Literature it is also used to hunt as

Business, Industries

LITERATUREREVIEW 2. 1 Catfish The catfish can be located around the globe. They are mostly bottom feeders which can be search in freshwater region. Meanwhile, they also have characteristics such as flat broad heads and obtain filamentwhich are called as barbel which are elongate at the entrance of its lip (A-Zanimals, 2008).

The known order for thecatfish is called Siluriformes which rangesof almost 3000 knowns species around the world (A-Z animals, 2008). In general, almost all catfishes are omnivores, however others have favourite diets such aswood eating locariids (Nelson et al., 1999) and meanwhile there can also exists such as the parasitic catfishes thatcan feed on the blood of other animals such as the fish (de Pinna, 1992; Spotte, 2002). Their barbels was used to taste the foods as it contains taste buds. Inaddition, it is also used to hunt as it can help detect the scent of their preyand food in the wild. However, there are catfish that lacks the mechanism (A-Zanimals, 2008).

The catfish are prepared todefend themselves as some are furnished with defences' mechanism. Theirdefences can resemble as sharp balances spines. It can perpetrate seriousdamage to enemies (Baron et al., 1996).

Other catfish can be venomous (Dorooshi, 2012). They are different frommost freshwater fishes as they are nocturnal creatures and usually depend highlyon senses other than their sights, such as the tactual and the chemo sensitivebarbels, or a bigger olfactory organ. Thus, these creatures are able to adapttheir lives in different habitats such as holes, aquifers, and deep riverchannels. Meanwhile, they also can normally leave the river and walk on landsuch as the air breathing clariid catfishes (Burgess, 1989). The

general size is arounda meter and this normally depend upon the species (A-Z animals, 2008).

In any case it can go in estimationfrom only a centimeter long to more than two meters in length. The biggestspecies is the European wels catfish, as it can found up to 5 meters long and canweigh around 330 kg (Treeoflife, 2003). Meanwhile, the second largest is theMekong catfish, which is found living in different parts of the Mekong Riverthat streams through Laos, Thailand, Cambodia and Vietnam. The largest Mekongcatfish ever discovered was measured almost 3 meter in length. 2. 2 Japanese catfish The characteristic of the Japanesecatfish is the normal for any Silurusspecies.

It has a small dorsal fin which is dark grey at its sides. Theirstomach is white colour with sporadic white dabs at each side. They also obtainbarbels as any common catfish.

However, the specialty of the Japanese catfishis having one pair of the mandibular barbell which is longer than their headwhile another pair of the mandibular barbell is 1/3 to 1/5 of the total lengthof their maxillary barbell (Liu, 1990). During the adolescent stage, the fishcan be around 6 to 7 cm as their standard length. Also, amid this stage, they haveone additional combine of mandibular barbell however it will deteriorates as itenters the adulthood (Atoda, 1935). Furthermore, Japanesecatfish can create its home in or under of stream or at lake banks, old logs, shakesor even under rocks. While others would discover openings in banks, and somecan make the gaps themselves.

The spawning season will come in the spring orlate spring from May up to June. They are able to spawn eggs around 5000 up to10000 eggs which depends on their age and size. While for their sex, it can beseen an apparent sex ratio of the species is extremely high toward females tomales. They are intraspecific variety in their regenerative nature, especiallyduring mating conduct, as it has been research inside the neighbourhoodpopulaces in Japan (Maehata, 2007). In Japan, a pastinvestigation of the Japanese catfish in almost various lake has indicates a diversemating conduct. For instances, in the lake Biwa populaces it had demonstrated asettled succession of activities, for example the pursuing, the sticking, theenclosing with pressing by the male, and by hovering of the matched fish, andthe females are constantly enveloped by a solitary male (Maehata, 2002), whileat the Ooi lake and at the Fuefuki lake, the populations does not demonstratesuch the same behavioural sequence which was the process of enfolding afemale’s body by a male.

The circling by the paired fish has also not been seenbut instead the females will usually enfolded by around two different males(Maehata, 2007). In the spawning activities, the Japanese catfish will scatter their eggs. This was believedto be aimed at reducing the number of juvenile mortality rate (Katano et al., 1988). The male is generally theall-time caretaker and defender of the eggs.

As the fry will continueto grow to adult phase, their diet will begin to increases as many type ofanimals such as the crustaceans, the clams and also small fish become theirfood (Katano et al., 1988). In almostall the

matured adult fish are active and feed during night time. However, thisfish also feed in condition such as dirty and lower vision waters during sunlight.

The hunting method relies upon their sense of scent and taste due to the catfishhaving very poor sight (Maehata, 2007). When the larvae had aged to juvenileand become matured, they will then began to form schools and move together. Moreover, they do not possess anymigrating characteristic such as travelling downstream and upstream river.

But will spend a lot of their lives in lakes bottom, thereservoirs and river streams. 2. 3 African catfish The African catfish is known to be apowerful freshwater fish.

It can develop to in the range from 1. 4 up to 2m long and can also weigh infrom a minimum of 8kgs up until 59kgs (Freyhof, 2016). For its characteristic, the body colouration can fluctuates from olive green, to darker and dark withthe flanks frequently uniform dim to olive-yellow with dim slate or greenishdarker back (FAO, 2012).

In its underparts, the colours are pale olive to whiteand are mottled randomly with dull tanish green, or consistently gleamingolive. It is heavy bone with a levelheaded and obtaining premaxilla while having lower jaw pointed teeth organisedin few lines. Meanwhile, it also has four pairs of long trailing sensory organsthat is recognise as barbels around its mouth (A-Z animals, 2008). In addition, the fish has a high number of gill rakers differing from 24 to 110. The numberwill increase with the size of the fish.

These fish are an insatiable beast and will likely eat everything in itssight (Ataguba et al., 2012). Theirprey also includes several organism such as the insects, the crabs, theplankton, the snails, small fish, small birds, and many more (Ibrahem, 2011). It is generally an individual bottom feeder, however they are known to be to agreat degree versatile to conditions and can move in groups at the watersurface. Meanwhile, it can also shows an assortment of strongly behaviour suchas sucking the surface for earthbound creepy crawlies and also some plant pieces that was washed into the water by overwhelmingrains and pack-hunting of small cichlids. The growth is generally rapid, wherethe fish can obtain their maximum size within a couple of years (FAO, 2008). African catfish are generally conveyed far and widearound the world. The species can extend from South Africa up to Middle, Westand North Africa.

It is likewise had been dispersed around different continentsuch as the Middle East and Eastern Europe. Furthermore, they are alsoadditionally similarly introduce in Jordan, Lebanon, Israel and Turkey. It hasalso been brought into most of the different nations in Africa, Europe, Asiaand South America. Similarly to some other species, China also introduced itwithin its rice fields and is currently holding the position of among the mainproducing countries (De Silva, 2010). The pattern for African catfish culturehas been increase throughout the following years since it introduction as oneof the biggest fish species in aquaculture. Even the market for African catfishin the sub-Saharan Africa has been increasing and evolving each year (FAO, 2010).

2. 4 Aquaculture production of catfish By and large, all of the catfishesaround the globe has affected the global economy as they have esteem and arealways gathered as human utilization, pet exchanging and recreations. Theoverall catch record of the freshwater and marine catfishes in 2000 has alreadysurpassed 500, 000 metric tons (FAO, 2000). In addition, a few catfishes such asthe Flathead catfish in North America and also the Goliath catfish in SouthAmerica are being forcefully looked for angler in the angling sport (FAO, 2000). In contrary, a numerous number of catfish has been translocated andacquaint with the new zones which makes some of the generous monetarymisfortune and could also harm common environments and local fish abundancy (Schmitt, 2016). There is significant catfish pests in North America which is the walkingcatfish, C. batrachus, in Florida, and while also the Flatheadcatfish, Pylodictis olivaris, in the Atlantic slope drainages(Fuller et al.

, 1999). While in Asia and thePacific, the family Clariidae (Clariasspp.) had dominated the aquacultureproduction, by being up to the 80% of the total 76, 000 tons catfish which produced in 1991 (FAO, 2000). The mostcultured species were C. batrachus, C. macro-cephalus and C. gariepinus. However, only the Africancatfish was the introduced species that had an important effect on the Asianaquaculture industry (FAO, 2010).

The very first introduction was done inVietnam of the year 1975, where the species was then spread widely all overAsian region. Although the Asians do not find its meat quality and its largesize preferable, due to its rapid growth and hardiness of the fish, it has madeit very interesting among the fish

farming business. While for the Japanesecatfish, In general, it is rapidly gaining high popularity in aquacultureindustries mostly in Asian region. It has been used cultured in Japan by manyaqua culturist. In Vietnam, the production of Japanese catfish is very high inmiddle and lower section of rivers where they are harvested throughout year. Furthermore, the Japanese catfish isalso a known sport fish due to its aggressiveness and powerful body. Generally, fish sport person love catfish as one of the best freshwater fishing game inthe world. 2.

5 Growth performance of catfish The development of a fish can becharacterized as an increased in magnitude, it can also be estimated by theirsize and also the tissue piece. It speaks to a standout amongst the mostnoteworthy parameters in aquaculture (Silva etal., 2015). Growth isestimated by the units of the length and the weight and is best spoken to asthe important development rate. The main relationship between the weight andthe length can provides an index of the state of well-being of a fish. The conditionfactor ‘ K’Fishes can display a ‘ determinate’ which is a sort of development inbrief types of hotter areas and an ‘ indeterminate’ sort of extensive types ofcolder districts (Dutta, 1994). It could also be measured by using othercriteria such as the glycine uptake by scales, the hepatosomatic index, theRNA: DNA ratio and also the protein retention in the tissues.

The nutritionwhich includes the quality and quantity of food, will play an important role ingrowth regulation (Siddiqui, 2014). A few number ofenvironmental factors, such as the temperature, the oxygen concentration,

the salinityand the photoperiod, can also affect the rate of growth (Tang et al., 2008). There are fish that canexhibit a determinate type of growth in short-lived species of warmer regionsand an indeterminate type in long-lived species of colder regions (Dutta, 1994).

The water temperature is a standout amongst the most critical physicalvariables influencing fish development and creation. Fish are cold bloodedcreatures which expect around an indistinguishable temperature from theirenvironment (Viadero, 2005). The growth performance of theAfrican catfish can be affected by many factors such as stocking density, feedformulation and water quality. Past studies of Micha (1976) suggest that thegrowth of African catfish to decrease with increasing stocking densities. However, (Van de Nieuwegiessen et al., 2008) had indicated that both the high and low densities had also some detrimentaleffects on fish welfare based on juvenile African catfish of 10-100g. Factorssuch as feed can affects the growth of African catfish by the number of proteinlevel contain in the feed.

High level of protein is very essential to thegrowth of fish but an optimum level is known better to provide high growthefficiency (Tunde et al., 2016). As for Japanese catfish, the growth of the catfish was very fast and it can grew to an average bodyweight, 100g at 80 days after hatching in the natural condition (Akazaki et al., 1991). The Japanese catfish hadcontain less information regarding the nutrients that can help its growth but anotherpast studies of Cong Liu (2012) states that the dietary protein of 43% anddietary

lipid of 7% had no significant growth effect on Japanese catfishcompared to S.

meridionalis which had shown better growth performance in the samedietary nutrient. However, the Japanese catfish optimum level of dietary proteinis 45% for the best development (Kim etal., 2014). Sex of the Japanese catfish also influences its growthperformance as female grow much faster than male (Kim et al., 2001).

This is due to reaching sexual maturity has reduceits growth rate and reduce its feed efficiency for male.