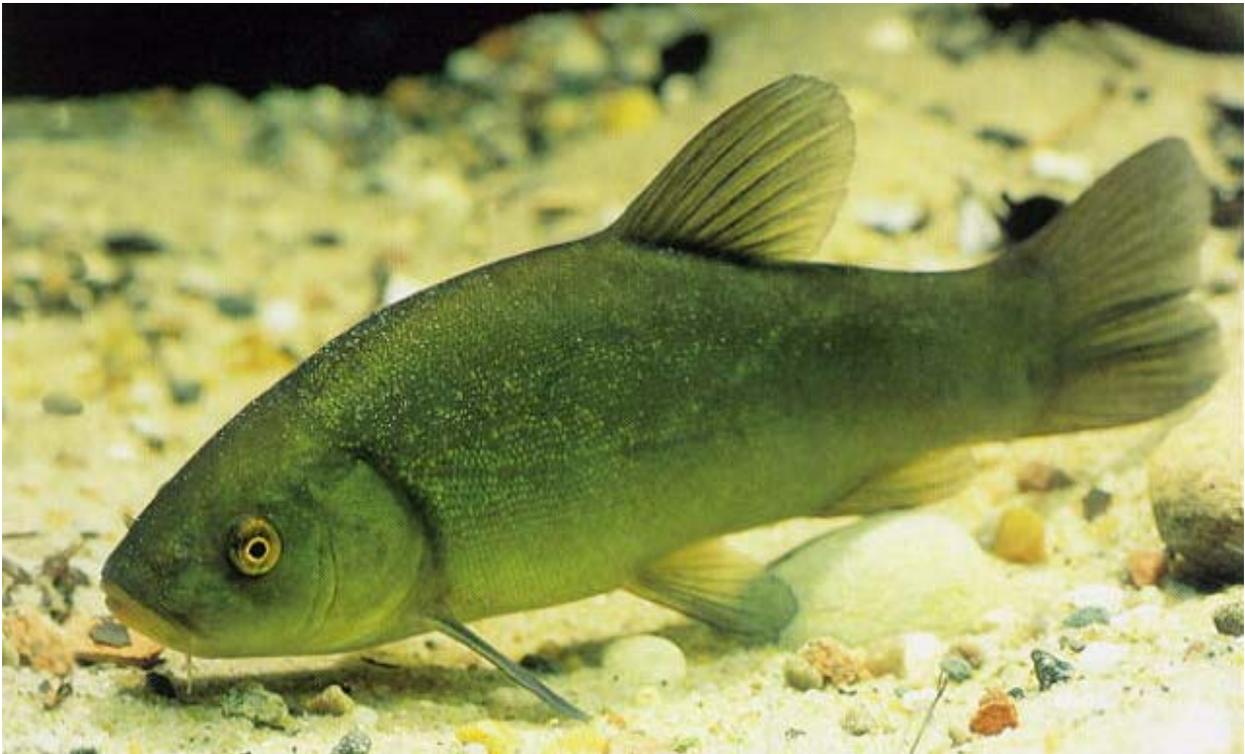


***Tinca tinca*, Tench**

Kurtis Nordstrom

Fish 423

Fall, 2011



Picture 1 - Zienert, Steffen. "*Tinka tinka*". Photo. <http://nas.er.usgs.gov>. 24 Jan. 2011. 22 Nov. 2011

Diagnostic Information

Tinca tinca is a type of large freshwater minnow. It is part of the Class Actinopterygii (ray finned fish), Order Cypriniformes (Carps), Family Cyprinidae (Minnows or Carps), and the Genus Tincinae. *T. tinca* has also gone by *Tinca vulgaris* in older literature and is commonly called tench.

Distinguishing characteristics

The basic characteristics of tench is 4 dorsal spines, 8 or 9 dorsal soft rays, 3 or 4 anal spines, 6-8 anal soft rays, and 39-41 vertebrae. Tench have a laterally compressed body and a deep and short caudal peduncle. They are generally olive green but can also be dark green and reflect a gold coloration of the ventral surface. The head is triangular shaped with small, orangish-red eyes and a long snout (Spillman 1961). The mouth is very oblique and has a pair of large maxillary barbels at the corner of the mouth (see Figure 1). Tench have small scales with more

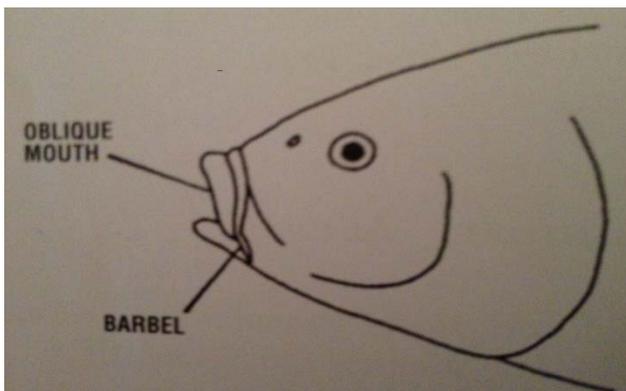


Figure 1: Wydoski, S. R. "*Tinca tinca* mouth and pair of barbels". Figure. *Inland Fishes of Washington*. 2nd ed. Seattle. University of Washington Press. 2003.

than 100 scales on the lateral line. *T. tinca* does look similar to the common carp, but does not have heavy spines coming from the base of the anal and dorsal fin. Common carp have 2 pairs of maxillary barbels where the tench have 1 and have much fewer scales on the lateral line (Wydoski and Whitney 141-142).

Life History

Life cycle

T. tinca have a life span of up to ten years. They can grow up to 18 inches long and weigh 3 pounds (Wydoski and Whitney 141-142), but have slow growth rates (Erguden and Goksu 2011). Female tench become sexually mature between 3 and 7 years where it takes males 2 to 3 years to reach sexual maturity (Macri *et al.* 2011). During their first few years tench growth, during sexual development, is dominated by increasing its length and then is dominated by weight gain (Benzer *et al.* 2009). They are very durable fish and are highly resistant to disease due to the small scales and a mucus layer which cover their bodies (Benzer *et al.* 2010). Very little research has been done on the development of tench. Most research is done on sexual reproduction for aquaculture.

Feeding Habits

Tench are omnivores (Gray and Dauble 2001) with a very broad diet and tend to feed in areas where there is a large supply of

macrophytes (Alas *et al.* 2009). When Tench are young they feed on small prey items like algae and microscopic organisms. When they are older they switch to larger prey items like aquatic insects and invertebrates such as snails and clams. Tench have also been found to eat amphipods, mayflies, caddis flies, dragon flies, organic detritus (animal and plant) (Wydoski and Whitney 141-142), and aquatic vegetation (Benzer *et al.* 2010). The stomach contents of tench have been examined in different lakes in Washington. In 1995 in Lake Washington 52 percent of the stomach content were fingernail clams and snails, while the rest of the stomach contained fish eggs. In Medical Lake and Loon Lake most of the stomach contents consisted of *Daphnia*. In Medical and Loon Lakes copepods and midges were mostly consumed by tench. Two tench were examined in Lake Roosevelt and their stomach contents were 24 percent snails, 40 percent insects, and 36 percent organic detritus (Wydoski and Whitney 141-142). Alas *et al.* (2009) found fish eggs, fins, and other “fish items in the alimentary canal. There have been many different findings to what tench actually eat due to their broad diet. They eat different items depending on what is available in particular regions, but generally tench feed mainly on benthic organisms, preferably large crustaceans (Alas *et al.* 2009).

Reproductive Strategies

Males hit sexual maturity between 2 and 3 years while females reach sexual maturity

from 3 to 7 years (Macri *et al.* 2011). In the US the tench spawning season lasts from May till June and in Europe it lasts from May to August. Tench will aggregate to shallow, warm water where they will lay the eggs on aquatic plants. The eggs have an adhesive characteristic that allows them to stick well to plants (Wydoski and Whitney 141-142). Tench breed during warm seasons when the water temperature is between 20 and 31.6 degrees. However, Gray and Dauble (2001) have found Cyprinids including tench to be reproducing in temperatures from 10-16 degrees Celsius in the Columbia River. In warmer water females tend to mature faster, spawn more frequently, and have a higher fecundity than females in colder water. Ovulation is triggered by the hormone GnRH and females will have several batches of eggs during the breeding season. Male spawning is triggered by the hormone GI (Linhart *et al.* 2006) Eggs account for about 10 percent of the body weight of females during the breeding season a high density of eggs are released (Erguden and Goksu 2011). The number of eggs per batch decreases with each batch released within the spawning season (Rodriguez *et al.* 2008). Females can lay between 7,800 to 19,560 eggs per batch of egg and the number of eggs increases as females increase in age. The diameter of the eggs are largest in the beginning of the breeding season and are around 0.87mm in diameter (Erguden and Goksu 2011).

It is important to know that many male tench in captivity have been manipulated to be triploid.

Most research on the reproductive strategies for male tench is about triploidy in males. Triploidy has been used as a way to control tench reproduction if they escape or are intentionally introduced. Linhart *et al.* (2006) found that triploid tench have a much higher growth rate than diploid. Triploid males had a lower number of sperm than diploids, but the sperm head size was larger due to the increase in the amount of DNA. There was a decrease in fertilization from triploid males, but triploid males still had a high level of success when mating with diploid females (Linhart *et al.* 2006). It was believed that triploid males could not produce offspring, but recent studies like the one by Linhart *et al.* (2006) have shown this is possible. The problem is many aquacultures induces triploidy to ensure that tench released or that escape into the wild will not be able to mate and create populations of tench, but since tench can still reproduce that method is not very effective. In places where tench is intentionally stocked with triploid males, a population would be able to breed and establish.

Environmental Optima and Tolerances

Tench have a wide range of environmental tolerance, but prefer to be in slow moving warm water such as lakes and ponds but are also found in slow moving streams. They tend to stay in shallow water where it is warmer and in the dense aquatic vegetation. These areas are optimal for breeding where they can lay their

eggs on the vegetation and provide a shelter for the fry. Tench are able to survive in tropical conditions as well as colder environments like here in the Pacific Northwest (Wydoski and Whitney 141-142). Tench have adapted to very drastic environmental changes. When a pond or body of water they inhabit dries up tench are capable of burying their selves into the mud to remain moist and wait until water returns. They also burry themselves during winter to wait for warmer weather (Baughman 1947).

Biotic Associations

Tench play large roles in their ecosystems and provide many benefits. They are very effective at preventing blooms of algae (Macri *et al.* 2011), provide opportunities for fishing, and are a food source to both humans and animals. They are also important in returning minerals and nutrients from the bottom of lakes and streams as they are constantly mixing up the muddy bottoms in search of food (Benzer *et al.* 2010).

Tench do have negative impacts on their environments. In places tench are found there is a decrease in other fish species. Tench feeding on aquatic plants inhibits inorganic nutrient salts, nitrogen, and phosphorous in the sediment to move back up into the water (Benzer *et. al* 2010). They can carry parasites that can be very harmful to other species. The two most common types of parasites, *Ligula intestinalis* and *Asymphyrodora tincae*, are described below.

There are currently no studies on these parasites in tench in the Pacific Northwest.

Tench provide a food source for many game species (Wydoski and Whitney 141-142), but this cause problems for many birds who eat tench as tench can carry a tapeworm parasite called *Ligula intestinalis*. This parasite uses many fish species including *T. tinca* as a second intermediate host during its plerocercoid stage and then birds as its final host where it reproduces. *L. intestinalis* will reach maturity in 3-5 days when it gets into its bird host. Tench ingest this parasite from eating zooplankton (Ergonul and Altindag 2005). Ergonul and Altindag (2005) found that 1-2 year old tench with zooplankton in their stomachs and the parasite, but 3 year old tench did not have either. They concluded that tench must acquire the parasites earlier in life when they are feeding on zooplankton. These finding were also found by Fitzmaurice (1970). This does not mean that older tench cannot acquire the parasites as Ergonul and Altindag (2005) found older tench with the parasites, but believe it was through accidental ingestion of zooplankton when feeding on other organisms. Ergonul and Altindag (2005) looked at 272 specimens of tench in Mogan Lake, Turkey and found a high number of the population was infected. Out of the 272 specimens 109 individuals were infected with *L. intestinalis*. One individual can have up to 9 individuals of *L. intestinalis* in them. The infestation was found to be highest during July and the lowest in May. The infestation period in

Turkey corresponds to the breeding season and could have implication for breeding. *L.intestinalis* can cause inhibition of the development of gonads in fish which can cause population declines in tench as they will not be able to reproduce (Ergonul and Altindag 2005). Another common parasite of tench is *Asymphylogora tincae*, a type of worm, and found in the alimentary canal of tench (Alas *et al.* 2009). Alas *et al.* (2009) found that 33.15% of the tench caught contained *A. tincae* in Beysehir Lake, Turkey. The second host that this parasite uses is mollusks and fish as its final host. Fish acquire this parasitic worm when they feed on mollusks that are infected (Alas *et al.* 2009). Here in the Pacific Northwest there are a lot of mollusks harvested for aquaculture and tench have spread to a large area of Washington where these diseases may pose a threat.

Current Distribution

Globally

Tench are currently found throughout Europe, their native land, and has been introduced to North America, South America, Africa, Australia, and Asia (Alas *et al.* 2009).

United States

In the United States tench have been stocked and reported all across the US including Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Illinois, Kentucky, Louisiana, Maryland,

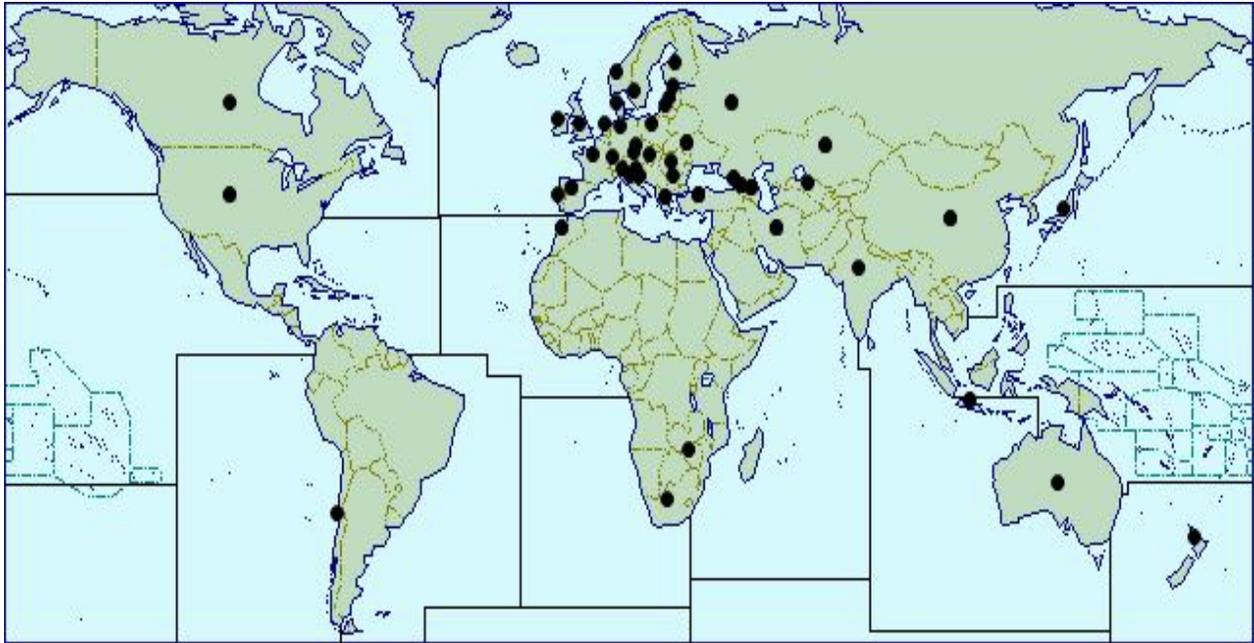


Figure 4: "Global Distribution of *Tinca tinca*". Figure. <http://www.cabi.org>. 26 Nov 2011.

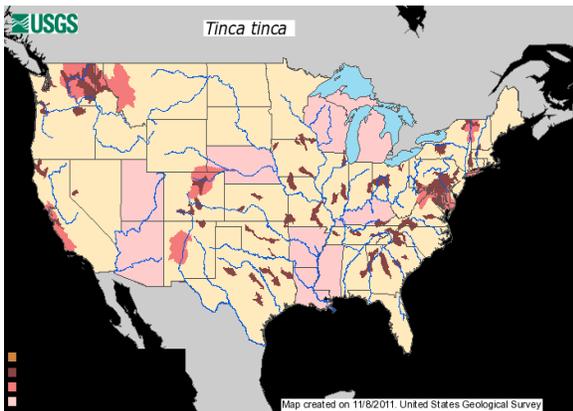


Figure 3: United States Geological Survey. "Geographical distribution of *Tinca tinca* in the United States". <http://nas.er.usgs.gov> 8 Nov. 2011. 22 Nov. 2011.

Massachusetts, Michigan, Mississippi, Missouri, Nevada, New Jersey, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

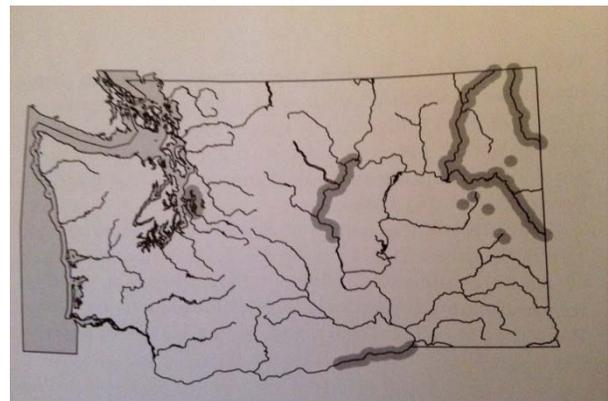


Figure 2: Wydoski, S. R. "Distribution of *Tinca tinca* in Washington State". Figure. *Inland Fishes of Washington*. 2nd ed. Seattle. University of Washington Press. 2003.

Pacific Northwest

In Washington tench were originally stocked in Fourth of July Lake, Fetz Lake, Diamond Lake, and in a pond in Spokane. They have also been released into Lake Washington. From these sources tench have spread into Lake

Union; Columbia River, mainly in the northeastern and north central Washington in Rufus Woods Lake; Lake Roosevelt; Spokane River; Sprague Lake by Spokane; Medical Lake, Clear Lake, and Silver Lake in Spokane County; Box Canyon Reservoir; and Pend Oreille River (see Figure 4). There is a high density of tench in Box Canyon Reservoir. A single individual was caught at Little Goose Dam in 1997 and again in 1998 about 70 miles from Snake River (Wydoski and Whitney 141-142). If tench get into Snake River it will allow them to spread even further throughout Washington, Wyoming, Idaho, and Oregon (USGS 2009).

Using the Columbia River waterway tench have started to move into northern Oregon and have established in the mouth of the Umatilla River near the Oregon Washington border. In Idaho tench have established in Kelso Lake, Hayden Lake, and Chatcolet Lake through connective waterways from Spokane Valley (USGS 2009). Tench have also been found in British Columbia (Baughman, 1947). **History of Invasiveness**

The tench is native to Europe, but has been introduced to the Americas, Africa, Australia, and Asia (Alas *et al.* 2009). Tench are a major food source in Europe and highly valued for fishing. There have been many attempts at cultivating and introducing tench into the wild. There is a lot of conflicting data on when and where tench originally came into the United States due to the limited amount of data kept from the late 1800s. The following events are the most documented cases and have had the

largest impacts on tench establishment and spread. Tench were originally cultivated in the US by the United States Bureau of Fisheries beginning around 1883 and were later stocked in different waters. (Wydoski and Whitney 141-142). Tench were brought into Washington D.C. in 1885 for cultivation, but in 1888 and 1889 the Potomac flooded in the farm ponds and many Tench escaped and spread throughout the water systems in the eastern US. In 1922 tench were brought over from Italy by Mr. Graviati who created a farming pond in San Mateo County, California. After this time many other farm pond owners began cultivating tench and the distribution of tench spread all over the US (Baughman 1947). These trench pond farms increased the propagule pressure of tench and helped to increase their introduction into the wild. Some farm ponds flooded and became connected to water systems allowing the tench to spread and establish all over the US (Baughman 1947). In 1895 and 1896 tench were stocked for fishing in many waterways in Washington such as Fetzer Lake, Diamond Lake, Fourth of July Lake, and in a pond in Spokane. Tench were also purposely released into Lake Washington after they were put on exhibit in Seattle for the Alaska-Yukon Exposition in 1909. Tench from the fair were transferred to the University of Washington and put in a large pond (Drumheller Fountain). They were then released into Lake Washington where they established and moved into Lake Union and the Lake Washington water system. Tench are predominantly found

throughout the Lake Washington water system, Columbia River system, and Box Canyon Reservoir (Wydoski and Whitney 141-142).

Invasive Process

Pathways, vectors, routes of introduction:

Tench were brought into the United States from Europe on ships for food and as a sport fish for fishing. Tench have been highly used in aquaculture throughout the US, but Idaho is the only place that still has tench farming ponds (Baughman, 1947). They were brought into the Pacific Northwest for the same reasons, but also for exhibition for the Alaska-Yukon Exposition and intentionally released (Wydoski and Whitney 141-142). After their intentional introduction into lakes, tench were able to spread by traveling through streams, rivers, and connective waterways. They have also escaped from farm ponds when these ponds were flooded out, giving the tench a pathway into more water bodies (Baughman 1947).

Factors influencing establishment and spread

Tench have had high propagule pressure the Pacific Northwest. They have been released in many areas and many times for sport fishing and to dispose of them. This has increased the establishment and spread of tench. Some of the areas released, like Lake Washington and lakes in Spokane Valley, had many connective waterways that have allowed for the spread of tench (Wydoski and Whitney 141-142). Tench

are very resistant to disease and are hardy fish (Benzer *et al.* 2010). They also have a high environmental tolerance as discussed above where they can bury in the mud to avoid unfavorable conditions (Baughman 1947). These factors have allow tench to spread and establish into many different environments. Females lay a very large number of eggs per batch and this increases the chance of survival of many of the fry (Erguden and Goksu 2011). Large batches of offspring greatly increase the chance of spreading and establishing with more individuals in the waterways.

Potential impacts

Tench are a major food source throughout Europe and have been used as a food source within the US. Due to the higher reproductive rates (Erguden and Goksu 2011) and hardiness (Benzer *et al.* 2010), they could again be highly used in aquaculture in the US. This would not only provide another source of food, but also have positive economic impacts. Tench are a very popular gaming fish for anglers (Wydoski and Whitney 141-142) and tench can bring in revenue to areas where they are fished. Tench can also be used to control algae in places where we get algae blooms (Macri *et al.* 2011). Tench do have a large potential for negative impacts. Their high reproductive rate (Erguden and Goksu 2011) could allow them to take over lakes and streams and outcome native species for resources. A decrease in native fish species has been observed when tench are present

(Benzer *et. al* 2010). This poses a risk for many native species here in the Pacific Northwest, especially for the valuable salmon. Tench will be using up resources that salmon normally would and there is the risk of predation on salmon eggs and fry plus predation on other native fish species. Tench carry parasites that can be put a lot of waterfowl and mollusks at risk. *L. intestinalis* uses birds uses this host for reproduction (Ergonul and Altindag 2005) and if this parasite is present in tench there is the potential for a decline in bird populations who feed on tench. The other common parasite in tench *A. tincae* uses mollusks as its second host then fish (Alas *et al.* 2009) and again this parasite brought in with tench could harm native mollusks such as economically valued ones like the razor and manila clams. Since the parasite uses fish as its final host (Alas *et al.* 2009) we could see an outbreak of *A. tincae* in native fish populations and in turn a decline in these populations. Tench not only have the potential to impact other species, but whole ecosystems. They do provide some good to ecosystems. They mix up the muddy bottoms in rivers and lakes releasing nutrients back into the water. Tench also eat aquatic plants which stops inorganic salts, nitrogen, and phosphorus from being returned to the water via plants (Benzer *et. al* 2010). Tench could cause a change in water flow and turbidity of streams through eating aquatic plants and changing the structure of the bottoms of rivers.

Management Strategies and Control Methods

There are no management or control efforts in the Pacific Northwest as it is not believed that tench pose a threat in areas they are established (Wydoski and Whitney 141-142), except in Idaho where there high numbers have caused some problems for native species (Baughman 1947), but there is currently no management on these tench. This may be due to colder waters in the Pacific Northwest, but as annual temperatures increase there may be an increase in tench as they prefer warmer waters. Research needs to be done to determine the spread of tench with the warming of waters. Even though it is believed there numbers are too few to pose any problems, lots of tench are still being caught in surveys. 21 were collected in 1999 out of Fufus Woods Reservoir and have been found to be abundant in Box Canyon Reservoir. There may be a larger wild population of tench than estimated because tench tend to stay on the bottom and are mainly caught by fisherman with worms (Wydoski and Whitney 141-142) so the chance of catching a tench is low.

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Other Resources

Washington Department of Fish and Wildlife (WDFW):

Web Site: <http://wdfw.wa.gov/ais/>

Phone Number: 1-888-WDFS-AIS

AIS Coordinator Allen Pleus:
Phone Number: 360-902-2724
Email: pfuller@usgs.gov

US Geological Survey (USGS)
Web Site: <http://nas.er.usgs.gov/>
NAS Program Coordinator Pam Fuller:
Email: pfuller@usgs.gov

Robert H. Gray
Address: RH Gray & Associates, 2867 Troon
Ct. Richland, Washington 99352
Email: rhgray@ix.netcom.com

Dennis D. Dauble
Address: Pacific Northwest National Laboratory,
P.O. Box 999, Richland, Washington, 99352

Current Research and Management Efforts

There is very little research being done in the Pacific Northwest. The majority of research done on tench comes out of Europe where tench are widely used in aquaculture and the research is centered on the aquaculture aspect of tench. There is no expert contact for the Pacific Northwest for tench, but Gray and Dauble have done research on Cyprinids in the Columbus River which includes tench. Their research has focused on the life history of Cyprinids. Their contact information is available above. There are organizations that are monitoring the distribution of tench within

the Pacific Northwest and throughout the US such as the US Geological Society. The USGS should be contacted if tench are caught or sighted to help monitor their distribution and abundance (<http://nas.er.usgs.gov/>). The nonindigenous aquatic species coordinator is Pam Fuller and can be contacted at pfuller@usgs.gov. Also the Washington Department of Fish and Wildlife is another resource for information on tench and any sightings of tench should also be reported to them (<http://wdfw.wa.gov/ais/>). Allen Pleus is the WDFW's aquatic invasive species coordinator and can be contacted at (360) 902 – 2724; wdfw.wa.gov. These organizations contact information is also available above.