

# SAFARI ZONE RESEARCH

Analysis by [Professor Rex/Rex PHD](#)

Forward:

Recently I was working on a video to detail the top 10 rarest shiny Pokémon in generation 3. What I've stumbled upon while researching for this video is huge. For years, any knowledgeable shiny hunter would have told you that it is never worth it to throw bait in the Safari zone and that a "balls only" approach is the way to go. Until just this week I would have said the same, until I noticed something on Bulbapedia while doing research... FRLG use a very peculiar formula for determining catch rates, so I decided to dig into it a little. Using new discoveries detailed in this paper, I have found a previously unknown method to increase Chansey's catch rate by a massive 80% over balls alone.

Reviewed by Mwnic/Monkey

## The Catch Factor

[From Bulbapedia Courtesy of KelvSYC:](#)

**NOTE:** The Following information has errors, but it was where I started

*"The Safari Game mechanics were overhauled to more closely resemble the one in the Hoenn Safari Zone. Like it, there is an additional "catch factor" that begins at 100/1275 of the Pokémon's catch rate (rounded down). ... If Rocks are thrown, it will be "angry" for 2-6 turns, during which the catch factor is doubled. Being "angry" or "eating" is mutually exclusive, though modifications to the catch factors will stack (reverting to its original value whenever the Pokémon is neither "angry" nor "eating"). Whenever a Safari Ball is thrown, the catch factor is converted back to a catch rate by multiplying by 1275/100 and rounding down."*

Revision as of 08:35, 4 May 2011 (edit) (undo)

[KelvSYC](#) (talk | contribs)

[Newer edit](#) →

Interestingly enough, it seems like nobody had considered the ramifications of the rounding that occurred after the division. If you divide a number (X), by another number (Y), floor it, and then multiply it by the same number, (Y again) the result will always be  $\leq$  the original

$$\text{FLOOR}(X/Y) * Y \leq X$$

If not for the rounding obviously the values wouldn't change  $(X/Y) * Y = X$

However, since floating point numbers are not preserved we end up with major changes to the catch rates of the Pokémon in the safari zone.

The figure below lists the changes that are made to the catch rate of each Pokémon because of this rounding. I have tested these rates using a LUA script in VBA-rerecording and the results indicate that there is in fact a lower catch rate in the Safari Zone which shall be deemed the "Base Safari Zone Catch Rate"

Kangaskhan Testing:

Odds of capture with catch rate 45 and safari ball: 9.3%

Odds of capture with catch rate 38 and Safari Ball: 8.1

N = 5000, captures = 353, Catch rate: 7.06% Closer to 8% than 9%

Chansey Testing:











Odds of capture with catch rate 30 and safari ball: 6.2%

Odds of capture with catch rate 25 and Safari Ball: 4.9%

N = 6000, Captures = 257, Catch Rate: 4.2% Closer to 5% than 6%

Obviously not definitive but enough for our purposes here.

## Base Catch Rates

FR/LG Base Catch Rates*			
Pokémon	Base Catch Rate	Catch Factor	Base Safari Catch Rate (Per Ball)**
	30	2	25 (4.9%)
	45	3	38 (8.1%)
	60	4	51 (10.7%)
	75	5	63 (12.3%)
	90	7	89 (19.8%)
	120	9	114 (23.4%)
	190	14	178 (40.1%)
	225	17	216 (50.3%)
	235	18	229 (50.3%)
	255	20	255 (50.3%)

To dig a little deeper, I found the RAM addresses of the “Catch Factor” and played around with them a little. Some things that were discovered worth mentioning are:

- The catch factor remains modified, even after a Pokemon is no longer angry or eating.
- The catch factor can be influenced by multiple baits, or rocks
- The catch factor cannot be reduced below 3, (IMPORTANT!) or increased above 20
- Once the catch factor is modified it is never reset, so balls and rocks have odd interactions

Example: Magikarp has a base catch factor of 20,



Address	Value	Notes
0200008C	20	Catch Factor
03004FA3	0	Number of Turns
0200008A	0	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls

As we can see in the first turn the amount of remaining bait is 0

after being baited once it becomes 10,



Address	Value	Notes
0200008C	10	Catch Factor
03004FA3	1	Number of Turns
0200008A	3	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls

After the first throw it increases to 3, which means we got a roll of 3 on our bait roll

after a second time it becomes 5,



Address	Value	Notes
0200008C	5	Catch Factor
03004FA3	2	Number of Turns
0200008A	4	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls

and very importantly a third bait will reduce it to 3,



Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	3	Number of Turns
0200008A	5	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls

a fourth bait will not reduce the catch factor below 3.



Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	4	Number of Turns
0200008A	6	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls

Note that the amount of bait only increased from 5-6. This demonstrates the maximum of 6

A rock will increase the catch factor to 6 from 3.

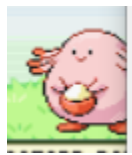


Address	Value	Notes
0200008C	6	Catch Factor
03004FA3	5	Number of Turns
0200008A	0	Remaining Bait
0200008B	2	Flee Factor
02039994	5	Remaining Safari Balls


The fact that there seemed to be a minimum catch rate was exciting. This was the first time I had come across any proof to back up claims made by [kelvSYC in a Serebii post from 2010](#).

*“To determine whether a Safari Zone Pokémon is caught, you use the following formula:  $S = C * (100 / 1275) * (M + 1 / B + 1)$ , where  $C$  is the Pokémon's catch rate,  $M$  is the number of times you threw mud, and  $B$  is the number of times you threw bait. If  $S$  is smaller than 3, set it to 3, and if it is bigger than 20, set it to 20.”*

Although Kelv wasn't completely correct, the minimum “Catch Factor” was about to have some major repercussions for Chansey and the gang. Chansey's base catch factor is 2. The values from my RAM watch indicated that this was true. However, this minimum catch factor of 3 only applies after a bait has been thrown. Check this out...



Address	Value	Notes
0200008C	2	Catch Factor
03004FA3	0	Number of Turns
0200008A	0	Remaining Bait
0200008B	9	Flee Factor




Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turns
0200008A	2	Remaining Bait
0200008B	9	Flee Factor
02039994	15	Remaining Safari Balls

LGreen threw some BAIT at the CHANSEY!

This means a single bait can increase the catch rate per ball of Chansey from 4.9% to 8.1% for the rest of the encounter!

Additionally all the Pokemon who already have a catch factor of 3 don't have it reduced by bait



Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turn
0200008A	0	Remaining Bait
0200008B	9	Flee Factor


























Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turn
0200008A	2	Remaining Bait
0200008B	9	Flee Factor
02039994	5	Remaining Safari f

LGreen threw some BAIT at the TAUROS!

## Flee Factor

Unlike the catch factor, which is modified each time bait or balls are thrown, the flee factor is determined once and has calculations preformed upon it without changing. The flee factor is determined by taking a Pokémon's base flee rate and multiplying it by 100/1275 then rounding down. Each Pokemon from the safari zone has a set flee rate, which I pulled out of a [disassembly of Pokemon Firered](#).

### Base Flee Rates [\[edit\]](#)

FR/LG Base Flee Rates*	
	25 (10%)
       	50 (15%)
      	75 (25%)
	100 (35%)
     	125 (45%)

The flee factor of a Pokémon cannot be reduced below 2, so with or without bait Magikarp has a 10% chance to flee.

A baited mon will have its catch factor divided by four and floored. This causes all Pokemon in the Safari Zone have a 10% flee rate while they are eating.

The reason for this is that the highest base flee factor of any Pokémon is 9 which, when baited, results in a modified flee factor of 2.

To test this, I tried baiting Magikarp which should have given it a very small chance to flee. However, in multiple tests I was rarely able to get it to stay for more than 10 turns.

Pseudo code for determining flee factor:

if (eating):

$$M = \frac{1}{4}$$

elif (angry):

$$M = 2$$

else:

$$M = 1$$

base flee factor = floor((Flee Rate) x 1275/100)

modified flee factor = floor((base flee factor) x M)

flee factor to use = max(modified flee factor, 2)

## Bait

At the start of a turn the game will check to see if there is any bait left in front of a Pokémon. If there is, it will eat. A turn that starts with a Pokémon who is eating will have a 10% flee chance. The first turn, or any turn that starts with the Pokémon watching carefully, will use the regular flee chance during the flee check.

When bait is thrown, a 'pile' of bait will be put in front of the Pokémon. Each time a bait is thrown this pile will increase by 2-6 'bites' of bait, to a maximum of six bites of bait. For example: if a Pokémon who is already eating and still has 3 'bites' of bait in front of it gets given more bait the pile will increase by 2, or 3 as it cannot surpass 6. From what I can tell, the odds of giving any amount of bait seems to be evenly distributed, so there is a 1/5 chance to give 2 'bites' of bait, just as there is a 1/5 chance to give 4.

At the start of a turn the game will preform an eating check. If there is any bait left in front of the Pokémon it will eat for that turn. NOTE: The amount of bait is not reduced until the end of the turn.

If a bait is thrown, turn the amount of bait in front of the Pokémon will increase. However, bait will not take effect until the next turn. This means that throwing bait at a non-eating Pokémon will not change the flee factor for the current turn. On the first turn, even if bait is thrown the flee check will use full flee factor odds.

Once the ball or bait have been thrown the game will preform a 'Flee check'. If the Pokemon is still eating, the baited flee factor will be used to determine the results. If the Pokémon was 'watching carefully', or it's the first turn the unmodified flee factor will be used. The flee check is done by generating a random number from 0-99 inclusive, and comparing it to 5x the flee factor. If the random number is less, the flee check is successful. A successful flee check will cause the Pokémon to flee otherwise the next turn will take place. Pokemon with a base flee rate of 125 have a flee factor of 9; this results in a 45% chance to flee. An eating Pokemon will always have a flee factor of 2 which results in a 10% flee chance.

At the very end of the turn the amount of bait will be reduced by one. This decrease will take place even if bait was just thrown so the maximum number of 'bites'/turns of bait that can be stacked is equal to the max pile size - 1 = (6) - 1 = 5 Turns. Since the minimum roll of a bait throw is 2 the lowest number of "eating" turns that can be granted from a bait roll is one.

It should be noted that contrary to Bulbapedia and other sources this means that the number of turns of anger or eating granted from rocks/bait is 1-5 instead of 2-6


Note: Technically the eating check is done at the end of a turn  
I just thought it would be easier to explain it as occurring at the start  
(Eating check does still occur AFTER the bait has been reduced)

Example: Two bait is added to the pile on the first throw, 1 eating turn is granted.  
 To see bait stacking effects, refer to the Magikarp example

Tauros is encountered and has no bait in front of it, for this turn it is considered to be 'watching carefully'


Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turn
0200008A	0	Remaining Bait
0200008B	9	Flee Factor

A bait is thrown and 2 bait is added to the pile. Flee check will be preformed with a 45% flee rate



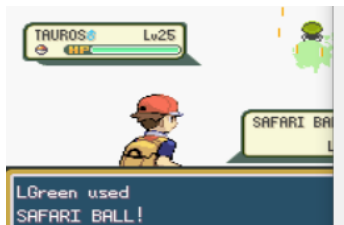
Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turns
0200008A	2	Remaining Bait
0200008B	9	Flee Factor
02039994	5	Remaining Safari Balls

Amount of bait is reduced by one. The game will preform the eating check. Since there is bait the Pokémon will be eating for the next flee check.




Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	0	Number of Turns
0200008A	1	Remaining Bait
0200008B	9	Flee Factor
02039994	5	Remaining Safari Balls

After a bait or a ball is thrown the Flee check will occur. Since the Pokemon is eating the odds of it fleeing will be 10%



Address	Value	Notes
0200008C	3	Catch Factor
03004FA3	1	Number of Turns
0200008A	1	Remaining Bait
0200008B	9	Flee Factor
02039994	4	Remaining Safari Balls

If the Flee check is unsuccessful the Pokémon will not flee, bait is reduced by one and the 'Eating check' is preformed. Since there is no bait remaining, it will be watching carefully for the next flee check



0200008C	3	Catch Rate
03004FA3	1	Number of Turns
0200008A	0	Remaining Bait
02000089	0	Reamining Anger
0200008B	9	Flee Factor
02039994	4	Remaining Safari Balls

## THE NUMBERS! (EXCITING STUFF)

I've created a program, which takes into account the new information that I have discovered, for calculating the probabilities of catching Pokémon in the Safari Zone

Note: The success rates are very precise estimates

Prior to what was previously accepted, I've determined the odds of successfully catching Chansey goes from about 10.3% to 18.5% by utilizing a pattern of both bait and balls.

The best pattern requires a start of bait, ball, bait which allows us to stack up a little bait before jumping into a deeper pattern of (3x ball, bait, 2x Ball, bait) repeating until the Pokémon flees, is caught or starts watching carefully. If Chansey begins watching carefully, then restart the pattern as though it was a new encounter.

### OUTPUT FOR CHANSEY

Base catch rate: 30

Base catch factor: 2

Modified catch rate: 25

Odds of capture per ball: 4.90415%

Base catch rate: 30

Catch factor after bait: 3

Modified catch rate after bait: 38

Odds of capture per ball after bait: 8.09086%

Base flee rate: 125

Odds of fleeing per turn while not eating: 45.0%

Base flee rate: 125

Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 10.2818%

Odds of capture with one bait followed by only balls: 17.6221%

Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 18.0809%

FOR BEST RESULTS THE FOLLOWING PATTERNS

SHOULD BE RESTARTED IF THE POKEMON EVER 'WATCHES CAREFULLY'

Odds of capture with a pattern of (Bait, Ball) ->

(Bait, Ball, Ball) Repeating: 18.3026%

Odds of capture with a pattern of (Bait, Ball) ->

(Bait, Ball, Ball, Ball, Bait, Ball, Ball) Repeating: 18.5405%



Since the other 125 flee rate Pokémon have a higher base catch rate, the benefits of the bait ball pattern aren't as noticeable, but an increase from 16.4% to 18.5% is nothing to scoff at

OUTPUT FOR DRAGONAIR/PINSIR/SCYTHER/TAUROS/KANGASKHAN

Base catch rate: 45  
Base catch factor: 3  
Modified catch rate: 38  
Odds of capture per ball: 8.09086%

Base catch rate: 45  
Catch factor after bait: 3  
Modified catch rate after bait: 38  
Odds of capture per ball after bait: 8.09086%

Base flee rate: 125  
Odds of fleeing per turn while not eating: 45.0%

Base flee rate: 125  
Odds of fleeing per turn while eating: 10.0%

-----  
THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 16.3617%  
Odds of capture with one bait followed by only balls: 17.6221%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 18.0809%

FOR BEST RESULTS THE FOLLOWING PATTERNS  
SHOULD BE RESTARTED IF THE POKEMON EVER 'WATCHES CAREFULLY'

Odds of capture with a pattern of (Bait, Ball) ->  
(Bait, Ball, Ball) Repeating: 18.3026%  
Odds of capture with a pattern of (Bait, Ball) ->  
(Bait, Ball, Ball, Ball, Bait, Ball, Ball) Repeating: 18.5405%

With a slightly lower chance to flee, Dratini isn't as much of a flight risk as the others. It does benefit from bait, but the optimal way to catch Dratini is by throwing a bait and then throwing consecutive balls until it starts watching carefully.

OUTPUT FOR DRATINI

Base catch rate: 45

Base catch factor: 3

Modified catch rate: 38

Odds of capture per ball: 8.09086%

Base catch rate: 45

Catch factor after bait: 3

Modified catch rate after bait: 38

Odds of capture per ball after bait: 8.09086%

Base flee rate: 100

Odds of fleeing per turn while not eating: 35.0%

Base flee rate: 100

Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 20.0969%

Odds of capture with one bait followed by only balls: 22.0042%

Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 22.8828%

FOR BEST RESULTS THE FOLLOWING PATTERNS

SHOULD BE RESTARTED IF THE POKEMON EVER 'WATCHES CAREFULLY'

Odds of capture with a pattern of (Bait, Ball) ->

(Bait, Ball, Ball) Repeating: 22.1917%

Odds of capture with a pattern of (Bait, Ball) ->

(Bait, Ball, Ball, Ball, Bait, Ball, Ball) Repeating: 22.5975%

There are no other Pokémon in the safari zone who benefit from bait. REMAINING PAGES BORING

OUTPUT FOR SEAKING

Base catch rate: 60  
Base catch factor: 4  
Modified catch rate: 51  
Odds of capture per ball: 10.6615%

Base catch rate: 60  
Catch factor after bait: 3  
Modified catch rate after bait: 38  
Odds of capture per ball after bait: 8.09086%

Base flee rate: 75  
Odds of fleeing per turn while not eating: 25.0%

Base flee rate: 75  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 32.3113%  
Odds of capture with one bait followed by only balls: 27.5530%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 28.4172%

OUTPUT FOR PARASECT/VENOMOTH

Base catch rate: 75  
Base catch factor: 5  
Modified catch rate: 63  
Odds of capture per ball: 12.3310%

Base catch rate: 75  
Catch factor after bait: 3  
Modified catch rate after bait: 38  
Odds of capture per ball after bait: 8.09086%

Base flee rate: 75  
Odds of fleeing per turn while not eating: 25.0%

Base flee rate: 75  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 36.0047%  
Odds of capture with one bait followed by only balls: 27.5530%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 28.4172%

OUTPUT FOR EXEGGCUTE

Base catch rate: 90  
Base catch factor: 7  
Modified catch rate: 89  
Odds of capture per ball: 19.7530%

Base catch rate: 90  
Catch factor after bait: 3  
Modified catch rate after bait: 38  
Odds of capture per ball after bait: 8.09086%

Base flee rate: 75  
Odds of fleeing per turn while not eating: 25.0%

Base flee rate: 75  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 49.6123%  
Odds of capture with one bait followed by only balls: 27.5530%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 28.4172%

OUTPUT FOR NIDORINO/NIDORINA/RHYHORN

Base catch rate: 120  
Base catch factor: 9  
Modified catch rate: 114  
Odds of capture per ball: 23.4178%

Base catch rate: 120  
Catch factor after bait: 4  
Modified catch rate after bait: 51  
Odds of capture per ball after bait: 10.6615%

Base flee rate: 75  
Odds of fleeing per turn while not eating: 25.0%

Base flee rate: 75  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 55.0187%  
Odds of capture with one bait followed by only balls: 33.5458%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 34.1499%

OUTPUT FOR PARAS/VENONAT/PSYDUCK/SLOWPOKE/DODUO

Base catch rate: 190  
Base catch factor: 14  
Modified catch rate: 178  
Odds of capture per ball: 40.9600%

Base catch rate: 190  
Catch factor after bait: 7  
Modified catch rate after bait: 89  
Odds of capture per ball after bait: 19.7530%

Base flee rate: 50  
Odds of fleeing per turn while not eating: 15.0%

Base flee rate: 50  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 82.2225%  
Odds of capture with one bait followed by only balls: 58.1423%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 56.7646%

OUTPUT FOR GOLDEEN

Base catch rate: 225  
Base catch factor: 17  
Modified catch rate: 216  
Odds of capture per ball: 50.2867%

Base catch rate: 225  
Catch factor after bait: 8  
Modified catch rate after bait: 102  
Odds of capture per ball after bait: 23.4178%

Base flee rate: 50  
Odds of fleeing per turn while not eating: 15.0%

Base flee rate: 50  
Odds of fleeing per turn while eating: 10.0%

-----  
THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 87.0860%  
Odds of capture with one bait followed by only balls: 62.2389%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 60.8750%

OUTPUT FOR NIDORAN M/NIDORAN F

Base catch rate: 235  
Base catch factor: 18  
Modified catch rate: 229  
Odds of capture per ball: 50.2867%

Base catch rate: 235  
Catch factor after bait: 9  
Modified catch rate after bait: 114  
Odds of capture per ball after bait: 23.4178%

Base flee rate: 50  
Odds of fleeing per turn while not eating: 15.0%

Base flee rate: 50  
Odds of fleeing per turn while eating: 10.0%

-----  
THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
-----

Odds of capture with balls only and no bait: 87.0860%  
Odds of capture with one bait followed by only balls: 62.2389%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 60.8750%

OUTPUT FOR POLIWAG

Base catch rate: 255  
Base catch factor: 20  
Modified catch rate: 255  
Odds of capture per ball: 50.2867%

Base catch rate: 255  
Catch factor after bait: 10  
Modified catch rate after bait: 127  
Odds of capture per ball after bait: 27.9743%

Base flee rate: 50  
Odds of fleeing per turn while not eating: 15.0%

Base flee rate: 50  
Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 87.0860%  
Odds of capture with one bait followed by only balls: 66.2678%  
Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 64.9805%

OUTPUT FOR MAGIKARP

Base catch rate: 255

Base catch factor: 20

Modified catch rate: 255

Odds of capture per ball: 50.2867%

Base catch rate: 255

Catch factor after bait: 10

Modified catch rate after bait: 127

Odds of capture per ball after bait: 27.9743%

Base flee rate: 25

Odds of fleeing per turn while not eating: 10.0%

Base flee rate: 25

Odds of fleeing per turn while eating: 10.0%

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THE FOLLOWING ODDS ARE PER ENCOUNTER - NOT PER BALL  
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Odds of capture with balls only and no bait: 91.0034%

Odds of capture with one bait followed by only balls: 71.5722%

Odds of capture with one bait followed by balls until  
the Pokemon stops eating where more bait is thrown: 69.7018%