MANAGING SANDPITS FOR BETTER FISHING

SANDPIT - A waterbody created as a result of the mining of sand and gravel to some level below the water table.

SOURCE OF WATER

- Mainly groundwater.
- Practically no watershed runoff (except during a flooding event) - usually just immediate shoreline area with a limited amount of surrounding land and often nearby cabin/house development.
- Nearby river or stream (if present) would have strong influence on water level – even when not flooding.

SOURCES OF SEDIMENT, NUTRIENTS, AND/OR POLLUTION

- Flooding event – direct source of:
  - sediments
  - organic materials (nutrients) such as corn stalks, tree branches, weeds, etc.
  - contaminants such as fecal coliforms, herbicides, fertilizers, and insecticides
  - undesirable fish such as carp, gizzard shad, buffalo, white perch, etc.
- Nearby cabin/house development and associated activities - contributing sources:
  - septic tank drain fields (nutrients)
  - lawn fertilizers or herbicides for weed control
  - windblown vegetative litter (e.g. leaves, grass clippings, etc.)
  - herbicides from over application for aquatic vegetation control
  - outboard motor contaminants
  - bank stabilization with materials containing contaminants (e.g. creosote which is found in railroad ties and bridge planks)
  - excessive stocking and/or feeding fish contributes organic nutrients through metabolic wastes, respiration, unused feed, etc.; also, decomposition of unused feed depletes aquatic oxygen levels.
- Ground water – direct source of:
  - nitrate and pesticide contaminants from primarily agricultural lands that have leached down into the water table.
- Waterfowl (resident and migratory) - direct source of:
  - fecal enrichment (nutrients) when high numbers of waterfowl (especially geese) are present and allowed to remain for extended periods of time.

SANDPIT BASIN TOPOGRAPHY

- Basin topography describes physical features of the bottom (natural and man-made).
- Sandpits (especially those recently created) generally have steep banks and dramatic changes in depths – resulting in primarily deep water with comparatively small surface area when compared to the total volume of water.

SANDPIT BASIN COMPOSITION

- Basin is composed primarily of sand which is very unstable.
- Sand is also a very unproductive substrate for growing vegetation (an important link in the food chain).

COMMON LIMNOLOGICAL CHARACTERISTICS OF SANDPIT WATER

- **Thermal Stratification**
  - Groundwater inflow/seepage is cold but surface water is warmed by the sun.
  - Since water has different densities at different temperatures (densest at 39º F), the coldest water in deep water areas sinks to the bottom and "separates" from the warm surface water.
  - If there isn't enough wind energy to overcome the thermal layering of the water (the surface area over which the wind blows is comparatively too small as compared to total volume and/or there is limited exposure to the wind due to surrounding trees/house development), the layers remain separated and no mixing occurs.
- **Chemical Stratification**
  - Groundwater contains very little (if any) oxygen and the layers of water are not being mixed, as a result oxygen is not being supplied to the deep cold water.
  - At some depth of light penetration, oxygen production from photosynthesis is negated by oxygen consumption for respiration (called the compensation depth).
  - Below the compensation depth, oxygen has been depleted by respiration (principally by oxygen-dependent bacteria using up the oxygen while decomposing organic matter such as dead algae/fish, leaves, metabolic waste, unused feed, etc.) and the water becomes stagnant.
  - This typically occurs about midsummer in sandpits without man induced aeration.
  - Result is that fish and other oxygen-dependent organisms can no longer live there even though temperatures are often preferred.
  - Older sandpits typically stratify at shallower depths due to the build-up of organic materials over time.
- **Biological Implications**
  - Organisms requiring oxygen cannot live below the compensation depth, <u>especially fish</u>**.**
  - This drastically reduces the sandpit's fish carrying capacity (pounds of fish produced).
  - Oxygen-depleted, midsummer water stagnation also contributes to extensive algae blooms because it holds nutrients (like phosphorous) in a form that rises upwards through the water column to the surface and used by algae.
- **Seasonal Turnover**
  - A sandpit mixes thoroughly in both spring and fall when surface and deep water temperatures are the same and winds blowing across the surface finally create enough energy to overcome the thermal layering. This could result in a fish kill – the severity of which depends on the amount of oxygen that remains after the oxygen depleted deep water mixes with the oxygenated surface water. There is also an upwelling of bottom nutrients at this time that could trigger a minor algal bloom.
  - This phenomenon should not be confused with midsummer water stagnation which frequently produces extensive pea-green algal blooms.

CONSTRUCTION / HABITAT DEVELOPMENT TO ENHANCE FISH PRODUCTION

1) In order to prevent a winterkill (fish dieoff) in sandpits, they should be 10 to 15 feet deep over at least 25% of the basin area, especially in sandpits that are not aerated during the winter. Once a sandpit freezes over, dissolved oxygen present in the water at the time of freezing is usually the only source of dissolved oxygen until the spring thaw. However, there is very little to be gained by having water deeper than 15 feet because fish may not be able to use it due to low oxygen levels that may be present during summer. Keep in

mind that fish production is based primarily on food production (mostly microscopic plants and animals) that occurs in the upper 3 to 5 feet of water.

2) Sandpits should have about 25% of their basin area < 6 feet deep for fish spawning/nursery areas, desirable aquatic vegetation, and food production (especially aquatic insects) for fish. The remaining 50% should have depths of 9 to 10 feet to prevent excessive development of submergent aquatic vegetation as the sandpit "ages" and to provide additional storage of dissolved oxygen – especially in the absence of winter aeration. The aging process typically results in the build-up of nutrients and the shallowing of shoreline areas due to wind action and human activity causing banks to slough off and the lateral movement of the unstable sand substrate in the near shore areas.
3) Sandpits should have irregular shorelines and islands (both above and just below the water surface) in order to increase shoreline area (littoral zone) because these are the areas of highest productivity. A portion of the shoreline (up to 30%) should drop off at a 3 to 1 slope into water over 6 feet, then at a steeper slope to the bottom. Numerous underwater humps can also be made.
4) Sandpits should be a safe distance from any river or stream, or a protective dike should be built around them in order to prevent contamination during floods by unwanted fish species, nutrients, pollutants, and sediment. Before building any dike, the Army Corps of Engineers has to be contacted (402-896-0723) to determine if said construction is allowable and what permits are needed.
5) Submerged structure, such as cedar trees, should be added at depths from 4 to 10 feet and on top of submerged humps and islands to provide a substrate for invertebrate production, cover for fish, and improved fishing by concentrating fish for anglers. Contact the Army Corps of Engineers (402-896-0723) regarding what type of materials that cannot be utilized and if a 404 permit is required.
6) Emergent aquatic vegetation should be planted along gradual sloping shorelines and submergent aquatic vegetation should also be planted or allowed to colonize near shore areas and underwater humps/islands. Housing developments and other man-related activities invariably introduce nutrients. Both of these plant types will help maintain good water quality by competing for and using/tying up nutrients that would otherwise be cycled into algae. They also provide beneficial shoreline stabilization, fish cover/ spawning habitat, and oxygenate the water. Only introduce aquatic/semi-aquatic plants already present in Nebraska. Many beneficial plants will become established naturally if allowed to do so.
7) In order to provide more spawning habitat and cover for fish and substrate for invertebrate production, various sizes of rock rubble and gravel should also be used in sandpits. They can be placed along gently sloping shorelines (both above and below the water line), on top of underwater humps and islands, and in high profile piles on the bottom. However, the majority of cover should be emergent and submergent aquatic vegetation. Make sure the various underwater structures don't become power boating and swimming hazards.
8) Excessive nutrients are commonly introduced from, but not limited to, septic tank drain field leaching. Septic tanks should be replaced with a hookup to the community sewer system wherever possible. If that isn't possible, a large septic tank system located "downstream" from the lake should be installed and all cabins and houses hooked up to it. The downstream side of a sandpit is the side where groundwater is flowing away from the pit. It must be emphasized that this approach does not solve the problem, it only transfers it downstream. If other sandpits are located downstream, you may be harming their water

quality through nutrient enrichment. Contact the Nebraska Department of Environmental Quality (402-471-0096) regarding permits and allowable sewer systems.

9) Another common source of nutrient enrichment is lawn runoff. This also can be a source of chemical contamination since fertilizers, herbicides, and insecticides are frequently used to create/maintain green lawns. Consequently, they should be used sparingly and only use fertilizers that either have no or very low phosphorous amounts.

10) Keep waterfowl numbers at a minimum to prevent fecal-nutrient enrichment of sandpits. Wild migrating ducks and geese or a few year-round resident birds cause few problems; however, a large number of resident geese can cause serious problems. Large amounts of bird droppings can cause unsightly messes around shoreline areas/nearby house development and create health hazards or poor water quality. Beneficial shoreline vegetation can be eliminated in areas of high waterfowl use. If geese numbers become too high, they should be hunted when/where possible or they can be hazed as long as there is no physical contact or harm to them. Contact the Commission's waterfowl specialist (402-471-5437) regarding waterfowl problems.

11) Many sandpits thermally and chemically stratify; therefore, they should be destratisfied in order to improve their water quality. Oxygen ties up key nutrients (phosphorous) in a chemical form that is not readily available to photosynthetic plants. Consequently, destratification allows oxygen to be mixed throughout the sandpit, thus depriving free floating plants, such as algae, the chance to prosper.

12) Destratification (complete mixing) of a sandpit can be accomplished with multiple whole-lake electrical circulation systems or air-bubbler systems (preferred for sandpits with extensive deep water areas and uneven bottoms). Air-bubbler systems can be powered by electricity, solar energy, or wind. However, solar and electrical units should be used if the lake has limited exposure to wind because of trees and/or close by housing development. Do not place the diffusers directly on bottom in order to prevent upwelling and/or circulation of bottom sediment/associated nutrients and subsequent utilization by aquatic vegetation (especially algae). Either attach them to a pedestal or suspend them, thus keeping the diffusers about 2 to 3 feet off the bottom. Whenever possible, these systems should be used throughout the year.

13) Aquatic vegetation should not be totally eliminated from a lake – the many benefits outweigh the disadvantages. If beneficial/desirable aquatic plants (many types of both submergents and emergents) are eliminated with the use of herbicides and/or grass carp (vegetation eating fish), the available nutrients will then be cycled into producing less desirable plants (algae and duckweed) that can become excessive and cause major water quality problems. Decomposition of substantial amounts of dead aquatic vegetation resulting from over application of herbicides, or algal bloom climax/dieoffs, can deplete oxygen levels which can stress or kill fish - especially if done during the summer months. It is better to "spot treat" with aquatic herbicides in selected problem areas or utilize other means of control (habitat alteration or physical/mechanical removal).

FISHERIES MANAGEMENT

1) Continuous destratification can increase a sandpit's fish carrying capacity (i.e. the lake will be able to produce/hold more pounds of fish). Chemical stratification during the hot summer months usually results in oxygen depletion in the colder, deeper water. As a result, fish are forced into the warm top layer which could be less than 6 feet thick in some instances. The volume of water in this warm top layer dictates the pounds of fish a

sandpit can support on a sustained basis, not the amount of water available during seasonal turnover (spring and fall).

2) Game fish that reproduce naturally, such as largemouth bass, bluegill, and crappie, should be given preference to species that must be periodically stocked since those that recruit naturally are better equipped to survive in sandpit habitats and are more economical.

3) Creating a quality bluegill fishery requires good littoral habitat (structure and vegetation). Also required are a protective size limit (8 inches) on the bluegill, a restrictive daily bag limit (< 10) if harvest is very high, and a high predator biomass in order to reduce numbers of smaller bluegill - resulting in increased food and improved growth rates for the surviving bluegill. A high predator biomass can be accomplished with largemouth bass. However, the largemouth bass population should be protected with a very restrictive size limit (e.g. 21 inches) or catch-and-release in order to maintain the high biomass. If bass reproduction/recruitment is low in an already existing fishery, adults may have to be supplementally stocked (up to 10 per surface acre of water) once to attain sufficient numbers of bass and then rely on subsequent bass reproduction. In new (no fish present) or recently renovated sandpits (all fish eliminated with the fish toxicant rotenone), bluegill can be initially stocked as 1-inch fingerlings the first year at 500 per surface acre of water and largemouth bass as 1 to 2-inch fingerlings at 100 per surface acre the second year. The Commission provides bluegill/largemouth bass fingerlings for sandpits that qualify for initial stockings.

4) Channel catfish will survive and grow if stocked, but may not reproduce naturally. Spawning habitat can be placed in the sandpit for the catfish; however, they may be able to reproduce but their young may not recruit (survive) due to predation by largemouth bass. Catfish should be at least 10 inches long to ensure survival and stocked at a rate up to 50 per surface acre of water with actual rate dependant on anticipated harvest. It is important not to overstock them because smaller catfish may compete with bluegill and small bass for food. Channel catfish are not an effective predator for controlling bluegill.

5) Northern pike are an effective predator, but rarely reproduce naturally in sandpits; therefore, they must be periodically stocked to be maintained. To ensure they will not be eaten by largemouth bass, pike 8 to 12 inches (up to 15 per surface acre of water) or adults (up to 5 per surface acre of water) should be initially stocked. Only stock them if there is angler interest.

6) Either black or white crappie are capable of providing a good sandpit fishery if their recruitment can be effectively controlled by predators such as largemouth bass or northern pike. Protection of these predators is essential. Even with effective predation, crappie population densities may vary from year to year, thus displaying the typical cyclic pattern found in many public lakes. If gizzard shad are present, white crappie should provide the better fishery. Adult crappie (9 to 10 inches) should be used/stocked at a rate up to 5 per surface acre of water in sandpits with existing fish populations.

7) Yellow perch generally recruit poorly and grow slowly in eastern Nebraska waters, possibly because eastern Nebraska is on the southern edge of their range. They are not recommended in sandpits since their growth is usually poor and they tend to occupy the deeper, more openwater areas of the lake not frequented by the shoreline predators (largemouth bass and northern pike).

8) Walleye seldom do well in small lakes (<250-300 acres). They do not maintain high population densities (usually <15 lb/surface acre of water); therefore, they need large lakes in order to develop large total numbers. As a result, they provide few benefits as a predator in smaller sandpits and few are returned to the angler. They rarely reproduce

and recruit naturally in small lakes; therefore, they must be periodically stocked in order to be maintained. When stocked into an existing fishery, they should be stocked as large fish (>8inches) during the fall at a rate up to 15 per surface of water which can become very expensive.

9) Wipers (white bass x striped bass hybrid) are the most promising openwater predator fish for utilizing gizzard shad. They must be stocked at sizes large enough (> 8 inches) to be able to effectively utilize the smaller shad for prey and to avoid being eaten themselves. Wipers should be stocked in the fall at a rate up to 15 per surface acre of water. They will not reproduce/recruit naturally in a sandpit; therefore, must be periodically stocked to be maintained. Unfortunately, supply is somewhat limited – possibly because of high demand for them, or because of the lack of private fish hatcheries culturing them. Therefore, they should be protected. Either have catch and release or very restrictive harvest (e.g. 18 inch size limit and daily bag of 1). If adequate prey of the proper size is available and there is a low density of largemouth bass present, 4 to 6-inch fingerlings up to 50 per surface acre of water can be used instead.

10) White bass is another predator that feeds predominately on openwater prey. They can help utilize shad if wipers are not available. They can be introduced by stocking/transferring adults (8 to 12 inches up to 5 per surface acre of water) or advanced fingerlings (4 to 6 inches up to 50 per surface acre). If no reproduction/recruitment occurs or is limited, they will have to be periodically stocked at least every third year to maintain/supplement the population.

11) Fish species which should be prevented from entering sandpits are gizzard shad, carp, carpsucker, buffalo, bullhead, gar, green sunfish, white perch, and yellow bass. These undesirable fish tie up available nutrients/food that would otherwise be utilized by fish species desired by anglers. These fish (especially white perch and yellow bass) consume the spawn and young of other fish thus limiting reproduction/recruitment of desirable fish species. Unfortunately, yellow bass and especially white perch are frequently misidentified as white bass. As a result, anglers and sandpit owners trying to save money unintentionally stock them instead of white bass. If any of these undesirable fish have already gained access to a sandpit, attempts should first be made to control them with predator fish stockings, and if that fails, they should be eradicated with the fish toxicant rotenone when economically feasible. Low dose (9 parts per billion) applications of rotenone (5% active ingredient) have been used to selectively remove gizzard shad.

12) Feeding fish is often considered as a way to promote fish growth. However, commercial feeds are expensive and must be fed to the fish on a regular basis (electric feeder with timer) to be of any value. If the aforementioned undesirable fish species are present, they will likely consume a large portion of the commercial food. Furthermore, the accumulation of nutrients from uneaten pellets and the increased waste output by artificially fed fish may deplete oxygen levels in the lake due to subsequent decomposition of said pellets and wastes. Also keep in mind the additional nutrients may also be utilized by algae which could trigger an algal bloom and corresponding water quality problems. A more natural way of feeding fish is to place a light or electric powered bug killer over the water during the night and let the fish feed on the resulting floating insects. Take all necessary precautions to prevent accidental electrocution of swimmers and/or anglers (insulate/secure the wiring) and install a photoelectric cell or manual off switch at the power pole and a circuit breaker.

ANGLER REGULATIONS

- All desirable fish need to be protected from overharvest, and size limits are the best way to accomplish this if the sandpit gets a lot of fishing pressure.
- Bag limits help distribute fish among more anglers – they typically do not prevent overharvest unless set at a very low limit.
- Unfortunately, even a small amount of noncompliance can destroy the benefits of just about any regulation.
- Current state fishing regulations apply to a lake if **any** of the fish present in it are considered public fish (came from a public source - e.g. river, stream, public lake, etc.).
- Enforcement of any special fishing regulations on a private sandpit (e.g. regulations more strict than state regulations) is the responsibility of the homeowners association.
- The most difficult problems with special regulations will be:
  - getting people to agree to the regulations and
  - getting them to comply with the regulations.
- WHEN ARE FISHING PERMITS REQUIRED ON PRIVATE WATERS?

Unless holding a permit, it shall be unlawful for any person who is sixteen years of age or older to take, angle for, or attempt to take any kind of fish, bullfrog, snapping turtle, tiger salamander, mussel or minnow from the waters of this state or posses the same, except the owner or invitee of the owner of any body of water (a) located entirely upon privately owned land, (b) which is entirely privately stocked, [and] (c) which does not connect by inflow or outflow with other water outside such land [either permanently or temporarily].

Whenever an invitee, who angles for fish in any body of water which is entirely upon privately owned land and which is entirely privately stocked, catches fish which he wishes to remove from the premises, the owner or operator by consent of the owner shall furnish to such invitee a written statement setting forth the name of the owner, the name of the invitee, the number of fish taken, and that such fish were caught in a body of water which is entirely upon privately owned land and which is entirely privately stocked.

TECHNICAL ASSISTANCE

- Contact your area Fisheries Biologists or the Private Waters Specialist in Lincoln (402-471-5435) for further information. Or, go to the Commission's website www.OutdoorNebrska.org and in the Fishing Section search for the Nebraska Pond Management handbook or the Nebraska Pond Guide series. Both have pertinent management information (e.g. vegetation control and/or plantings, adding fish structure, aeration, the Commission's stocking program, etc.) that can also be applied to sandpits.
- Technical assistance over the phone and on-site assistance are available except when/where past recommendations have been ignored.
- It is recommended that lake associations become members of the North American Lake Management Society (www.nalms.org) which is comprised of general public, lake managers, and scientists concerned with protecting and improving lakes and reservoirs and/or the Nebraska Lake Association which is comprised of members from various lake associations located across the state.