

Additional Information on the ABC Control Rule Caribbean Fishery Management Council

What is ABC?

ABC is the acceptable biological catch. This is a term used by management agencies which refers to the range of allowable catch for a species or a group of species. This is set by the Council's Scientific and Statistical Committee (SSC). The Acceptable Biological Catch (ABC) is the catch reduced below OFL to account for scientific uncertainty (catch with less than a 50% probability of exceeding the true OFL). The OFL or overfishing level is an estimate of the catch level above which overfishing is occurring. Please see Figure 1 below.

What is a Control Rule?

A Control Rule (CR) describes a plan for pre-agreed set of rules. These rules are based on variables related to the status of the stock. The status of the stock describes whether a population is healthy or undergoing overfishing. The Control Rule is like a recipe to be followed by the SSC. The information considered by the SSC in this recipe includes information from expert opinion based on the knowledge of those involved in the industry and the scientists conducting research, among other sources of information.

What is an ABC Control Rule?

An Acceptable Biological Catch (ABC) Control Rule is then a step by step guide that can be followed every time to obtain the ABC for each species or group of species as data become available. This ABC CR as developed for the US Caribbean has 4 tiers or levels. The first and second levels need data not available yet in the US Caribbean. The third level (Tier 3) was developed after examining the potential of the data limited models during the SEDAR 46 but, it is not yet completed. However, the SSC determined that it had potential for use in the future.

The fourth level, Tier 4, uses basic catch data and expert opinion as well as what is known about the fish life history of the fish, its ecological function, and the intensity of its exploitation. The life history information includes for example the maximum age of the fish and how long it takes for the fish to reproduce, among other factors. The information on the ecological function of the fish considers its role in the food chain and the ecosystem.

These tiers address the amount of scientific uncertainty. Scientific uncertainty includes the possible misidentification of species, the under reporting of the catch, the over-reporting of the catch, the lack of information about the life history of the fish and how vulnerable the fish population is to being fished to the extent that they cannot reproduce anymore. In the discussion of uncertainty there is also consideration of changes in the catch history due to changes in gear such as changes in the type of gear, changes in the size of mesh, etc. These changes can also be impacted by dramatic environmental changes as for example, storms and hurricanes and fronts. Also, changes in regulations such as the implementation on minimum size or seasonal closures, among other factors could impact catches. For example, if there is minimum size in place and compliance is high, one could infer that the population is not likely to be undergoing overfishing.

But, the data to prove that the fish stock is not undergoing overfishing might not be available. Uncertainty increases with increasing lack of knowledge and data from the fish populations.

Tier 4 in the ABC Control Rule applies to fish species for which there is no assessment; when no evaluation of the population has been successfully conducted. Tier 4a addresses those fish species or groups of species that are not likely to be undergoing overfishing, “stock unlikely to be subject to overfishing.” Tier 4b applies to fish stocks or groups of species with no accepted assessment and when a “stock is likely subject to overfishing.”

A fish stock is said to be subject to overfishing when harvesting is done at a rate that is not sustainable; much more fish is being harvested than that amount that will maintain a productive fish population.

The terminology used in the ABC Control Rule Tiers 4a and 4b can be confusing and a definition of the terms employed is pertinent:

OFL: overfishing limit: The OFL is an estimate of the catch level above which overfishing is occurring. Catches should not be above this level to maintain a sustainable fishery.



Figure 1 OFL, ABC and ACL: definition and who is responsible for their determination.

To determine OFL, that amount of fishing that can take place without subjecting the population to overfishing, Tier 4a takes into consideration the landings, both commercial and recreational when available. The SSC considers all data available and examines the longest time period of the fishery, the highest landings, the years with little and great variability in the landings and the factors influencing these landings. But, it needs to determine when the fishery was NOT subject to overfishing. That is, that period of time when there was not excessive exploitation, a period of time when the fishery shows catches that appear to be sustainable over time.

The data from the commercial catch for a species, spiny lobster in this case, can be graphed as shown below in Figures 2, 3 and 4. The examples shown on these plots are for spiny lobster pounds reported annually from the year 2000 to 2015. These are annual landings for all fishing gears for each Island, Puerto Rico, St. Thomas/St. John and St. Croix. The graphs also show the annual catch limit (ACL) implemented in 2012 and the variability of the catches around the ACL.

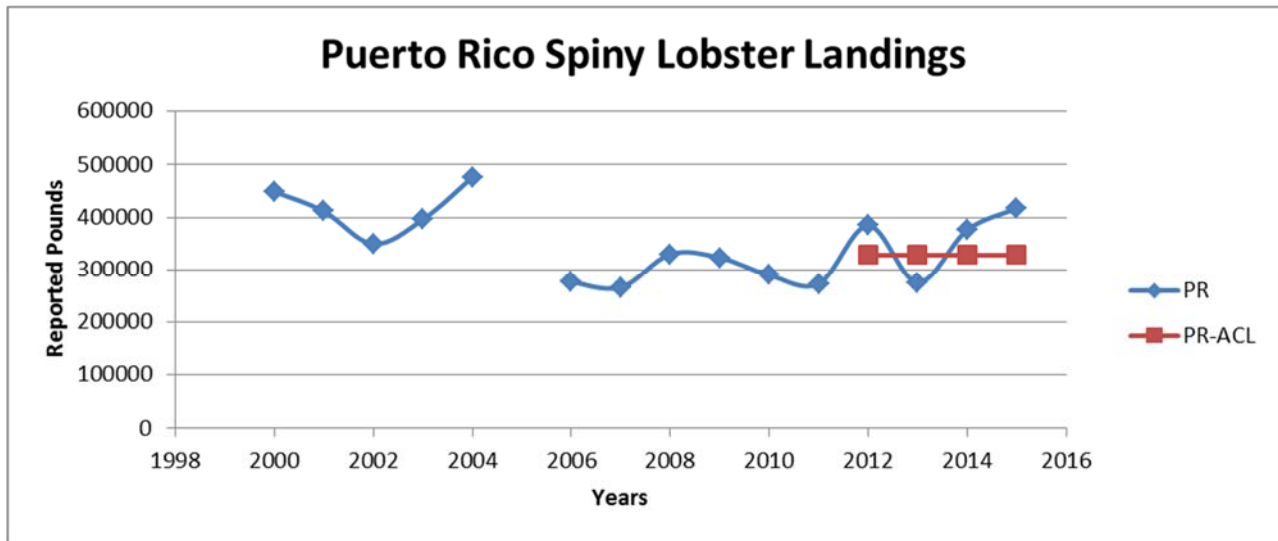


Figure 2 Spiny lobster commercial annual landings in pounds for Puerto Rico.

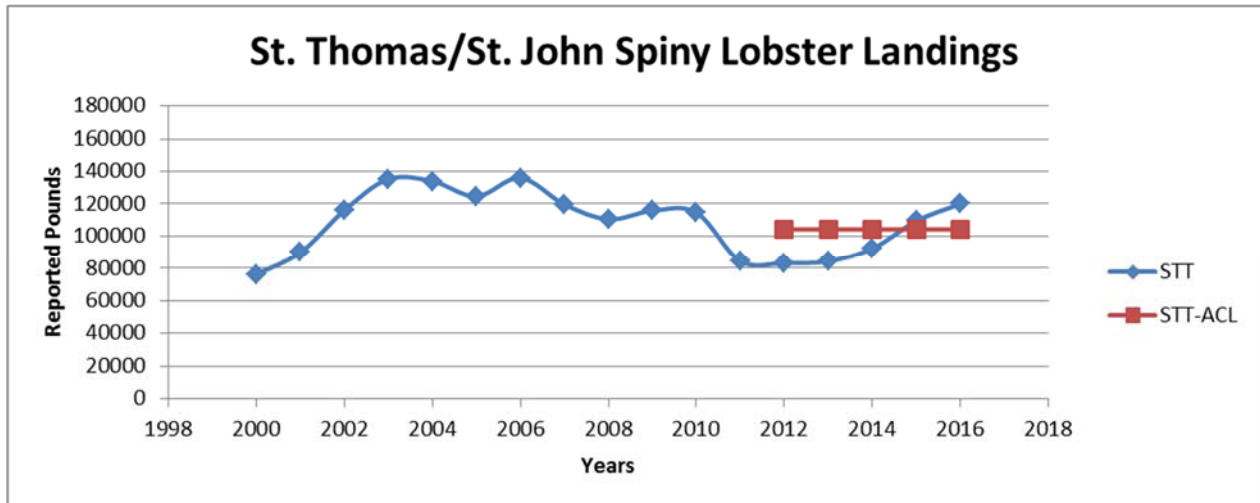


Figure 3 Spiny lobster commercial annual landings in pounds for St. Thomas/St. John.

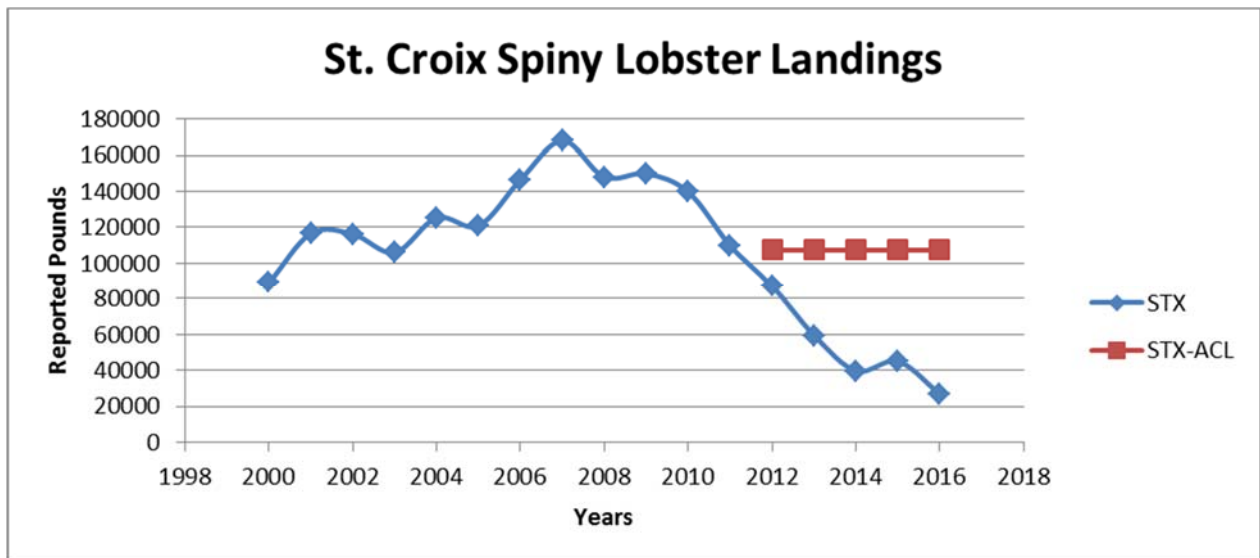


Figure 4 Spiny lobster commercial annual landings in pounds for St. Croix.

The data for lobster have been available for many years. The regulations on the minimum size of 3.5 inches of carapace length and the ban on the take of berried females have been in place since the 1970s in the USVI and since the 1980s in Puerto Rico and the federal waters. There have been changes in the gear regulations such as increases in mesh size, and the ban on nets and the implementation of annual catch limits (ACL). Compliance with regulations is said to be high. This information is all made available to the SSC during their deliberations.

There are other factors to consider when analyzing the catch data:

1. Why are there years with high landings and other with such low landings?
2. How much is the recreational catch? NOTE: there is no continuous data on lobster catches by the recreational sector.

3. How was the total catch reports
 - a. Did everyone report correctly?
 - b. Reported more?
 - c. Reported less?
 - d. If less, was there a reason?
 - i. Is it changes in the economies (less restaurants, less tourism, etc?)
 - ii. Is everyone abiding by the regulations?
 - iii. Are there biological reasons such as changes in the reproductive season?

Once the SSC reviews the data and discusses the selection of the years when the fishery was not likely subject to overfishing, they follow the steps laid out in the ABC CR. These steps are explained in the Tutorial (Please refer to the document by Bill Arnold titled: Understanding the ACCEPTABLE BIOLOGICAL CATCH (ABC) Control Rule).

There are a few definitions to review from the ABC CR. These are scalar and buffer. These are determined by the SSC.

A scalar is a number that appears in the equation to show that there should be a decision made as to how well the data available describe the real situation of the fishery. The determination is based on what is known about the life history and vulnerability of the fish:

- a. Dolphinfish are short lived while groupers are long lived;
- b. Dolphinfish reproduce early while groupers reproduce late in life
- c. Spiny lobster reproductive season is longer than that of groupers
- d. Some snappers reproduce everywhere while some groupers reproduce at very specific sites for example the yellowfin grouper at Grammanik Bank
- e. Are they very fecund or not,
- f. Do they change sex as some groupers and parrotfish or not (snappers)
- g. Can they be easily fished out?

It is the SSC who determines the weight of the scalar. The SSC takes into consideration in their deliberations the expert opinion of the participants in the fishery and the expert opinion of other scientists if no published literature is available. The SSC also considers the information available through the grey literature, that is, the scientific information that has not been peer reviewed for publication. The data available such as the landings and life history, the expert opinion and the ecological function of the species are weighted to determine the scalar. The more information that there is available, the better the data and the more confidence in the information the SSC have, the higher the scalar.

The scalar could be higher if there is a long and certain catch record, if there is information on the biology of the species, or if there are regulations in place with known high compliance from the resource users.

However, if there are regulations in place but the compliance is very low confirmed by anecdotal information, enforcement reports, biological data from the information collected by the port agents when measuring fish or other sources, then the scalar could be lower. How low? That is part of the uncertainty the SSC has to deal with.

In Tier 4 then the scalar is determined by the SSC based on all those factors mentioned above. Better data results in better decisions.

Tier 4 also includes the use of a buffer. A buffer is like a cushion or a shield, a safeguard against not knowing, against uncertainty in the scientific data. The buffer in this case is also determined by the SSC. The SSC also takes into consideration the information provided to them by the fishers, managers, other scientists in the determination of the buffer.

These steps in the ABC Control Rule are applied to each species or group of species that have been proposed for federal management under the Island Based Fishery Management Plans. The list of species for each Island is included in Appendix A.

Once the SSC determines the ABC for each species or groups of species in Appendix A, it makes its recommendations to the Council. The Council then determines the annual catch limit (ACL). The Council in its determination of the ACL has to take into consideration management uncertainty, the risk that it is willing to take in establishing an ACL that will result or not in a sustainable fishery. The Council receives recommendations on the buffer to be applied to the ABC for each species in order to maintain sustainable fisheries.

The Council cannot have an ACL greater than the ABC. This is established by law. The ACL can be equal to the ABC or it can be less than the ABC. The DAPs input to the Council is to recommend how small or large the reduction from ABC to ACL could be.

The ABC Control Rule has been discussed at a number of meetings including CFMC Regular Meetings, SSC and DAPs (individual and joint). The DAP Chairs from each Puerto Rico, St. Croix and St. Thomas/St. John have been present at the SSC Meetings. The SSC at their last meeting (April 3-7 2017, and after having discussed the ABC CR during various other meetings) recommended the following modifications to the ABC CR Tier 4 to the CFMC during the 159th meeting.

The latest version of Tiers 1-4 in the ABC Control Rule as presented at the 159th Council Meeting is shown below.

Acceptable Biological Catch (ABC) Control Rule

Tier 1 (Data Rich)

Condition for Use: Full stage-structured assessment where reliable time series on (1) catch, (2) stage composition and (3) index of abundance are available and the assessment provides estimates of MSST, MFMT, and PDF of OFL.

Minimum Stock Size Threshold (MSST) = $0.75 * SSB_{MSY}$ (or proxy)

Maximum Fishing Mortality Threshold (MFMT) = F_{MSY} (or proxy)

MFMT = F_{MSY} ,

MSY = Long-term Yield at MFMT; (Assuming the spawner-recruit relationship is well estimated, otherwise undefined.)

OFL = Yield at MFMT

ABC = x= OFL as reduced by scientific uncertainty[†] and risk of overfishing^{††}. The reduction factor is applied to the PDF of OFL, where the PDF is determined from the assessment (where $\sigma > \sigma_{\min}$ ^{†††})

$$ABC^* = d(x) \quad \text{where } d = \begin{cases} \text{Scalar} & \text{if } B \geq B_{\text{msy}} \\ \text{Scalar} * (B - B_{\text{critical}}) / (B_{\text{msy}} - B_{\text{critical}}) & \text{if } B < B_{\text{msy}} \end{cases}$$

Where:

Scalar is = 1 if risk of overfishing is specified (<0.5), <1 if not specified (=0.5)

B_{critical} is defined as the minimum level of depletion at which fishing would be allowed.

[†]Scientific uncertainty would take into account, but not be limited to, the species life history and ecological function.

^{††}Risk of overfishing determined by Council

^{†††} σ_{\min} could be equal to coefficient of variation; σ_{\min} is in a log scale

Tier 2 “Data Moderate”

Condition for Use: Data-moderate approaches where two of the three time series (catch, stage composition and index of abundance) are deemed informative by the assessment process, and the assessment can provide MSST, MFMT, and PDF of OFL.

Same as Tier 1, but variation of the PDF of OFL (σ) must be greater than 1.5 σ_{\min} (in principle there should be more uncertainty with data-moderate approaches than data-rich approaches).

Tier 3 “Data Limited Quantitative Assessments”

Condition for use: Relatively data-limited or out-of-date assessments.

MFMT = F_{MSY} (or proxy such as $F_{40\%}$)

MSST = *unknown*

OFL = catch at MFMT

ABC determined from OFL as reduced by scientific uncertainty[†] and risk of overfishing^{††}

- a. Where the reduction factor is applied to the PDF of OFL when the PDF is determined from the assessment (with $\sigma \geq 2\sigma_{\min}$),

OR

b. Where $ABC = \text{reduction factor} * OFL$, where *reduction factor* must be ≤ 0.9

†Scientific uncertainty would take into account, but not be limited to, the species life history and ecological function, the perceived level of depletion, and vulnerability of the stock to collapse.

††Risk of overfishing determined by Council

Tier 4: Landings & Ancillary Information (e.g., Productivity-Susceptibility Analyses, Expert opinion)

4a. Condition for use: No accepted assessment, but stock unlikely to be subject to overfishing. ~~and not likely to be overfished~~ If SSC consensus cannot be reached on the use of Tier 4a, Tier 4b should be used.

~~MSST, MFMT, MSY = unknown~~

$OFL = \text{Scalar} * 75^{\text{th}}$ percentile of reference period landings

Scalar ≤ 2 depending on perceived degree of exploitation, life history and ecological function

$ABC = \text{buffer} * OFL$, where *buffer* must be ≤ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70...)

4b. Condition for use: No accepted assessment, but stock likely subject to overfishing ~~and/or overfished or unclear~~. or SSC consensus cannot be reached on the use of Tier 4a.

~~MSST, MFMT, MSY = undefined~~

$OFL = \text{Scalar} * \textit{mean of the reference period landings}$ ~~of recent landings (most recent three years of available landings)~~

Scalar < 1 depending on perceived degree of exploitation, life history and ecological function

$ABC = \text{buffer} * OFL$, where *buffer* must be ≤ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70...)

NOTES: The SSC recommended the following changes to the ABC CR for Tier 4 (above): (1) Delete reference to “overfished”; (2) Allow flexible reference period (instead of most recent 3 years; and (3) Delete reference to MSST, MFMT, MSY, which are unknown.