coral habitat in Auau Channel of the MHI (Auau Channel, 241.7 nmi^2) and Hawaii's coastline length (653 nmi) to the coastline length of American Samoa (69 nmi). Using this ratio comparison provides a potential available area for black coral habitat in American Samoa (25.5 nmi^2).

American Samoa black coral habitat proxy Equation:
$$(241.7 \text{ nmi}^2 / 653 \text{ nmi}) * 69 \text{ nmi} = 25.5 \text{ nmi}^2$$

The ratio of Hawaii black coral MSY (8,250 lbs) and habitat area in Hawaii (241.7 nmi^2) was then compared to potential habitat area in American Samoa, resulting in a potential MSY proxy of 872 lbs.

American Samoa black coral MSY proxy equation:
$$(8250 \text{ lbs} / 241.7 \text{ nmi}^2) * 25.5 \text{ nmi}^2 = 872 \text{ lbs}$$

This crude estimation does not take into account differences in available shelf habitat. For example, American Samoa does not have the shelf area afforded by Penguin Banks in Hawaii, which includes the Auau Channel. Thus, this MSY is likely an overestimation. The SSC then determined that the black coral fishery in American Samoa can be regarded as Tier 4 because MSY/MSY proxy is known, but there is no harvest. Therefore, consistent with the Tier 4 control rule described in the American Samoa FEP which requires the ABC be set equal to $0.91 * MSY$, the SSC calculated the black coral ABC as 794 lbs and rounded this value down to 790 lbs.

COMMONWEALTH IN NORTHERN MARIANA ISLANDS: There is no estimate of MSY for black corals in CNMI, Additionally, there is no catch information available and this precludes the use of the Tier 5 Control Rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating the ABC for CNMI black coral.

The MSY proxy was based on comparing available black coral habitat in Auau Channel of the MHI (Auau Channel, 241.7 nmi^2) and Hawaii's coastline length (653 nmi) to the coastline length of the CNMI (179 nmi). Using this ratio comparison provides a potential available area for black coral habitat in CNMI (66.3 nmi^2).

CNMI black coral habitat proxy equation:

$$(241.7 \text{ nmi}^2 / 653 \text{ nmi}) * 179 \text{ nmi} = 66.3 \text{ nmi}^2$$

The ratio of Hawaii black coral MSY (8,250 lbs) and habitat area in Hawaii (241.7 nmi²) was then compared to potential habitat area in CNMI, resulting in a potential MSY proxy of 2,261 lb.

CNMI black coral MSY proxy equation:
 $(8,250 \text{ lb} / 241.7 \text{ nmi}^2) * 66.3 \text{ nmi}^2 = 2,261 \text{ lb}$

This crude estimation does not take into account differences in available shelf habitat. For example, CNMI does not have the shelf area afforded by Penguin Banks in Hawaii, which includes the Auau Channel. Thus, this MSY is likely an overestimation. The SSC then determined that the black coral fishery in CNMI can be regarded as Tier 4 because MSY/MSY proxy is known, but there is no harvest. Therefore, consistent with the Tier 4 control rule described in the Mariana Archipelago FEP which requires the ABC be set equal to 0.91*MSY, the SSC calculated the CNMI black coral ABC as 2,058 lb and rounded this value up to 2,100 lb.

GUAM: There is no estimate of MSY for black corals in Guam. Additionally, there is no catch information available, and this precludes the use of the Tier 5 Control Rule. Therefore, the SSC at its 108th meeting developed a proxy for calculating the ABC for Guam black corals.

The MSY proxy was based on comparing available black coral habitat in Auau Channel of the MHI (Auau Channel, 241.7 nmi²) and Hawaii's coastline length (653 nmi) to the coastline length of the Guam (58 nmi). Using this ratio comparison provides an estimate of the potential available area for black coral habitat in Guam (21.5 nmi²).

Guam estimated black coral habitat equation:
 $(241.7 \text{ nmi}^2 / 653 \text{ nmi}) * 58 \text{ nmi} = 21.5 \text{ nmi}^2$

The ratio of Hawaii black coral MSY (8,250 lb) and habitat area in Hawaii (241.7 nmi²) was then compared to potential habitat area in Guam, resulting in a potential MSY proxy of 733 lb.

Guam black coral MSY proxy equation:
 $(8,250 \text{ lb} / 241.7 \text{ nmi}^2) * 21.5 \text{ nmi}^2 = 733 \text{ lb}$

This crude estimation does not take into account differences in available shelf habitat. For example, Guam does not have the shelf area afforded by Penguin Banks in Hawaii, which includes the Auau Channel. Thus, this MSY is likely an overestimation. The SSC then determined that the black coral fishery in Guam can be regarded as Tier 4 because MSY/MSY proxy is known, but there is no harvest. Therefore, consistent with the Tier 4 control rule described in the Mariana Archipelago FEP which requires the ABC be set equal to 0.91*MSY, the SSC calculated the Guam black coral ABC as 667 lb and rounded this value up to 700 lbs.

Pink, Gold, Bamboo Coral in Established and Conditional Beds

HAWAII: Fishing for other precious corals (pink, bamboo and gold) is not currently conducted in Hawaii. One company used two one-man submersibles to survey and harvest pink and gold

corals at depths between 400 and 500 meters in the MHI during 1999 and 2001; however, they did not continue their operations after that time and the actual harvests cannot be reported here in order to protect confidential information (WPFMC 2009b).

Estimates of MSY, including a description of calculation methods for pink, bamboo and gold coral at the Makapuu Established Bed, are provided in the Hawaii FEP (WPFMC 2009b) and summarized in Table 2.

Table 2. MSY Estimates for Precious Corals in the Makapuu Bed

| Species (common name) | MSY (kg/yr) | Method of calculation |
|----------------------------------|-------------|---|
| <i>Corallium secundum</i> (pink) | 1,185 | Beverton and Holt Cohort production model |
| <i>Corallium secundum</i> (pink) | 1,148 | Gulland model |
| <i>Gerardia</i> spp. (gold) | 313 | Gulland model |
| <i>Lepidisis olapa</i> (bamboo) | 285 | Gulland model |

Source: WPFMC 2009b

Due to ecological considerations, MSY estimates were reduced for ecological considerations and thus, the rounded down MSY estimates or optimum yields (OY) for Makapuu Bed pink coral, gold coral and bamboo coral were set at 1,000 kg/yr, 300 kg/yr and 250 kg/yr, respectively (WPFMC 2009a). Additionally, as stated previously, a moratorium on gold coral harvest is currently in place throughout the western Pacific through June 30, 2013.

While OYs for pink and bamboo corals were specified on an annual basis, the Makapuu Bed harvest quotas are expressed as a two-year quota because it was considered economically disadvantageous to utilize the expensive specialized equipment required for selective harvesting of precious coral for only part of each year on only one coral bed. The more flexible biennial schedule allows the quota to be taken during any part of a two year period and makes it easier for harvesters to deploy in other areas once the two-year Makapuu Bed quota has been met (WPFMC 2009b).

Harvest quotas for pink, bamboo and gold coral at Hawaii's four Conditional Beds have been extrapolated based on bed size as compared with that of the Makapuu Established Bed using the following formula described in the Hawaii FEP (WPFMC 2009b).

$$\frac{\text{MSY for Makapuu Bed}}{\text{Area of Makapuu Bed}} = \frac{\text{MSY for Conditional Bed}}{\text{Area of Conditional Bed}}$$

Framework Amendment 1 to the Fishery Management Plan for Precious Coral Fisheries of the Western Pacific Region (WPFMC (2001) estimates the area of the Makapuu Established Bed as 3.60 km². For the Conditional Beds, WPFMC (2001) estimates the areas as follows: 180 Fathom Bank (0.8 km²), Brooks Bank (1.6 km²), and Kaena Point and Keahole Point (0.24 km²). Based on rounded down MSY (or OY) of 1,000 kg/yr for pink coral and 250 kg/yr for a bamboo coral at the Makapuu bed, and applying the formula above, WPFMC (2001) estimates OY for all Conditional beds as shown in Table 15 which are the harvest quotas, except for pink and bamboo

coral at Makapuu where the quota was doubled to 2,000 kg and may be taken over two year period.

Table 3. Estimated area and OY for pink and bamboo coral in Established and Conditional beds

| Bed | Pink Coral OY | | | Bamboo Coral OY | | |
|----------------------------------|--|------------------------|------------|--|------------------------|----------|
| Makapuu Established Bed | $\frac{1,000 \text{ kg}}{3.60 \text{ km}^2}$ | x 3.60 km ² | = 1,000 kg | $\frac{250 \text{ kg}}{3.60 \text{ km}^2}$ | x 3.60 km ² | = 250 kg |
| 180 Fathom Conditional Bed | $\frac{1,000 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.8 km ² | = 222 kg | $\frac{250 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.8 km ² | = 56 kg |
| Brooks Bank Conditional Bed | $\frac{1,000 \text{ kg}}{3.60 \text{ km}^2}$ | x 1.6 km ² | = 444 kg | $\frac{250 \text{ kg}}{3.60 \text{ km}^2}$ | x 1.6 km ² | = 111 kg |
| Kaena Point Conditional Bed | $\frac{1,000 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 67 kg | $\frac{250 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 17 kg |
| Keahole Point Conditional Bed | $\frac{1,000 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 67 kg | $\frac{250 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 17 kg |

In calculating ABC for pink coral at the Makapuu Established Bed, at its 108th meeting the SSC relied on a revised estimate of MSY for pink coral reported in Grigg (2002). Specifically, Grigg (2002) estimated an MSY for pink coral at the Makapuu bed of 1,500 kg/year which is 30% greater than the initial MSYs shown in Table 2, and 50% higher than the current OY and of 1,000 kg/yr. In calculating ABC for bamboo coral at the Makapuu Established bed, the SSC relied on the initial MSY estimate of 285 kg/yr as shown in Table 2 and not the OY of 250 kg/yr which was used to specify the existing harvest quota.

The SSC then applied these MSY values into the formula provided above to extrapolate an MSY proxy for pink coral and bamboo coral at the four Conditional Beds (180 Fathom Bank, Brooks Bank, Kaena Point and Keahole Point). However, the SSC did not use the true size of the bed areas listed in Table 3 to apply in this formula as it was unaware of these values at the time.

Instead, for each bed, the SSC used the estimated size of the permit area provided in 50 CFR 665. Specifically, the regulations define the permit areas for Makapuu Bed, 180 Fathom Bank, and Brooks Bank to include the area within 2 nmi of a specified point. Based on the formula, $\text{Area} = \pi r^2$, the SSC determined the area for these three precious coral beds to be approximately 12.57 nm² whereas, WPFMC (2001) defines the true area of these beds to be 3.60 km², 0.8 km², and 1.6 km², respectively. Additionally, the regulations define the size of the permit areas for Kaena and Keahole Points to include the area within 0.5 nmi of a specified point. Applying the formula, $\text{Area} = \pi r^2$, the SSC determined the bed areas for Kaena and Keahole precious coral beds to be 0.79 nm² whereas, WPFMC (2001), defines the true area for both Keahole and Kaena as 0.24 km². Table 4 provides the results of the SSC's MSY proxy calculations.

Table 4. SSC's MSY proxies for pink and bamboo coral at Established and Conditional Beds

| Bed | Pink Coral | | | Bamboo Coral | | |
|---------|---|-------------------------|------------|---|-------------------------|----------|
| Makapuu | $\frac{1,500 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 1,500 kg | $\frac{285 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 285 kg |

| | | | | | | |
|-------------------------------|---|-------------------------|------------|---|-------------------------|----------|
| Established Bed | 12.57 nm ² | | | 12.57 nm ² | | |
| 180 Fathom Conditional Bed | $\frac{1,500 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 1,500 kg | $\frac{285 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 285 kg |
| Brooks Bank Conditional Bed | $\frac{1,500 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 1,500 kg | $\frac{285 \text{ kg}}{12.57 \text{ nm}^2}$ | x 12.57 nm ² | = 285 kg |
| Kaena Point Conditional Bed | $\frac{1,500 \text{ kg}}{12.57 \text{ nm}^2}$ | x 0.79 nm ² | = 94 kg | $\frac{285 \text{ kg}}{12.57 \text{ nm}^2}$ | x 0.79 nm ² | = 18 kg |
| Keahole Point Conditional Bed | $\frac{1,500 \text{ kg}}{12.57 \text{ nm}^2}$ | x 0.79 nm ² | = 94 kg | $\frac{285 \text{ kg}}{12.57 \text{ nm}^2}$ | x 0.79 nm ² | = 18 kg |

The SSC then determined that deepwater precious coral fishery for pink and bamboo corals in the MHI can be regarded as Tier 4 because the MSY/MSY proxy is known, but there is no harvest. Therefore, consistent with the Tier 4 control rule described in the Hawaii FEP which requires ABC be set equal to 0.91*MSY, the SSC calculated ABC as shown in Table 5.

Table 5. SSC recommended ABCs for pink and bamboo coral at Established and Conditional Beds

| Bed | Pink Coral | | Bamboo Coral | |
|-------------------------------|------------------|-----------------------|------------------|-----------------------|
| | <i>MSY Proxy</i> | <i>ABC = 0.91*MSY</i> | <i>MSY Proxy</i> | <i>ABC = 0.91*MSY</i> |
| Makapuu Established Bed | 1,500 kg | 1,400 kg | 285 kg | 260 kg |
| 180 Fathom Conditional Bed | 1,500 kg | 1,400 kg | 285 kg | 260 kg |
| Brooks Bank Conditional Bed | 1,500 kg | 1,400 kg | 285 kg | 260 kg |
| Kaena Point Conditional Bed | 94 kg | 85 kg | 18 kg | 16 kg |
| Keahole Point Conditional Bed | 94 kg | 85 kg | 18 kg | 16 kg |

However, because the SSC did not use the actual size of each bed in its calculation of MSY proxies, the values represented in Table 5 above may not be the best available scientific information. For this reason, NMFS has recalculated MSY proxies consistent with the intent of the SSC's recommendation using the actual size of each bed and described by WPFMC (2001). Table 6 provides the results of the corrected MSY proxy calculations conducted by the NMFS.

Table 6. NMFS's corrected MSY proxies for pink and bamboo coral at Established and Conditional Beds

| Bed | Pink Coral | | | Bamboo Coral | | |
|-----------------------------|--|---|----------------------|--|---|----------------------|
| | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x | Area | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x | Area |
| Makapuu Established Bed | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x | 3.60 km ² | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x | 3.60 km ² |
| 180 Fathom Conditional Bed | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x | 0.8 km ² | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x | 0.8 km ² |
| Brooks Bank Conditional Bed | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x | 1.6 km ² | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x | 1.6 km ² |

| Bed | Pink Coral | | | Bamboo Coral | | |
|----------------------------------|--|------------------------|----------|--|------------------------|---------|
| Kaena Point Conditional Bed | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 100 kg | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 19 kg |
| Keahole Point Conditional Bed | $\frac{1,500 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 100 kg | $\frac{285 \text{ kg}}{3.60 \text{ km}^2}$ | x 0.24 km ² | = 19 kg |

Additionally, consistent with the SSC's recommendation, NMFS also re-applied the Tier 4 control rule to the corrected MSY proxy values shown in Table 6 above and re-calculated the ABCs for Hawaii pink and bamboo corals in the Established and Conditional Beds as shown in Table 7.

Table 7. NMFS recalculated ABCs for pink and bamboo coral at Established and Conditional Beds

| Bed | Pink Coral | | Bamboo Coral | |
|----------------------------------|-------------------|-----------------------|---------------------|-----------------------|
| | <i>MSY Proxy</i> | <i>ABC = 0.91*MSY</i> | <i>MSY Proxy</i> | <i>ABC = 0.91*MSY</i> |
| Makapuu Established Bed | 1,500 kg | 1,365 kg | 285 kg | 259 kg |
| 180 Fathom Conditional Bed | 333 kg | 303 kg | 63 kg | 57 kg |
| Brooks Bank Conditional Bed | 667 kg | 607 kg | 127 kg | 116 kg |
| Kaena Point Conditional Bed | 100 kg | 91 kg | 19 kg | 17 kg |
| Keahole Point Conditional Bed | 100 kg | 91 kg | 19 kg | 17 kg |

Pink, Gold and Bamboo Corals in the Hawaii Exploratory Area

HAWAII: Hawaii Exploratory areas (denoted as X-P-H) include coral beds, other than Established, Conditional or Refugia Beds within the EEZ. Currently there is a 1,000 kg limit for all deep water precious corals combined (all species except black coral) in the Hawaii Exploratory Area. The limit of 1,000 kg/year was determined with the goal of reducing the risk of overfishing a newly discovered bed while at the same time being large enough to provide economic incentive for fishers to engage in exploratory fishing (WPFMC 1979). There was no statistical basis for determining the limit, but instead it was based on Council judgment that 1,000 kg/yr should be sufficient incentive for exploratory fishing while posing little risk of overfishing (WPFMC 1979). The 1,000 kg/yr harvest quota in Hawaii represents about one-third of the estimated MSY for the precious coral species in all Established and Conditional beds while being large enough to offer an economic incentive for exploration (WPFMC 1979). Two fishing expeditions for precious corals occurred in the Hawaii Exploratory Area in the mid- to late 1980s (WPFMC 2009b). However, no activity has occurred since then. In 2011, NMFS issued two federal permits for fishing in the Hawaii Exploratory Area (X-P-HI); however, no trips have been made.

At its 108th meeting, the SSC recommended ABC be maintained at the current annual harvest quota of 1,000 kg/yr for pink and bamboo corals in the Hawaii Exploratory Area, and further recommended that this ABC be applicable to all EEZ waters of the State of Hawaii.

AMERICAN SAMOA: Exploratory areas (X-P-AS) include all EEZ waters around American Samoa as there are no known precious coral beds in the Territory. However, precious coral MUS are known to exist in the American Samoa EEZ, thus a fishery could possibly develop. The American Samoa Exploratory Area (X-P-AS) has a 1,000 kg/year limit of all species combined except black coral. The limit of 1,000 kg/year was developed with the goal of reducing the risk of overfishing a newly discovered bed while at the same time being large enough to provide economic incentive to engage in exploratory fishing (WPFMC 1979). There was no statistical basis for determining the limit, but instead was based on Council judgment that 1,000 kg/year should be sufficient incentive for exploratory fishing while posing little risk to overfishing (WPFMC 1979). No federal permit has ever been issued for precious coral fishing in the American Samoa Exploratory Area (X-P-AS).

At its 108th meeting, the SSC recommended the American Samoa black coral ABC be maintained at the current annual harvest quota of 1,000 kg/yr.

COMMONWEALTH OF NORTHERN MARIANA ISLANDS: The CNMI Exploratory Area (X-P-CNMI) includes all EEZ waters around the CNMI as there are no known precious coral beds in the Commonwealth. However, precious coral MUS are known to exist there and there has been a report of pink corals being harvested prior to World War II (WPFMC 2009c).

The CNMI Exploratory Area (X-P-CNMI) has a 1,000 kg/year limit of all deepwater precious coral species combined except black coral. The limit of 1,000 kg/year was developed with the goal of reducing the risk of overfishing a newly discovered bed, while at the same time being large enough to provide economic incentive to engage in exploratory fishing (WPFMC 1979). There was no statistical basis for determining the limit, but instead was based on Council judgment that 1,000 kg/year should be sufficient incentive for exploratory fishing while posing little risk to overfishing (WPFMC 1979). No federal permit has ever been issued for precious coral fishing in the CNMI Exploratory Area (X-P-CNMI).

At its 108th meeting, the SSC recommended the CNMI pink and bamboo coral ABCs be maintained at the current annual harvest quota of 1,000 kg/yr.

GUAM: The Guam Exploratory Area (X-P-Guam) includes all EEZ waters around Guam as there are no known precious coral beds in the Territory. However, precious coral MUS are known to exist there and have been collected in government surveys (WPFMC 2009c). The Guam Exploratory Area has a 1,000 kg/year limit for all species combined except black coral. The limit of 1,000 kg/year was developed with the goal of reducing the risk of overfishing a newly discovered bed, while at the same time being large enough to provide economic incentive to engage in exploratory fishing (WPFMC 1979). There was no statistical basis for determining the limit, but instead, it was based on Council judgment that 1,000 kg/year should be sufficient incentive for exploratory fishing while posing little risk to overfishing (WPFMC 1979). No

federal permit has ever been issued for precious coral fishing in the Guam Exploratory Area (X-P-Guam).

At its 108th meeting, the SSC recommended the pink and bamboo corals ABCs be maintained at the current annual harvest quotas of 1,000 kg/yr.

DRAFT