De Rust Grass Carp

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Grass Carp Stocking Policy

DETERMINING STOCKING RATES

For the purposes of making a quick and basic assessment of the proposed stocking, a stocking model was developed. An online question form or PDF form is available on the website, www.grascarp.co.za This must be completed as accurately as possible. GPS coordinates of the dam and ID number is essential. All fields marked with (*) on the online form must be filled in.

The following procedure is followed to determine the number of fish to be stocked into a water body:

1. Establish the size of the surface area of the dam.
2. Determine the percentage of weed infestation in the dam.
3. Determine the type of weeds in the dam.
4. Determine the weed factor.
5. Historical and seasonal dam levels.
6. Enter information into stocking model.
7. Select the specific water use or application.
8. Consider other factors such as water depth and temperature.
9. Select a stocking rate for the specific size of fish.
10. Maintaining sustainable results.
11. Conditions for finalizing stocking projects.
12. Permitting procedures.

1. Determining the size (surface area) of the dam.

   A simple calculation is made to establish the surface area of the dam in square meters. The following formulas can be used:

   - Surface area of square dams = Length x Width
   - Surface area of triangular dams = ½ x Length x Width
   - Surface area of round dams = 22 x dam radius x dam radius / 7

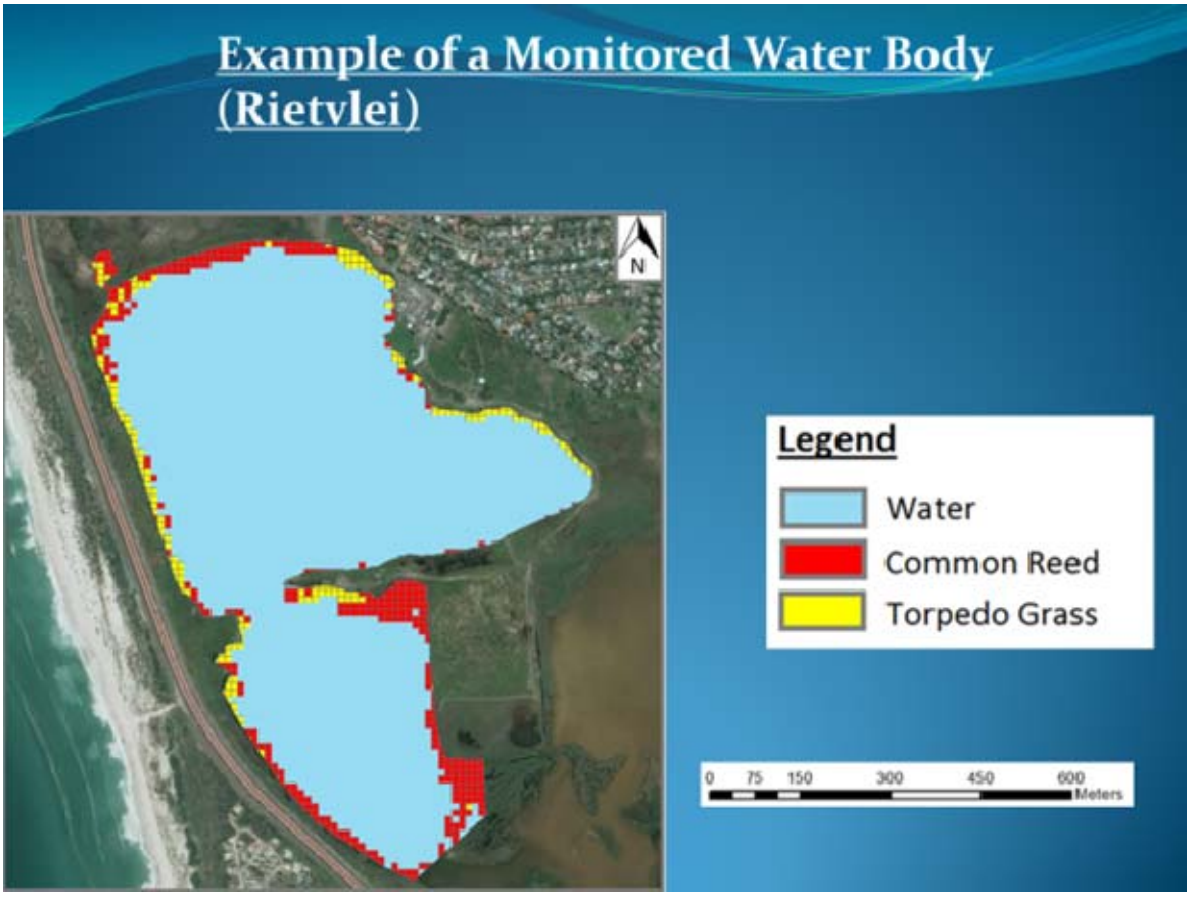
- Size can also be established using Google earth or maps

2. Determine the percentage of weed infestation in the dam.

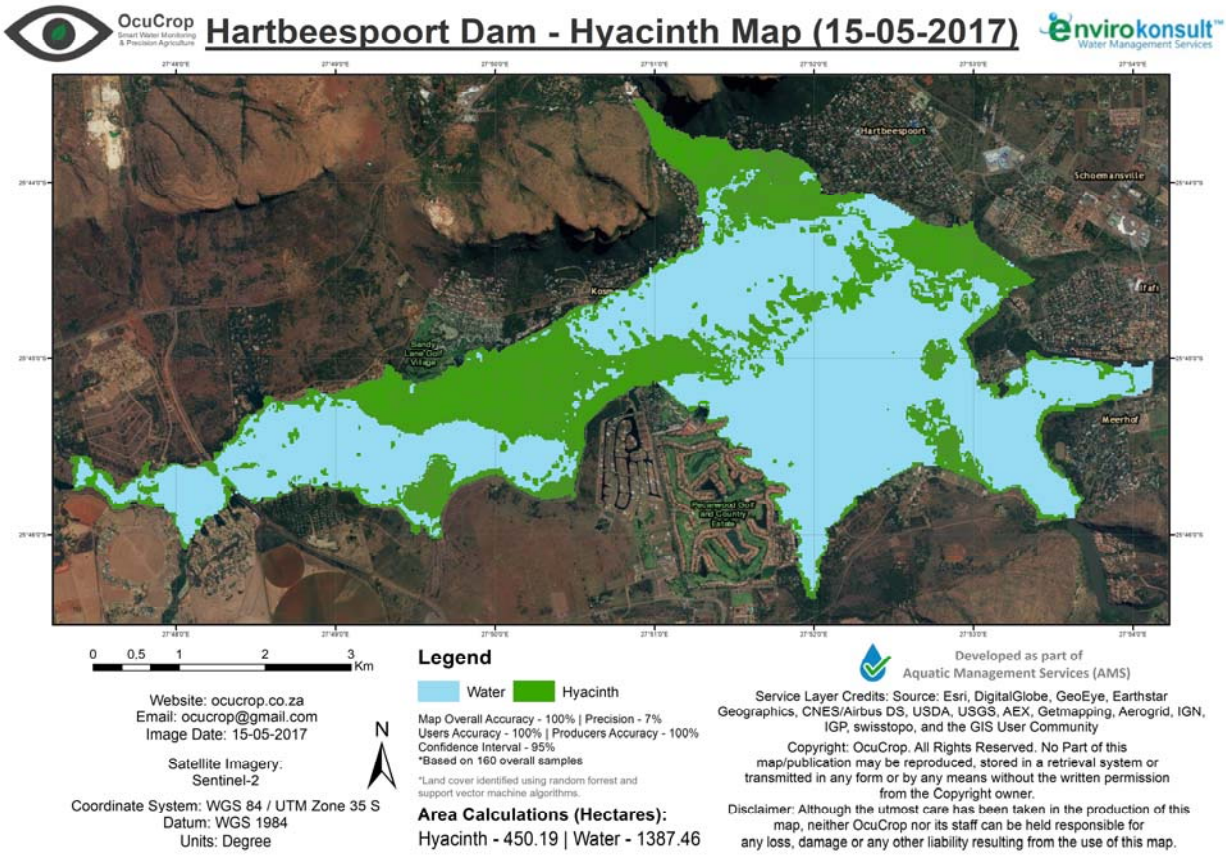
   Decide beforehand at what percentage stocking will be done, or determine the percentage of weed infestation in the dam. Historical data for a period of ten years are used to determine the percentage of weed infestation in the dam. Information available on Google earth and other platforms are utilized.

   Surveys can also be conducted by mapping the dam, using sonar technology combined with GPS mapping software.

   Advances satellite technology can be utilized for larger impoundments. Below are examples of such technology.



Images supplied by OcuCrop and Envirokonsult



3. Determine the type of the weeds in the dam

   Grass carp prefers certain types of weed. It is important to make a positive identification of the weeds, in order to develop the right stocking model.

   A table of the most common aquatic weeds found in South Africa is available on our website and face book page.

   If there is uncertainty about the species, a website can be used to identify the weeds. The link below should be followed:

   http://aquaplant.tamu.edu/plant-identification/

   After identifying the weed on the webpage, the management options icon is selected. Al the management options are listed as well a recommended weed factor in fish per acres.

4. Determine the weed factor

   The “weed factor” for grass carp is the amount of adult grass carp needed to effectively control a one-hectare infestation for a certain aquatic plant species. It is also referred to as a working population.

Research was done to establish the feeding preferences of grass carp. The combined research by Michael P. Masser, using grass carp in aquaculture and private impoundments, The Texas A&M University and an article by R.T. Pine and L.W.J. Anderson, Plant Preferences of Triploid Grass Carp, was used to compile the template below.

AQUATIC PLANT PREFERENCES OF STERILE GRASS CARP ON A SCALE OF 1 TO 20

As a general rule, all aquatic plants, 9 and lower on the scale of preference, are easily controlled by moderate stockings of grass carp. For plants higher on the scale, stockings have to be increased to achieve control. This is due to the feeding preferences of grass carp.

Preferences: 1 - 9 = weed factor* 30-35 fish/ha, 10 - 14 = weed factor* 40-45 fish/ha, 15 - 16 = weed factor* 50-55 fish/ha

The information contained below, was compiled from articles by Michael P. Masser, Using grass carp in aquaculture and private impoundments, The Texas A&M University and an article by R.T. Pine and L.W.J. Anderson, Plant Preferences of Triploid Grass Carp.

If the plant is not included in the above, please contact us to assist you in the identification process. Please read our stocking policy on our home page. It will give you more insight into the process of how we determine stocking densities. You can also follow this link to assist you in making a positive identification of a plant: https://aquaplant.tamu.edu/plant-identification/

*** The weed factor refers to the amount of grass carp, (working population after initial mortalities) necessary to control one hectare of a specific weed**

5. Historical and seasonal dam levels

For large storage dams, receding water levels due to the increase of water usage, pose a more complex challenge. As the ratio of the area of surface weeds, compared to the total surface area of the dam changes monthly, it necessitates the adaption of normal stocking models for static water bodies. Historical dam levels for the last ten years are used to refine the stocking models. The ten-year minimum and maximum seasonal levels are established as well as the ten-year average. These are then used as factors to determine the total average square meters of weed infestation for the last ten years. A stocking model for every dam is developed taking into account the gradual seasonal decrease of the surface area of the dam

and the gradual increase in evapotranspiration by ever increasing exposed aquatic weeds.
The shape, depth and contours of the dam are factors which have an influence in calculations. Source data is obtained from google earth and other platforms including satellite data.

All calculations are basically used to be able to predict future water levels, as water levels directly impact the number of weeds in a dam and therefore stocking rates.

6. Enter information into a stocking model.

   The following factors are taken into account:

   - The depth of a dam
   - Water surface area
   - Type of weed
   - % of weed infestation
   - Age of dam
   - Nutrient load
   - Highest seasonal water level
   - Lowest seasonal water level

7. Select the specific water use or application

   The primary water use of a dam will have a big influence on the final model. In the case of an angling dam, stocking rates should be lower to provide some cover for smaller fish and invertebrates, to help maintain a productive fishery.

8. Consider other factors such as average temperature.

   A series of other factors could be considered. The following are examples of factors that could play a role:

   - Seasonal temperatures
   - Other fish species present in the dam
   - Soil type
   - Water color
   - The species composition of the aquatic plant community
   - Water level fluctuations
   - Water quality
   - Human activity
   - Water use
   - Selected time frame for aquatic weed control

9. Select a stocking rate for the specific size of fish

- The ideal will always be to stock big fish. Factors such as the cost of air travel and transport costs for bigger fish have an influence on the fish size selected. The most economic fish size to stock is fish between 25 cm and 30 cm.
- Different sizes of fish are priced in such a way that irrigardless of size, the eventual cost per hectare is more or less the same.
- The table below was compiled after years of research in the USA. It serves as a good guideline to determine mortalities in South Africa.
- The same type of predators and conditions are present in South Africa.
- Information was obtained from:

  MANAGING AQUATIC VEGETATION WITH GRASS CARP

  A Guide for Water Resource Managers by John R. Cassini, Editor

Triploid Grass Carp Mortality Rates. Information from Florida Game and Fresh Water Fish Commision, Aquatic Plant Management Operations Manual			
Size of Fish (inches)	**Survival factor**	**Mortality Rate**	**Fish/acre**
6.0	**0.3333**	**66.6%**	**30**
6.5	**0.3703**	**63.0%**	**27**
7.0	**0.4000**	**60.0%**	**25**
7.5	**0.4347**	**56.5%**	**23**
8.0	**0.5000**	**50.0%**	**20**
8.5	**0.5233**	**17.4%**	**19**
9.0	**0.5555**	**44.5%**	**18**
9.3	**0.5882**	**41.2%**	**17**
10.0	**0.6666**	**33.3%**	**15**
10.5	**0.7500**	**25.0%**	**13**
11.0	**0.3333**	**16.7%**	**12**
11.3	**0.8989**	**11.0%**	**11**
12.0	**0.9595**	**1.4%**	**10**

10. Maintaining sustainable results.

Grass Carp is a very hardy species of fish. Under average conditions aquatic weed control should be maintained for at least ten years.

The ideal would be to restock at a certain percentage every year after the initial stocking. As this is in most cases not practical, the dam should be monitored annually to follow the progress made. A good practice would be to take a photograph every two months from the same position overlooking the dam. Photos could then be compared to establish any changes in the visible weed infestation

Grass carp is just one of the tools available to manage aquatic weeds and should be managed as any other tool available. If there are weeds present that are not preferred weeds of grass carp, other control measures like mechanical or chemical solutions should be implemented. All these management tools should then be combined into an integrated management plan or IAVMP. (Integrated Aquatic Vegetation Management Plan) At De Rust we recruit the services of professional environmental technicians to assist with the development of management plans for bigger dams.

The aim of the developed ten-to-twelve-year models, are to manage a biomass of invasive aquatic weeds that are constantly experiencing seasonal changes, with a number of grass carp, with an increasing biomass.

After stocking with grass carp, the aquatic weeds will increase for a period of time. The time period will depend on the size and amount of grass carp stocked. In other words, the stocking model selected. This is due to the fact that the total biomass of the gras carp is not large enough yet to neutralize the growth rate of the aquatic weeds. The average turning point for most of the stocking models selected is twelve months, at which point the grass carp have grown to a big enough combined mass that can effectively control the aquatic weed.

Building the stocking models can be as simple or complicated as you want it to be. To ensure that the desired, cost effective and practical end result is obtained, it is necessary to develop some basic assumptions and simplifications as to the factors influencing the end result.

- Because of receding water levels, the rate of aquatic weeds becoming exposed to the air is equal to the rate of aquatic weeds being exposed above the water level.
- The annual evaporation and evapotranspiration will be divided into equal monthly losses.
- The basis for determining evapotranspiration losses is that the loss of water through aquatic plant transpiration of exposed plants, is at least equal to water lost due to evaporation. In some instances, it is significantly higher.

11. Conditions for the finalizing stocking projects.

A quote and proposed stocking model will be sent to the client for scrutiny and authorization.

The proposed stocking rates will then accompany the permit application to the relevant provincial nature conservation authority, for scrutiny and verification.

12. Permitting procedures.

Permit applications can be conducted by us on your behalf.