In [44]:

```
import sys
import random
import logging


def constant(f):
    def fset(self, value):
        raise TypeError

    def fget(self):
        return f()
    return property(fget, fset)


class cr(object):
    """It is a constant class to define predator,
    prey(let's name catch) and empty sell id.
    If we don't know spicification, it's trouble
    """
    @constant
    def pr():
        return 1

    @constant
    def c():
        return 2

    @constant
    def em():
        return 3

    @constant
    def tr():
        return -1


class Creature:
    def __init__(self, death_p=0.2, reproduce_p=0.1, stay_on_sell_p=0.5, i
        self.p = {'d': death_p, 'r': reproduce_p, 's': stay_on_sell_p, 'k'

    def count_cell(self, position, empty_neib, catch_neib, ocean):
        if random.random() < self.p['d']:
            return None
        if len(empty_neib) == 0:
            return position
        if random.random() < self.p['r']:
            child = random.choice(empty_neib)
            ocean[child] = ocean[position]
            empty_neib.remove(child)
        if random.random() < self.p['s'] or len(empty_neib) == 0:
            return position
        new_position = random.choice(empty_neib)
        return new_position


class Predator(Creature):
    def __init__(self, death_p=0.1, rep_p=0.8, stay_p=0.5, kill_p=0.7, sta
        super().__init__(death_p, rep_p, stay_p, id=cr.pr)
        self.p['k'] = kill_p
        self.p['starv_rate'] = starv_rate
        self.p['h'] = 0

    def count_cell(self, position, empty_neib, catch_neib, ocean):
        ++self.p['h']
        if self.p['h'] > self.p['starv_rate']:
            return None
        position = super().count_cell(position, empty_neib, catch_neib, oc
```

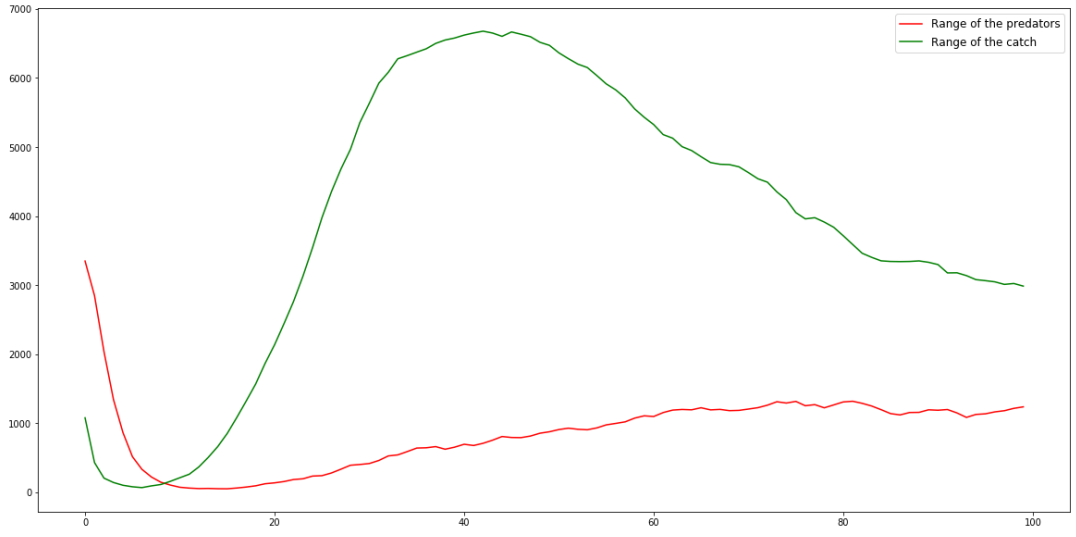
In [45]:
```
import numpy
import matplotlib.pyplot as plt
%matplotlib inline

X_1 = []
X_2 = []
Y = range(100)

for i in Y:
    oc.step()
    pr_rate = 0
    catch_rate = 0
    for i in range(oc.n):
        for j in range(oc.m):
            if (oc.field[j][i].p['id'] == cr.c):
                catch_rate += 1
            elif (oc.field[j][i].p['id'] == cr.pr):
                pr_rate += 1

    X_1.append(pr_rate)
    X_2.append(catch_rate)
```

In [46]:
```
plt.figure(figsize=(20,10))
plt.plot(Y, X_1, c='r', label = "Range of the predators")
plt.plot(Y, X_2, c='g', label = "Range of the catch")
plt.legend(loc='best', fontsize='large')
plt.show()
```



На основании моделирования гипотеза о цикличности отвергается