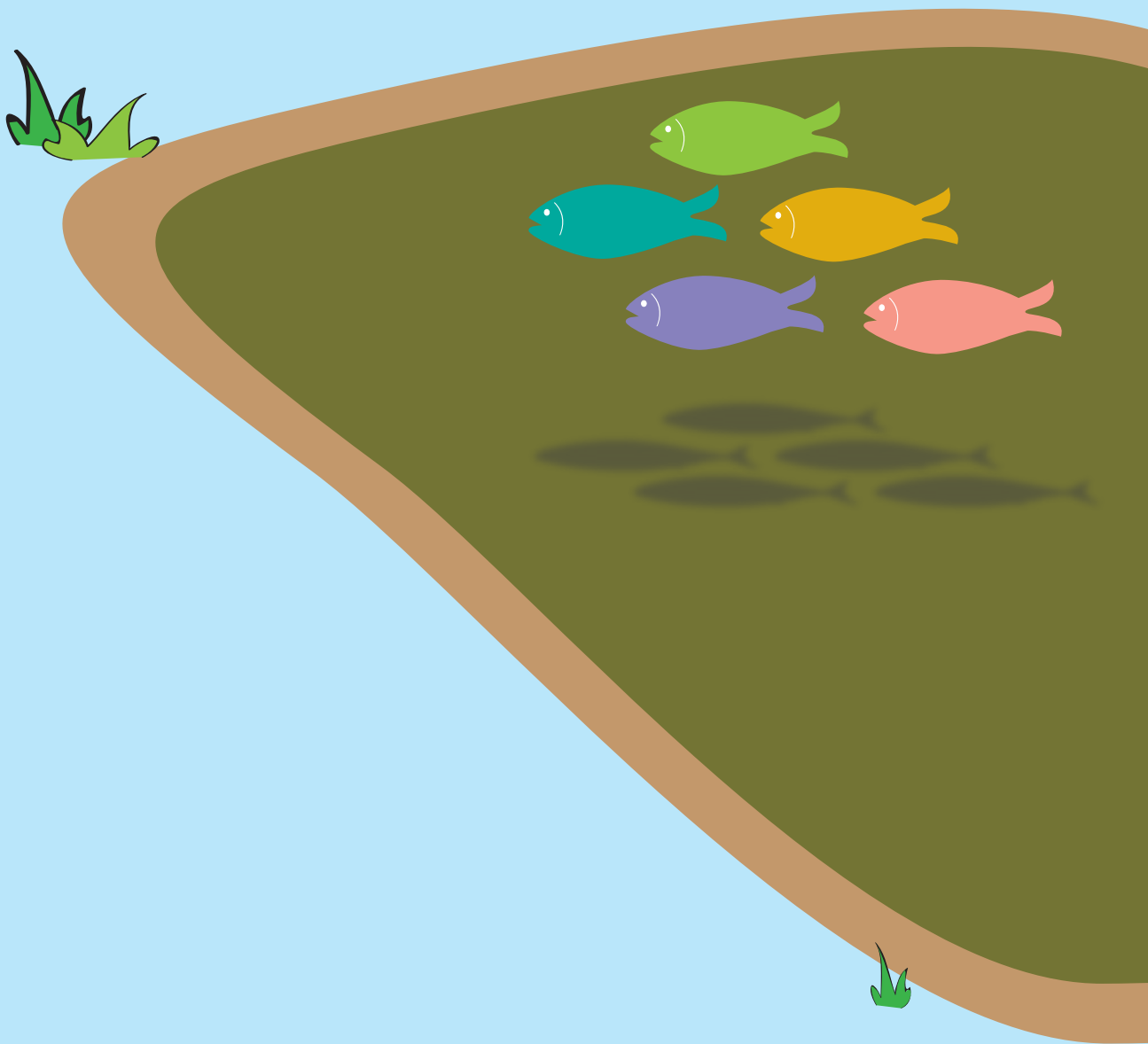


Five Keys to safer aquaculture products to protect public health



In collaboration with the Food and Agriculture Organization of the United Nations (FAO)

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Importance in promoting safer aquaculture products to protect public health

Fish is an important animal food source in the diets of more than one billion people. Fish provides essential nutrients such as proteins, essential fats, minerals and vitamins. Over 40 million people in the developing world are engaged in fishing and fish farming.

Since the mid-1990s, aquaculture has been driving the growth in global total fish production and represents in 2015 47% of the total world production. Small scale aquaculture production (commonly referred to as extensive aquaculture production in areas less than a hectare) is increasing all over the world and recognized as a critical resource for meeting current and future demands for food. While there are many national and international guidelines and standards designed for large aquaculture producers the educational materials available to introduce family farmers to the steps needed to produce safe and nutritious fish for themselves, their families and the local communities are limited.

In general, fish and fishery products have a good safety record and a large proportion of foodborne diseases associated with fish are due to lack of good hygienic and good handling practices after fish are harvested. There are, however, a significant proportion of illnesses that are caused by contamination of fish with disease causing microorganisms at primary production stage (i.e. in aquaculture ponds due to exposure to harmful microorganisms from human or animal feces).

The work of the World Health Organization (WHO)

WHO works to promote safe food handling practices all over the world and to ensure the same understanding in practice along the full chain - from farm to table. WHO's priorities include targeting those who usually do not have access to food safety education despite the important role they have in producing safe food for their community (e.g. rural workers, women).

As part of its global strategy to decrease the burden of foodborne diseases, WHO develops health messages to educate all types of food handlers, including consumers, on ways to prevent foodborne diseases. In 2001, WHO developed the *Five Keys to Safer Food*ⁱ which outline the practices needed to ensure safe food preparation in the small food businesses and at home. The *Five Keys to Safer Food* poster has been translated into over 90 languages and has served as the basis for numerous national and local food safety education programmes. Over the past ten years, WHO has extended the *Five Keys to Safer Food* programme to cover additional groups and sectors along the farm to table continuum. In 2012, WHO published the *Five Keys to growing safer fruits and vegetables: promoting health by decreasing microbial contamination*ⁱⁱ to support food safety education of rural workers who grow fresh fruits and vegetables for themselves, their families and for sale in local markets.

Education in food safety goes behind its goal

The extension of the Five Keys concept with the *Five Keys to safer aquaculture products to protect public health* supports the One Health approach, promoting understanding of the links between the health of humans, animals and the environment and how failures in good hygienic practices in one sector can affect the others. The adoption of effective food safety practices when growing and handling fish will have impact on overall hygienic and environmental behaviours, which will contribute to improve community health, protect the environment and build sustainable development.

ⁱ The WHO Five Keys to Safer Food at: www.who.int/foodsafety/areas_work/food-hygiene/5keys/en/

ⁱⁱ The WHO Five Keys to Growing Safer Fruits and Vegetables: promoting health by decreasing microbial contamination at www.who.int/foodsafety/publications/5keys_growing_safer/en/

About the Five Keys to safer aquaculture material

Target Audience

The manual is designed to support food safety education programme for small scale fish farmers who raise fish for themselves, their families and for sale in local marketsⁱⁱⁱ. The materials are designed to be used by health educators and aquaculture specialists conducting health and aquaculture training in rural communities.

Contents

The manual describes the key practices needed to ensure production of safe (and nutritious) fish from where to place the ponds to postharvest handling of fish.

The quality of fish feed influences the quality and the safety of fish production. However the use of added feed is not discussed or recommended in this manual because it is designed for extensive production ponds which receive no intentional feeding but depend upon natural food in the pond.

The Five key practices are: **1) Practice Good Personal Hygiene. 2) Clean the Pond Site, 3) Manage Water Quality, 4) Keep Fish Healthy, and 5) Use Clean Harvest Equipment and Containers.**

The manual is divided in three sections:

Section One explains the basic concepts of chemical and microbial contamination which should be understood by the trainer and explained to the trainee in simple language.

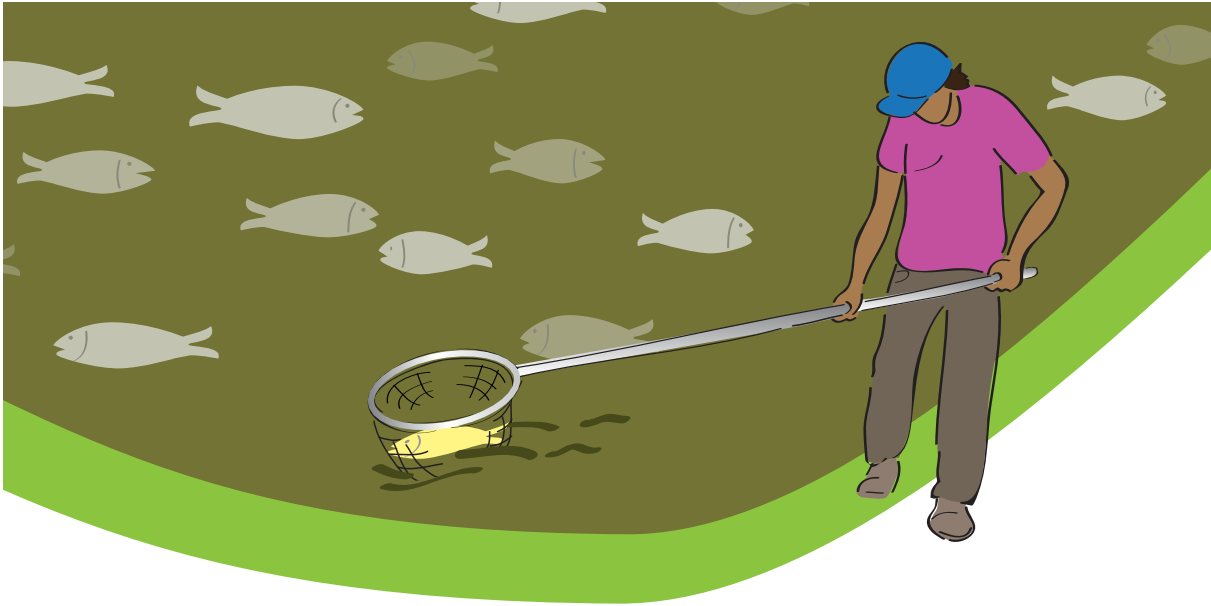
Section Two presents the key learnings of the Five key practices, an explanation of why the practices is important, the public health and aquaculture context, and suggestions on how implement the practices.

Section Three contains information for the trainer related to the planning of the training, suggested training exercises, an evaluation and a glossary of terms.

Adaptation

As with all of the *Five Keys to Safer Food* materials, WHO encourages trainers to adapt the non-scientific content of the training material to deliver the messages in the most effective manner for the participants

ⁱⁱⁱ Medium and large aquaculture producers should refer to the Good Aquaculture Practices (GAqP) developed by appropriate national authorities or international organizations



Validation of the manual and acknowledgements

This manual was developed by the WHO Department of Food Safety and Zoonoses with the technical contribution of Dr. Iddya Karunsagar, Senior Seafood Safety Officer, Food and Agriculture Organization of the United Nations (FAO), Dr. Margaret Miller, Senior Researcher, University of Maryland, USA and Dr. Marjorie Davidson, Health Educator, Center for Food Safety and Applied Nutrition, United States Food and Drug Administration (USFDA).

The support of the Department of Livestock and Fisheries, Ministry of Agriculture and Forestry, Lao People's Democratic Republic, the Aquaculture Department, Directorate of Fisheries, Ministry of Agriculture and Rural Development, Viet Nam and the Central Institute of Freshwater Aquaculture, Indian Council of Agricultural Research, Odisha, India in organizing three pilot-sessions to validate the manual is greatly acknowledged, as well as the contributions from the participants attending the pilot-sessions.

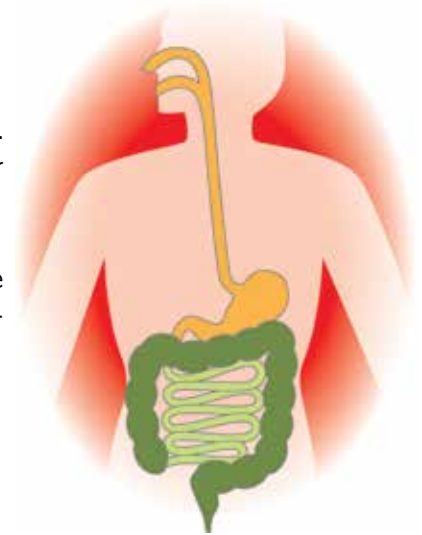
Thanks are also extended to the USFDA for their financial support.

SECTION ONE: BASIC CONCEPTS

What is foodborne disease?

Every day, people all over the world get sick from the food they eat. This sickness is called foodborne disease and is caused by either dangerous microorganisms or harmful chemicals.

Preventing contamination is the best way to prevent foodborne disease and improve your health and that of your family and community.



What are the symptoms of foodborne disease?

Every year, billions of people experience one or more episodes of foodborne disease, without ever knowing that it was caused by food. The most common symptoms of foodborne disease are:

- Stomach pains;
- Vomiting; and
- Diarrhoea.

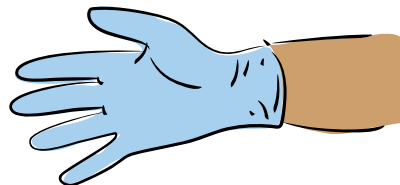
The symptoms depend on the cause of the disease. Symptoms may occur very quickly after eating the food, or may take days or even weeks to appear. For most foodborne diseases, symptoms occur 24 -72 hours after the food has been eaten.

A small number of foodborne disease cases can result in long-term health problems. Very severe diseases, including cancer, arthritis and neurological disorders can be caused by contaminated food. Some foodborne diseases can be transferred from person to person. Care givers can become sick from family members with a foodborne disease. For infants, the sick, pregnant women and the elderly, the consequences of foodborne disease are usually more severe and more often fatal.



What to do if you get sick?

Try not to handle or prepare food while you are sick, and for 48 hours after your symptoms stop. However, if this cannot be avoided, wash your hands with soap and water before and frequently during food preparation.



Mouth masks are recommended for people who may cough or sneeze while handling food. Gloves can be used to cover any cuts or lesions and should be changed frequently.

Advice on treatment of foodborne disease differs between countries and should be adapted to the local region.

As a general rule, one should drink plenty of fluids and maintain hydration during diarrhoea and seek medical advice when bowel movements are very frequent, very watery or contain blood, or symptoms last beyond 3 days.



What are microorganisms?

Microorganisms are very small living things. In fact, they are so small that they cannot be seen with the naked eye. It takes 1 million microorganisms to cover the head of a pin. Bacteria, protozoan, viruses, yeasts, moulds and parasites are all microorganisms.

There are three different types of microorganisms: the good, the bad and the dangerous. Good microorganisms are useful. They are used to:

- Make food and drinks (e.g. cheese, yogurt, beer and wine);
- Make medicine (e.g. penicillin); and
- Help to digest the food you eat.

Bad microorganisms, or spoilage microorganisms, usually do not make people sick. However, they cause food to look, smell and taste bad.

Dangerous microorganisms make people sick, and can even cause death. These are called “pathogens.” Most of these microorganisms do not change the appearance of the food – so you usually can not tell that the food is contaminated with dangerous microorganisms by just looking, smelling or tasting it.



Training Tips

- For simpler language, use the term “germs” when discussing microorganisms.
- Become familiar with dangerous microorganisms in your region.
- Stress that microorganisms cannot be seen.
- Providing pictures or actual examples of decaying fish may add interest, but be sure to stress the important point that dangerous microorganisms may not always make the food smell, taste or look bad.

How does microbial contamination occur?

All living things have microorganisms associated with them.

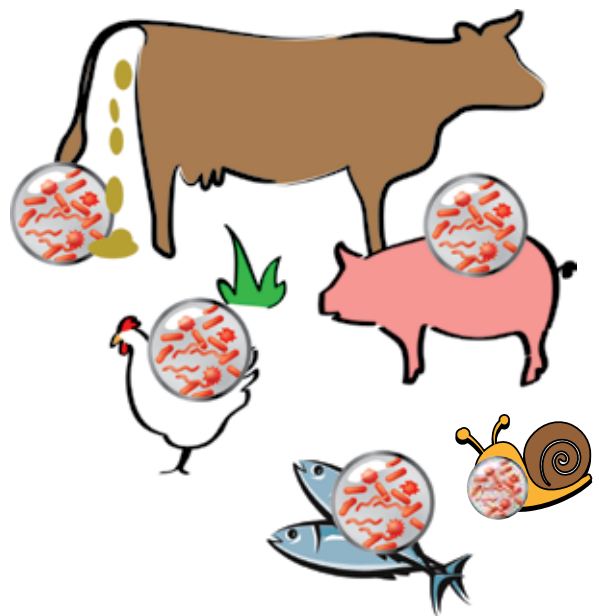
Animals including humans carry microorganisms in their mouths, gut and on their skin including hands and feet.

Many dangerous microorganisms are excreted in human and animal feces.

Microorganisms rely on someone or something to move them around. The transfer of microorganisms from one surface to another is called “contamination.”

Hands are the most common way microorganisms are transferred from one place to another.

Some dangerous microorganisms, especially parasites, can live in other aquatic organisms (e.g., snails) that act as carriers. Parasites can get into fish during early life stages, survive until the fish is eaten and infect humans eating the fish. Once the parasites get into fish, they are not be removed by steps like washing the fish before consumption. However, parasites can be destroyed by adequate cooking or freezing (according to Codex guidelines).¹



¹ Codex Code of Practice for fish and fishery products CAC/RCP 52-2003

Fish can become usually contaminated with dangerous microorganisms indirectly by:

- poor personal hygiene practices of the workers
- contamination of pond water with human or animal faeces
- contaminated water used for washing
- or dirty harvest equipment and containers

Training Tip

Give a demonstration of cross contamination by touching your hand to your face and then touching some food with that same hand.

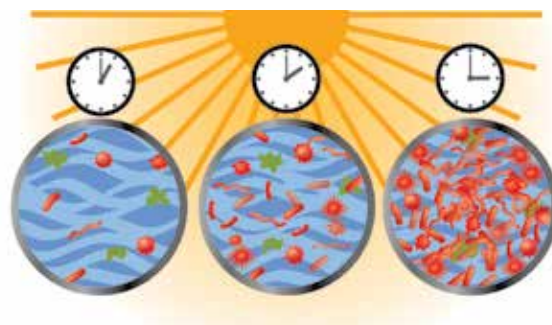
How do microorganisms grow?

Most microorganisms “grow” by multiplication. To multiply, microorganisms need:

- Food;
- Water;
- Time; and
- Warmth.

Under the right conditions, one dangerous microorganism can become 2 in just 15 minutes. This means that within 6 hours, 1 dangerous microorganism can multiply to over 16 million. To cause disease, some dangerous microorganisms need to grow to large numbers. Other dangerous microorganism can cause illness when they are present in very low numbers.

Under favourable environmental conditions, dangerous microorganisms can survive and multiply for long periods of time (even months).



Training Tips

- Discuss local fish raising practices that do and do not provide the ideal conditions for growth of microorganisms.
- Demonstrate the concept of microbial growth using dried beans, pebbles or other objects. Start with one object. In 15 seconds make it two objects, in another 15 seconds make it 4 objects and in another 15 seconds make it 8 objects, etc. (double the number of objects you have every 15 seconds).

Note

For this demonstration, 15 seconds is used instead of 15 minutes, which is the actual time it takes for microbes to multiply. This enables you to show how microbes multiply, within the time constraints of the training session.

What is chemical contamination?

Microorganisms are not the only cause of foodborne disease. People also get sick from harmful chemicals, which can contaminate food. These harmful chemicals include:

- Natural toxins;
- Heavy metals;
- Industrial pollutants;
- Chemicals used for cleaning;
- Agricultural chemicals including pesticides and animal medicines.

Pesticides can be used to kill pests that damage crops or that carry and spread diseases. They are intended to repel, destroy or control pests, including unwanted plants and animals that cause harm or interfere with the production, processing, storage of agricultural products. Pesticide can drift from nearby fields and contaminate pond water and fish. When using pesticides, preventative measures including:

- Use only approved pesticide products
- Wear protective gloves and clothing to prevent pesticides from entering your body
- Follow label directions for proper use including the proper

withdrawal time

- Protect neighbouring fields and aquaculture ponds from exposure
- Wash work clothes separately from other clothes before wearing them again

must be taken to protect people from health problems caused by pesticides.

Animal drugs are used to maintain animal health and promote growth and feed efficiency. Like pesticides, animal drugs added to feed or water can drift into fish ponds and contaminate pond water and fish. The addition of pesticides and animal drugs to ponds may harm the fish or mask a disease problem; and residues in fish meat can make the fish unacceptable to consumers.

Inappropriate use of antibiotics can harm human health by making disease more difficult to treat because of antimicrobial resistance.

“Poisoning” is a term used to describe sickness resulting from chemical contamination. While some poisoning occurs quickly after eating the poison, other times the poisoning results from repeated exposure and contributes to the development of chronic diseases including cancer.

How do fish get contaminated with chemicals?

Some fish species make harmful chemicals known as “toxins”. Other times fish are contaminated with toxins by consuming certain species of algae. Fortunately, toxin contamination is not a problem for most fish species raised in aquaculture.

Harmful chemicals that enter the environment through waste emissions and chemical spills can contaminate soil, air and water both directly and indirectly. Fish can absorb these chemicals from food and water; and people are exposed to these harmful chemicals when they eat contaminated fish.



How to reduce illness from chemicals

Simple measures can minimize chemical contamination of fish raised in aquaculture. These measures include:

- washing hands and changing clothes after handling chemicals;
- choosing a pond site where the chance of chemical contami-

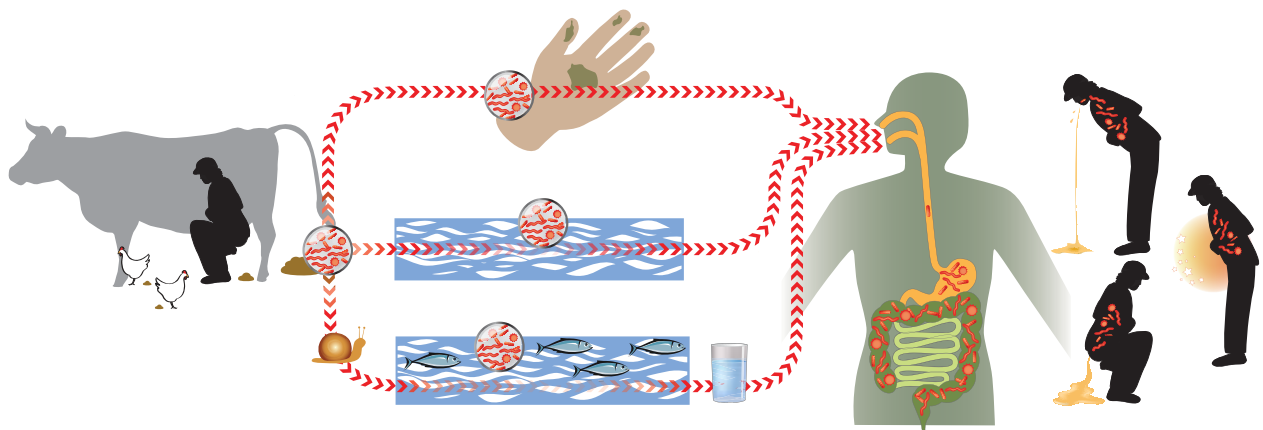
- nation is low;
- protecting pond water from chemical contamination;
- avoiding the use of chemical to manage fish health.

Keep fish safe: you can make a difference

Follow the Five Keys to safer aquaculture products to protect public health:

1. Practice good personal hygiene
2. Clean the pond site
3. Manage water quality
4. Keep fish healthy
5. Use clean harvest equipment and containers.

It is very important to follow the **Five Keys to safer aquaculture products to protect health** to prevent the spread of foodborne diseases.



- Many dangerous microorganisms are excreted in human and animal faeces.
- Hands are a common vehicle for transferring dangerous microorganisms.
- Contaminated water will spread dangerous microorganisms and is not suitable for human consumption
- Contaminated water can contaminate fish or other foods that are consumed without cooking

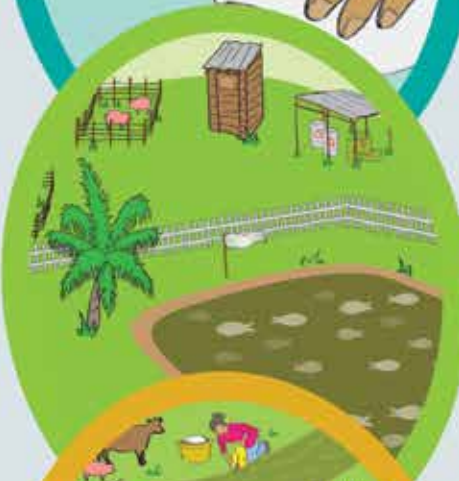
Five keys to safer aquaculture products to protect public health



Practice good personal hygiene

- Use toilet or latrine to urinate and defaecate
- Wash and dry hands with a clean, dry towel after toileting, diapering a child and contact with animals
- Cover cuts and sores when working around fish ponds
- Wash hands and change clothes after working around the ponds and harvesting fish

Why? Dangerous microorganisms and chemicals are found in human, animal and plant waste and infected wounds. Chemicals and dangerous microorganisms can be transferred by hands and clothing spreading contamination. Washing hands and changing clothes helps prevent the spread of contamination and decreases illness.



Clean the pond site

- Locate ponds away from latrines, livestock, and poultry
- Choose a pond site where the chance of contamination with heavy metals or other harmful chemicals is low
- Remove weeds, rubbish, chemical containers and old equipment from pond site
- Keep livestock and poultry in an area that prevents access to the fish pond

Why? Dangerous microorganisms in faecal waste from people and animals can also contaminate soil, aquatic animals and fish. Heavy metal and other harmful chemicals found in soil can cause illness in fish or in people who eat the fish.



Manage water quality

- Select a water source that has a very low chance of contamination with heavy metals, other chemicals and harmful microorganisms
- Prevent people and animals, including ducks, geese and pets, from flying over, wading or swimming in ponds
- Keep rubbish, food and faecal waste removed from the home away of the pond
- Do not pen animals over the pond

Why? Chemicals and harmful microorganisms from manufacturing activities and in faecal waste from humans, animals, including wild birds can contaminate water. These chemicals and dangerous microorganisms can then be transferred to the fish causing illness in the fish or contamination of the fish meat.



Keep fish healthy

- Stock ponds to the proper density with healthy fish seed stock from a certified hatchery or reliable supplier
- Maintain stock at the proper density in the growing pond
- Remove and dispose sick and dead fish daily
- Avoid using unapproved chemicals to maintain fish health

Why? Healthy fish require healthy seed, proper stocking density and good post-stocking management practices including managing stress and disease. Adding chemicals to ponds may harm the fish, hide a disease problem and leave residues in fish meat that can be unsafe for consumers.



Use clean harvest equipment and containers

- Wash harvest containers and equipment with clean water
- Harvest fish early in the day and transport live or cool quickly
- Use clean water to wash harvested fish
- Keep harvested fish in clean containers on non porous material

Why? During harvest, fish can become contaminated by contact with sick workers or water, ice, hands, harvest equipment and containers that are not clean. Containers made of smooth, non absorbent material are easy to clean and provide fewer places for microorganisms to grow.



World Health Organization

SECTION TWO: FIVE KEYS TO SAFER AQUACULTURE PRODUCTS TO PROTECT PUBLIC HEALTH

KEY 1: Practice Good Personal Hygiene

Key Learnings	Why?
<ul style="list-style-type: none"> • Use toilet or latrine to urinate and defaecate • Wash and dry hands with a clean, dry towel after toileting, diapering a child and contact with animals • Cover cuts and sores when working around fish ponds • Wash hands and change clothes after working around the ponds and harvesting fish 	<p>Dangerous microorganisms and chemicals are found in human, animal and plant waste and infected wounds. Chemicals and dangerous microorganisms can be transferred by hands and clothing spreading contamination. Washing hands and changing clothes helps prevent the spread of contamination and decreases illness.</p>

Health and environmental security

Aquaculture activities of building ponds, stocking and harvesting fish can contaminate hands and clothes with chemicals or dangerous microorganisms. Changing clothes after working around fish ponds and harvesting fish helps prevent contamination of food, people and the environment.

How to practice good personal hygiene

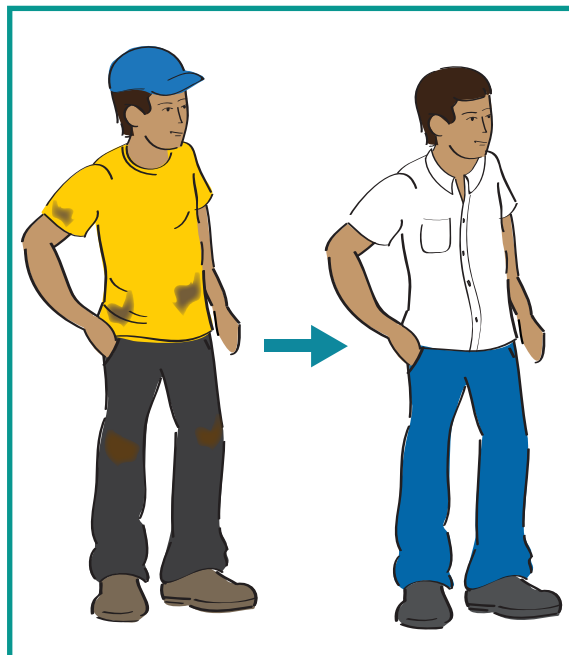
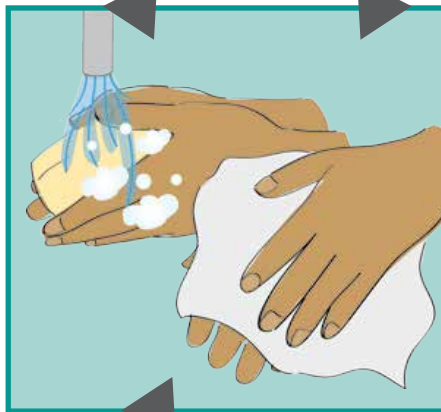
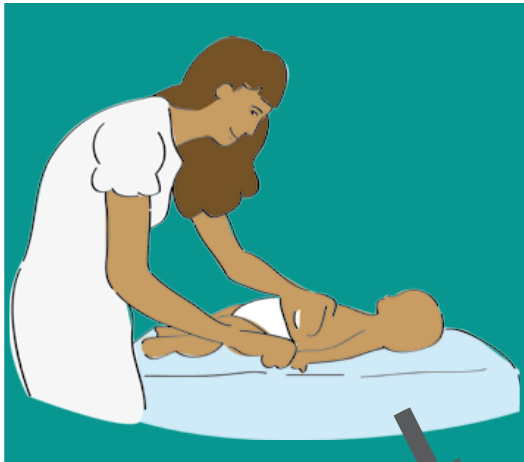
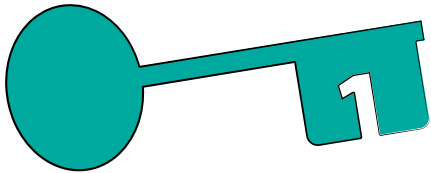
Wash hands using the proper hand washing procedure.

1. Wet hands under clean, safe running water. Add soap.
2. Wash hands, wrists, in between fingers and under nails in clean, safe water using soap. Continue to rub hands together with soap for at least 20 seconds.
3. Rinse hands under clean, safe running water.
4. Dry hands thoroughly with a clean, dry towel. If possible, use a paper towel.

Considerations for the trainer

While washing hands with soap and water is ideal, many people do not have access to soap or detergent. Coal ash is commonly used as a substitute for soap. This method of hand washing is acceptable.

If a toilet or latrine is not available, recommend using a covered bucket designated for human excreta sometime called a "honey bucket". The honey bucket should be emptied and cleaned in the latrine or other designated area so the contents will not contaminate water sources or the fish pond.



KEY 2: Clean the Pond Site

Key Learnings	Why?
<ul style="list-style-type: none"> ▪ Locate ponds away from latrines, livestock, and poultry ▪ Choose a pond site where the chance of contamination with heavy metals or other harmful chemicals is low ▪ Remove weeds, rubbish chemical containers and old equipment from pond site ▪ Keep livestock and poultry in an area that prevents access to the fish pond 	<p>Dangerous microorganisms in faecal waste from people and animals can also contaminate soil, aquatic animals and fish. Heavy metal and other harmful chemicals found in soil can cause illness in fish or in people who eat the fish.</p>

Health and environmental security

Rubbish and food attract animals. Snails, which are host for parasites, live in the weeds around the pond. Removing these attractions and not allowing livestock to access the pond will help prevent contamination of the pond site, water and fish. Placing items that look scary or make noise (such as a scarecrow or windmill) help keep animals out of the pond site. Putting shiny ribbons around the ponds helps scare away birds. Removal of all plastic bags and containers from the pond site is necessary since plastic degrades very slowly and is harmful to the environment, animals and people.

How to clean the pond site

Identify and remove possible sources of contamination including heavy metals, chemicals and dangerous microorganisms before selecting the pond site. Remove oil and abandoned farm equipment. If the sources of chemical contamination can not be removed consider moving the pond.

Faecal waste should be moved away from the pond site and properly treated before adding to ponds. Cut and remove weeds from around the pond site.

If possible separate animals from the pond with a wall, fence or pen.

Considerations for the trainer

The contamination of soil from chemical and microbiological sources can vary based on locale and can be difficult to assess. Sources of chemical contamination can include aging or abandoned farm equipment, oil and gasoline spills; agrichemicals and veterinary drugs; and air pollution from nearby industries or roadways

Most microbiological contamination comes from untreated human and animal faeces..

Trainers should emphasize the environmental hazards associated with plastic bags, bottles and containers especially from a fish health and safety perspective.

Identify the sources of contamination in the area and focus the discussion on how these sources can be identified and removed, or decontaminated. It is best to site a pond to minimize chemical and faecal exposure. It may not be possible to prevent all animals from accessing the pond, but limiting access by humans, animals and birds helps to minimize the risk of faecal contamination.



KEY 3: Manage Water Quality

Key Learnings	Why?
<ul style="list-style-type: none"> ▪ Select a water source that has a very low chance of contamination with heavy metals, other chemicals and harmful microorganisms ▪ Prevent people and animals, including ducks, geese and pets, from flying over, wading or swimming in ponds ▪ Keep rubbish, food and faecal waste removed from the home away of the pond ▪ Do not pen animals over the pond 	<p>Chemicals and harmful microorganisms from manufacturing activities and in faecal waste from humans, animals, including wild birds can contaminate water. These chemicals and dangerous microorganisms can then be transferred to the fish causing illness in the fish or contamination of the fish meat.</p>

Health and environmental security

Locating latrines away from ponds and preventing animals from entering the pond helps to minimize the risk of water contamination from faecal waste. Storing chemicals, manure, and faecal waste, away from fish ponds limits the potential for water contamination during heavy rainfalls or natural flooding and limits potential contamination.

How to limit water contamination

Identify potential sources of contamination from heavy metals, chemicals or dangerous microorganisms before selecting the water source. Surface water safety is highly variable and difficult to predict because surface waters are very susceptible to contamination from manufacturing facilities, humans and animals. When using water from rivers or streams as source water for the pond, take the water up-stream from other household activities, e.g. bathing, washing clothes, sheltering of animals.

Spring fed ponds are safe as long as the spring water is not contaminated. Ground water may be a better source, but should be checked for heavy metals, chemicals and dangerous microorganisms by your local government expert or university specialist.

Rubbish, food and faecal waste can harm water quality directly and by attracting animals that can contaminate pond water through their faeces. Removing the rubbish and waste from around the pond helps prevent water contamination. Placing items that look scary or make noise (such as a scarecrow or windmill) help keep animals out of the pond site. Putting shiny ribbons around the ponds helps scare away birds.

Considerations for the trainer

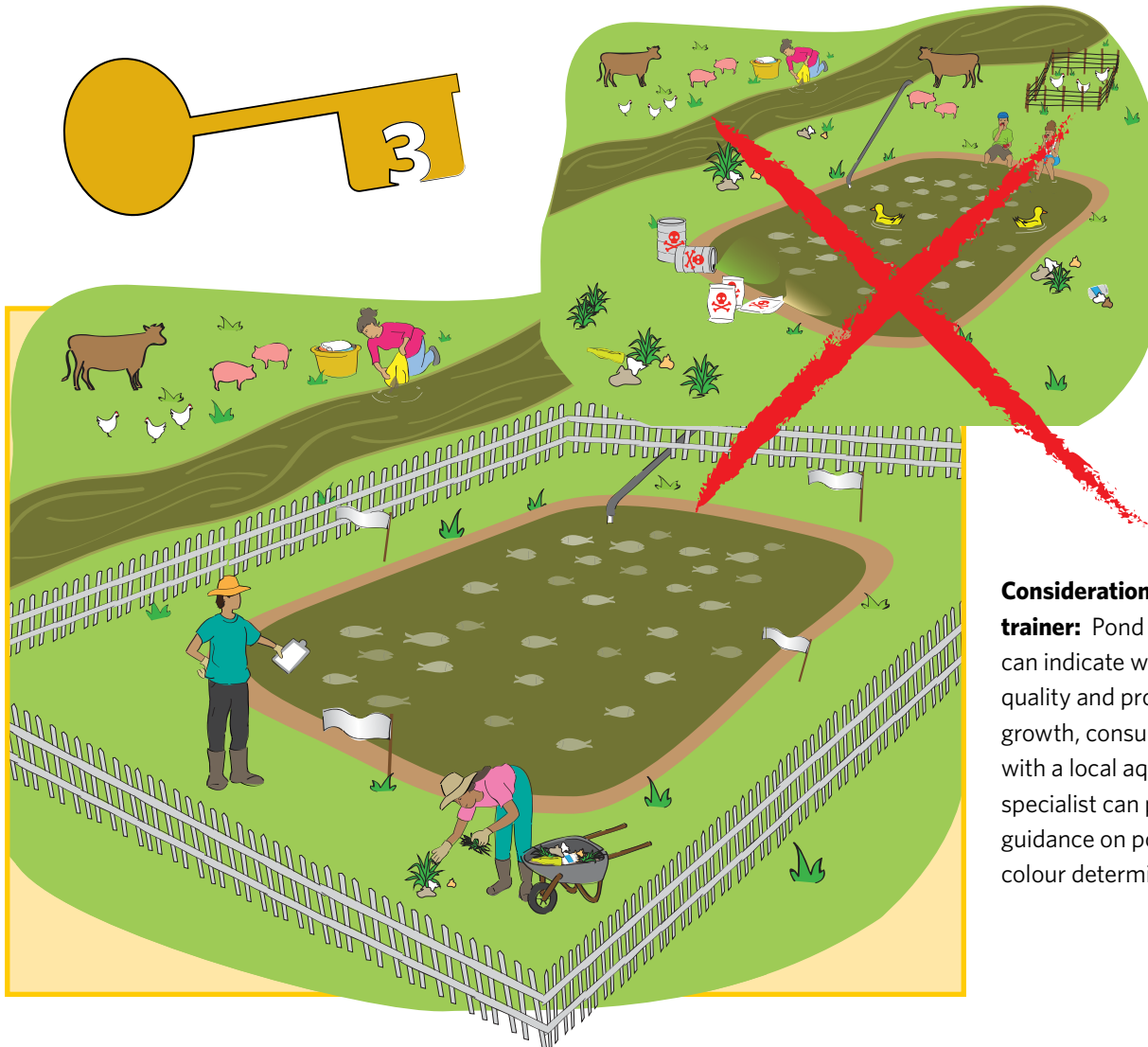
The importance of using high quality water for aquaculture production safety and quality needs to be emphasized. Discourage use of the pond for activities others than aquaculture, i.e. the pond should not be used for waste disposal, washing clothes or dishes or wading and swimming.

In situations where farmers have integrated aquaculture and animals, faecal waste must be treated before adding to the pond. Time required to treat faecal waste varies with temperature and moisture.²

The quality of source water may vary with the season. Consider filling the ponds when quality is at its best. For fresh water aquaculture, adding water from ground water sources including springs and wells can improve quality. Developing a low-cost water filtration system to improve quality is an option if source water is of poor quality.³

² WHO Guidelines for the use of wastewater, excreta grey water (2006). Volume III Waste water and excreta use in aquaculture. http://www.who.int/water_sanitation_health/wastewater/wastewateruse3/en/

³ FAO Fisheries and Aquaculture Technical paper 574: Assessment and Management of fish safety and quality available at www.fao.org/3/a1f3d2bf-6888-4266-a274-9f1cd2aa1240/i3215e.pdf.



Consideration for the trainer: Pond colour can indicate water quality and proper algae growth, consultation with a local aquaculture specialist can provide guidance on pond colour determinations

KEY 4: Keep Fish Healthy

Key Learnings	Why?
<ul style="list-style-type: none"> ▪ Stock ponds to the proper density with healthy fish seed stock from a certified hatchery or reliable supplier ▪ Maintain stock at the proper density in the growing pond ▪ Remove and dispose sick and dead fish daily. ▪ Avoid using unapproved chemicals to maintain fish health 	<p>Healthy fish require healthy seed, proper stocking density and good post-stocking management practices including managing stress and disease. Adding chemicals to ponds may harm the fish, hide a disease problem and leave residues in fish meat that can be unsafe for consumers.</p>

Health and environmental security

Using poor quality seed stock can slow fish growth rate, cause illness in the fish, and lower fish survival rates. Using good quality seed ensures fish are healthy when they come into the pond. However, stocking quality fish seed alone does not ensure a successful crop, it is just the first step.

Stocking fish to the proper density helps minimize injuries, reduces stress for fish and prevents deterioration in water quality. Injury and stress of fish can lead to more disease in the fish.

How to determine seed quality

Locate a reputable hatchery to buy fish seed. Place seeds in a clear clean plastic bag so that you can see that the seeds are active, healthy in appearance, and uniform in size. Healthy fish seeds have a high potential for survival, better growth, and less disease. In some localities, stress tests and screening for specific pathogens are performed to better check the seed quality.

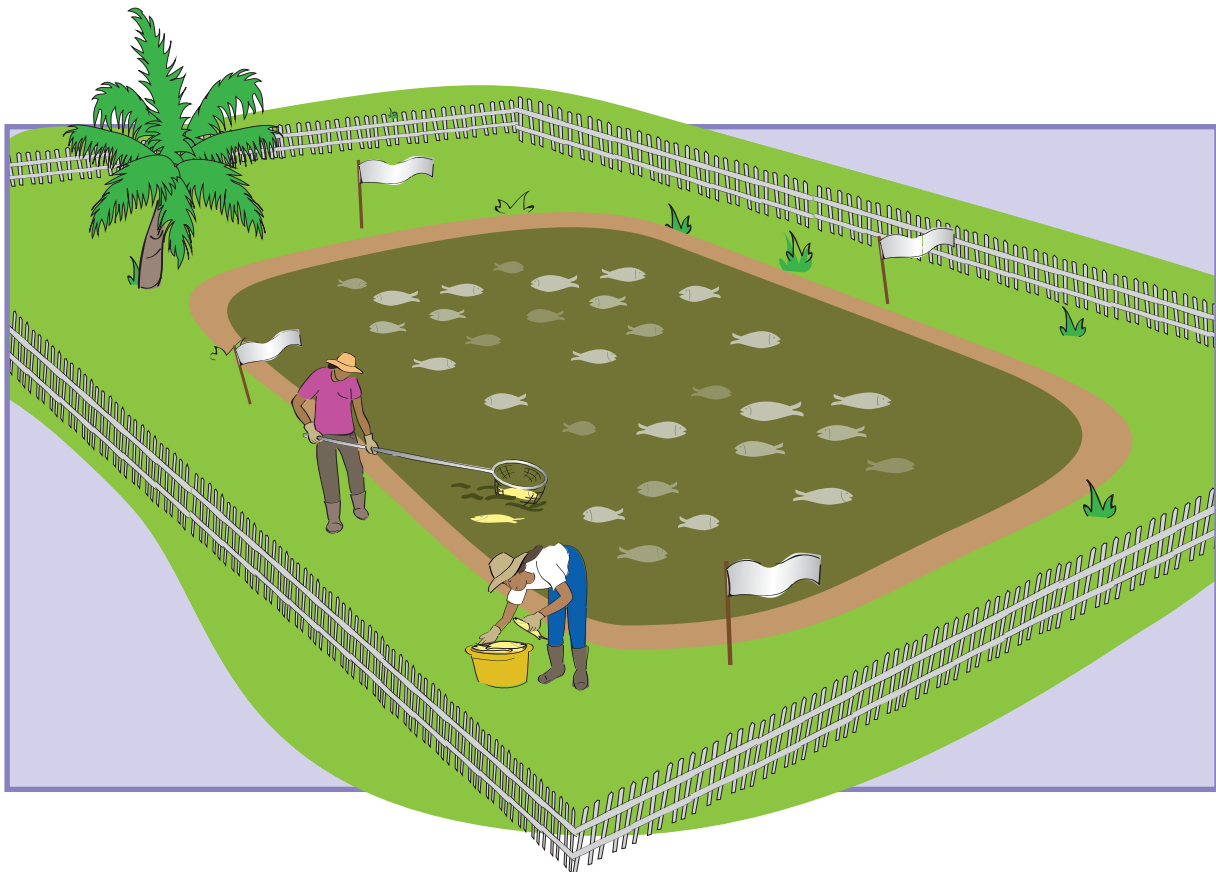
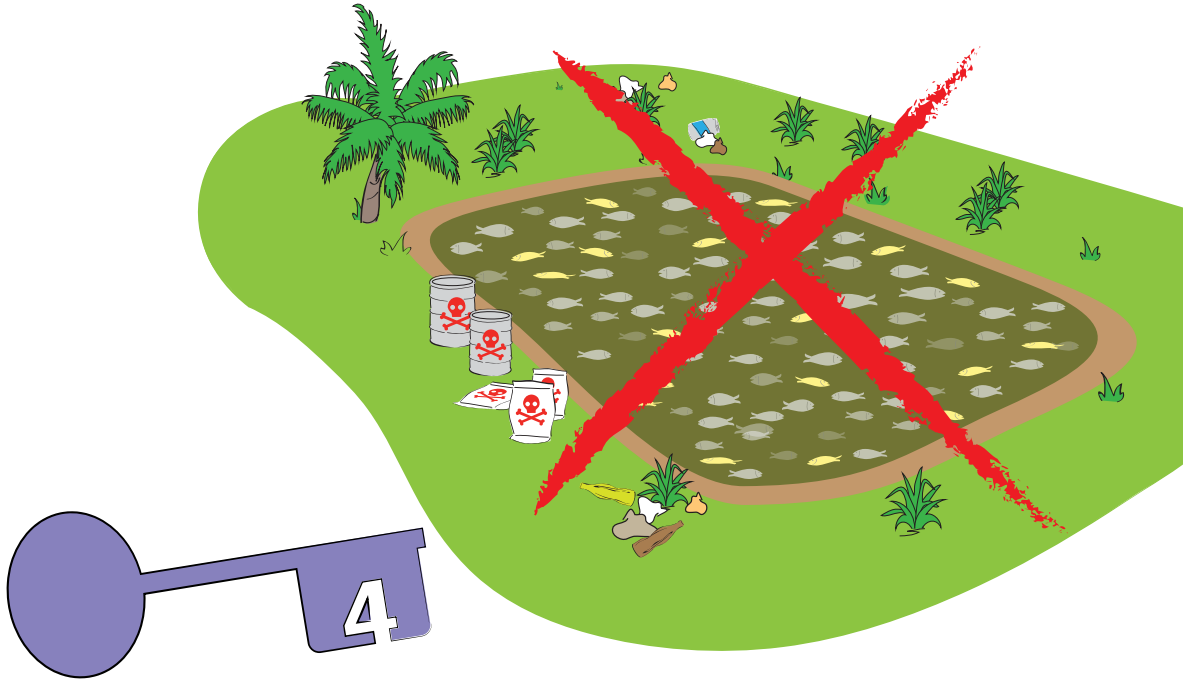
Stocking density varies by species, temperature and other environmental factors. Check with your local authority (government agency or university) to find out the amount of stock that is appropriate for your fish species, area and pond size.

Considerations for the trainer

The behavior of the fish is a good indication of fish health. Generally the fish should only come to the surface to eat. When fish are sick, they are often seen close to the surface and inactive. These sick fish should be removed to prevent the spread of disease. Adding chemicals or drugs to the pond can hide a disease problem and result in

large numbers of fish dying.

In some areas, intrusion by wild fish species is a problem as the wild fish may harbour disease causing agents. Consult your local aquaculture specialist for advice on controlling wild species intrusion.



KEY 5: Use Clean Harvest Equipment and Containers

Key Learnings	Why?
<ul style="list-style-type: none"> ▪ Wash harvest containers and equipment with clean water ▪ Harvest fish early in the day and transport live or cool quickly ▪ Use clean water to wash harvested fish ▪ Keep harvested fish in clean containers on non porous material 	<p>During harvest, fish can become contaminated by contact with sick workers or water, ice, hands, harvest equipment and containers that are not clean. Using containers made of smooth, non absorbant material are easy to clean and provide fewer places for microorganisms to grow.</p>

Health and environmental security

Workers are encouraged to wear appropriate personal protective equipment when harvesting large size fish. Contamination of fish by pathogenic and spoilage microorganisms and by chemicals and other toxins in the environment is a major source of food borne disease. Keeping fish at cool temperatures preserves quality and safety by slowing the growth of microorganisms (both pathogenic and spoilage). Wash harvest equipment and storage containers with clean water before and after use and air dry when not in use.

How to keep equipment and harvesting areas clean

Store harvest containers off the ground in a clean, dry covered location, to prevent contamination by pests, dirt and water
 Clean the area used for washing, sorting and packing fish at the end of each day to reduce the risk of contamination.
 Rinse, clean, and air dry nets between uses.

How to transport safely

Transport the fish live or keep harvested fish cool by putting them in containers with enough clean ice to cover the fish entirely or by putting the containers in a cool storage facility
 When fish are to be held for extended periods or transported to distant markets, the fish should be kept cool.
 If fish are to be marketed live, they should be held under conditions which minimizes stress.

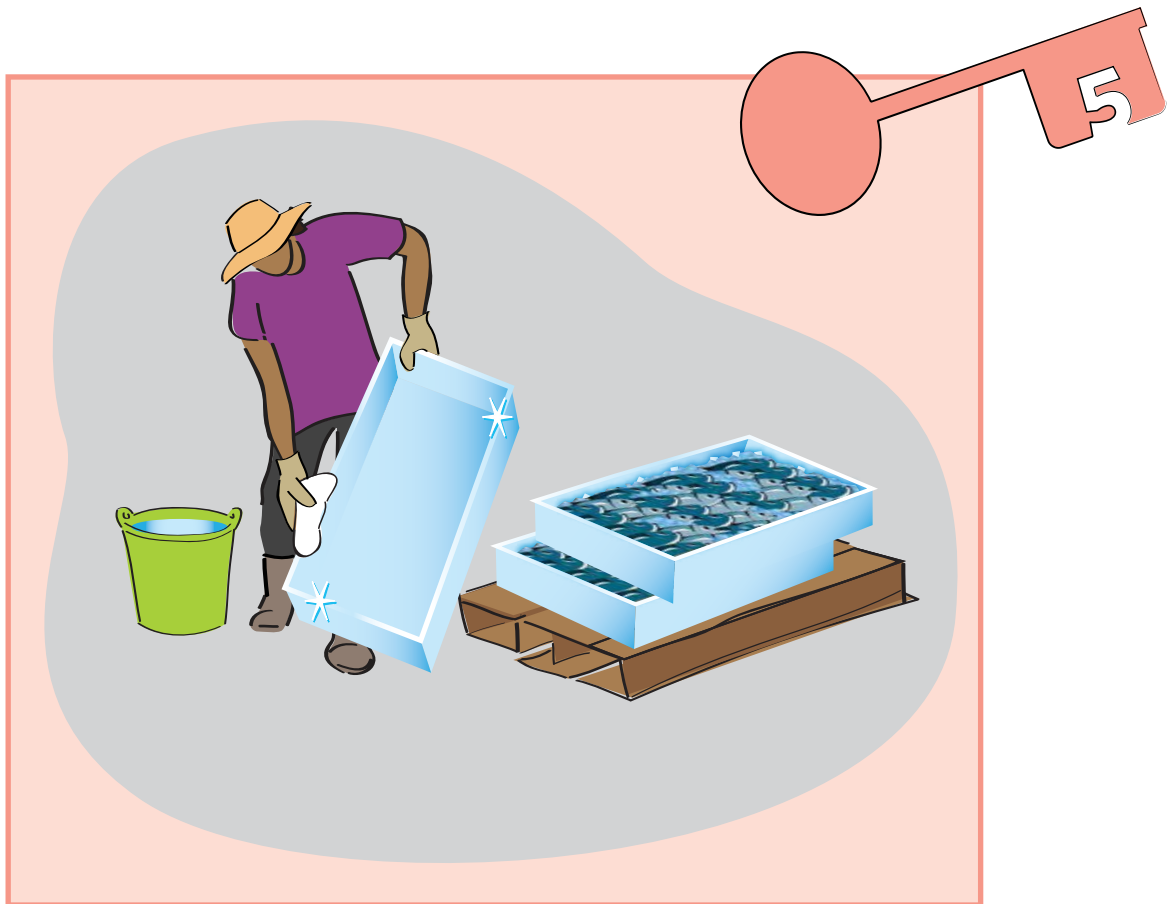
Considerations for the trainer

Most fish contamination occurs in the harvest and post-harvest period. Fish can become contaminated with microorganisms from unclean equipment. Determine the type of equipment used to harvest and store fish in your region. Storage containers made of natural materials, for example wooden crates or woven baskets, often contain numerous cuts and crevices which can trap dangerous microorganisms and allow for their growth. Ideally storage containers should be insulated as well as easy to clean like plastic.

If certain marine fish like tuna are not cooled immediately after harvested, histamine and other biogenic amines (e.g. scombotoxin) are formed and can affect consumer health. Fortunately this is not a problem with fish species raised in fresh water ponds. However, improper handling of harvested fish provides an opportunity for bacteria to grow. Even a small amount of dangerous microorganisms that may be present in fish can multiply and reach levels that can result in human illness.

For guidance on maintaining fish safety and quality in the market place see *A Guide to Healthy Food Markets* (http://www.who.int/foodsafety/publications/capacity/healthymarket_guide.pdf).

Additional training on maintaining food safety in the home is available in the Five keys to safer food poster (<http://www.who.int/foodsafety/publications/consumer/5keys/en/>) and manual (<http://www.who.int/foodsafety/publications/5keysmanual/en/>).



SECTION 3: TRAINING SESSIONS

Planning the Training Session

This section provides suggestions for planning the training. Use it as a guide to understand your audience and prepare for your upcoming training session(s).

Choosing a training location

Various places are good locations to hold discussions or make a presentation. Holding a training session near the pond sites with a group of small farmers may be the most efficient method.

In some communities there are women support groups, small farmer associations and training institutes. These organizations can help support training and implementation of the Five Keys messages.

Once you have identified a training location, determine the resources that are available to conduct the training. Displaying the poster in the local language is encouraged before and after the training sessions.

Adapting the programme to meet participant's needs

Learning about the participants – and being sensitive to their lives and situations – can help you be more effective in getting your audience to adopt new, safer practices. By watching and listening to what is currently happening on small farms, you will be able to adapt the training to meet the local needs. For example, if toilet facilities are not available discussions may focus on safe handling of human excreta.

In order to get to know the participants, there are some basic questions to consider.

Who are the members of the group?

Where are they located? What language(s) do they speak?

Are there special sensitivities, e.g. women. Women may be less willing to speak openly about hygiene practices in front of men.

Once you have reviewed the training manual/materials, secured your training locations and considered the needs and sensitivities of the participants, you can tailor the training session to the local conditions/facilities and needs/skill level of your audience(s).

Creating an agenda

Once the participants are identified and a site is selected, training day activities can be determined. A suggested training day agenda follows.

On training day, it is helpful to follow a specific agenda to ensure that all the important material is covered. The suggest agenda below follows the design of the manual and allows for the fullest use of the material. The programme is designed to be completed in one day; however, you can split it up into several short sessions. Also, keep in mind that some of the more detailed keys, such as "Manage water quality" may take longer and lead to extended discussion.

1. Welcome and Introductions

Use the beginning of the training to introduce yourself and visit with your audience to make them feel comfortable. This will help make the course discussion and participation easier and will facilitate learning. Have everyone introduce themselves. Conduct an opening icebreaker exercise.

2. Review the program goals

Take time to briefly go over the objective of the course so everyone has a common understanding of the purpose of the training. Stress the importance of the training for the health of participants, their families and the community.

3. Summarize the basic concepts section

It is important to give an overview of what dangerous chemical and microorganism are, where they come from and how they can contaminate aquaculture ponds and fish. As the trainer, you should be familiar with the information presented in the basic concepts section. This will help you to answer questions. It may not be necessary to present all of the basic concept material during the training session. Depending on the specific issues in your area, you may choose to spend more or less time on a particular basic concept.

4. Teach the key learnings for each of the Five Keys

Review the key learnings and why for each key with the group, and then perform the exercise related to each key. If the group is too large to complete the exercises effectively, break up in to smaller groups to complete the exercises.

5. Hold a question and answer session after discussing each key

Make sure to give time for questions and answers after discussing each of the Five keys. This will help ensure that the participants fully understand the material. Do the same for all Five keys, and then summarize them with the group at the end.

Make copies of the Five Keys poster in the local language and hand them out to each participant before the training. Suggest that the participant post their copy somewhere near the pond for use as a reminder.

Training Exercises:

KEY 1: Practice Good Personal Hygiene

Overview

Proper toileting practices can affect the health of families and communities. It is important to know that simply following good personal hygiene practices, people can help prevent contamination of fish ponds and fish meat – and help prevent the spread of disease!

Learning Objectives: This exercise focuses on current personal hygiene practices and ways to improve sanitation. Human and animal faeces contain dangerous microorganisms that can contaminate the pond site, water and fish, and cause foodborne diseases when the fish is eaten. These microorganisms can survive for long periods (even months) on the soil around the pond and in pond water.

At the end of the exercise, participants will be able to:

- Describe good personal hygiene practices.
- Explain how good personal hygiene practices prevent the spread of disease.
- Identify barriers to good personal hygiene practices.
- Motivate their family, friends and community to adopt good personal hygiene practices.

Training Plan:

1. Review **Key 1: Practice Good Personal Hygiene**
2. Have the participants talk about current personal hygiene practices in their homes and communities. Encourage participants to talk about both good and poor practices.

Some questions that can be asked to start the discussion:

- What practices have you witnessed/experienced in your homes or communities?
For example: Good practices versus practices that increase food safety risk.
- How might you reinforce good practices in your community?
- How might you influence people to change the poor practices?

3. Restate the most important points with the group.

Note: If the group is large, divide participants into groups of 4 or 5 and allow 10 – 15 minutes to come up with their list of what they can do to help keep fish pond water and fish free of faecal contamination and how they might reinforce good practices and influence those around them to change the poor practices. Pull the entire group back together and ask one person from each group to report on their discussion

Training Exercises:

KEY 2: Clean the Pond Site

Overview

The first step for insuring a healthy and safe fish rearing is to select a good site for the pond. The pond site should be away from sources of contamination from heavy metals and other harmful chemicals; and located away from latrines and animals. In cases where the pond site already exists, consider ways to minimize contamination. Keeping animals away from the pond is important because faecal waste from animals can contaminate the pond site. Keeping the pond site clean helps prevent contamination of the pond site, water and fish meat—and prevents the spread of diseases.

Learning Objectives: This exercise focuses on how to select, clean and maintain the pond site.

At the end of the exercise, participants will be able to:

- Explain where the latrine should be located and how faecal waste can be disposed of safely.
- Explain the importance of minimizing chemical contamination.
- Describe the proper location for livestock and poultry.

Training Plan:

1. Review **Key 2: Clean the Pond Site**
2. Explain that this is a simple Fact or Fiction? exercise. Participants should raise their hands to indicate a “fact” or “fiction” response to each question.
3. Read the Fact or Fiction? question aloud to the participants. Ask them to indicate “fact” or “fiction” by raising their hands.
4. Then, ask the group to discuss why it is “fact” or “fiction”. When appropriate, tie in other important safety points, such as good personal hygiene practices.

FACT or FICTION?

Questions for Exercise KEY 2

1. Removing old leaky farm equipment and chemical containers from the pond site decreases the risk of chemical contamination.

[**FACT:** Chemicals can leak out of old farm equipment and chemical containers and contaminate the pond site.]

2. Removing weeds from around the pond site makes it look better but not safer.

[**FICTION:** Weeds around the pond sometimes contain parasites that infect fish]

3. Trash should be removed from around the pond to prevent it from attracting domestic and wild animals.

[**FACT:** All efforts should be made to avoid drawing animals into or near the fish pond.]

4. One should not put items that look scary or make noise around the pond site

[**FICTION:** Items that looks scary or make noise should be placed around the pond site to scare away wild birds.]

5. It is a good idea to have the pond site close to animals and latrines.

[**FICTION:** Faeces from animals and latrines can be washed into the pond site by rainwater and contaminate the pond site.]

Training Exercises:

KEY 3: Manage Water Quality

Overview

Selecting good source water for the aquaculture pond and maintaining water quality is critical for growing healthy fish and to ensure that the fish meat is safe to eat. Dangerous microorganisms in animal and human faecal waste can contaminate water and be transferred to the fish. Industrial chemical pollutants can also contaminate water and then can be transferred to fish. It is important to understand the source(s) of water used for fish ponds and the contamination risks associated with different water sources to reduce pond contamination. If water quality is poor, unknown or cannot be controlled, fish contamination is minimized by applying control measures.

Learning Objectives: This exercise focuses on how to motivate family, friends and the community to understand the importance of selecting and maintain a good water source. Measures that help maintain water quality are also reviewed.

At the end of the exercise, participants will be able to:

- Describe why water quality is important for fish growth and fish meat safety.
- Identify how to protect pond water from contamination.
- Understand the importance of treating organic waste.

Training Plan:

1. Review **Key 3: Manage Water Quality**
2. Divide participants into groups of 4 or 5. Have the participants describe their current water use practices in terms of the information presented in Key 3. For example: discuss how they select source water for a pond; how drinking water is selected; what water is used for bathing and washing of clothes.
3. Ask participants to discuss how they can manage their water quality to ensure both the health of the fish and safety of the fish meat.
Allow groups 10 - 15 minutes for the participants to describe current water use practices. Make a list of management practices that can be used to maintain water quality.
4. Bring the entire group back together and ask one member of the group to report on the discussion. Encourage other participants to add to the points presented to foster a lively discussion. Write down the points given as each group presents.
5. Reinforce learning by using the information provided to emphasize the most important points. Discuss actions that participants can take to maintain water quality. (Use a different colored marker to check off the actions they can practice versus the ones which they cannot practice. Discuss alternatives for actions that cannot be practiced.)

Training Exercises:

KEY 4: Keep Fish Healthy

Overview

Growing healthy fish requires healthy seed, maintaining proper stocking density and good post-stocking management that minimizes fish stress and disease. Using poor quality seed stock can result in slow fish growth and lower fish survival. Unfortunately, use of good quality seed does not ensure a successful crop. A successful crop requires keeping fish health by managing the stocking density, removing sick and dead fish, avoiding temperature and other environmental stress and minimizing exposures to pathogens.

Learning Objectives: This Fact or Fiction? exercise focuses on the practices needed to keep fish healthy.

At the end of the exercise, participants will be able to:

- Explain why fish seed stock should come from a certified hatchery or reliable supplier
- Discuss why appropriate stocking density is important.
- Describe how and when to remove dead and diseased fish.
- Identify why using unapproved chemicals and drugs can harm fish health.

Training Plan:

1. Review **Key 4: Keep Fish Healthy**
2. Explain that this is another Fact or Fiction? exercise. Participants should raise their hands to indicate a “fact” or “fiction” response to each question.
3. Read the Fact or Fiction? question aloud to the participants. Ask them to indicate “fact” or “fiction” by raising their hands.
4. Then, ask the group to discuss why it is “fact” or “fiction”. When appropriate, tie in other important safety points, such as managing water quality

FACT or FICTION?

KEY 4: Keep Fish Healthy

- 1.** The negative effect of using poor quality seed can be overcome by the time fish are ready for harvest.
[**FICTION:** Using poor quality seed not only slows fish growth rate and leads to more fish illness but lowers survival rates decreasing the yield at harvest.]
- 2.** Using a good quality seed stock guarantees healthy fish at harvest.
[**FICTION:** Using good quality seed insures that the fish are healthy when they enter the pond but does not insure maintenance of fish health up until harvest.]
- 3.** Fish growth rate is influenced by the number of fish in the pond.
[**FACT:** Keeping fish at the proper density improves fish growth rate by minimizing injuries and stress that slow growth rates and increases disease in the fish.]
- 4.** To minimize disease, sick and dead fish should be removed and disposed of at least daily.
[**FACT:** Removing sick and dead fish daily helps prevent the spread and disease and prevent deterioration of water quality.]
- 5.** Adding chemicals to the pond is a good way to prevent disease or increase growth rate.
[**FICTION:** Adding chemicals to the pond can hide the disease problem slow growth and result in more dead fish.]

Training Exercises:

KEY 5: Use Clean Harvest Equipment and Containers

Overview

While there are many practices that can lead to contamination of the pond site, pond water and fish, fish usually become contaminated with dangerous microorganisms during harvest and the post-harvest handling. Extra care must be taken to insure that harvest equipment and containers are clean and that fish are harvested and handled hygienically. The principles of hygiene and cleanliness are always important and can be adapted to any farm.

Learning Objectives: This exercise will review the harvest and storage practices needed to minimize the chance of the contamination of fish during harvest and storage; and encourage participants to discover how cleanliness and hygiene can be applied to improve the safety of fish meat.

At the end of the exercise, participants will be able to:

- Explain practices that can help keep fish free of contamination during the harvesting and post-harvest handling.
- Explain why harvest and packing equipment and facilities should be kept clean.
- Discuss potential contamination risks that can occur during harvest and storage and techniques to minimize these risks.

Training Plan:

1. Review **Key 5: Use Clean Harvest Equipment and Containers**
2. Divide participants into groups of 4 or 5. Allow groups 10 – 15 minutes for the participants to describe their harvest and storage practices. Make a list those practices that could lead to contamination of the fish and practices that could be used to prevent the contamination.
3. Bring the entire group back together and ask one member of the group to discuss the list.

Encourage participants to add to the points given to foster a lively discussion. Create a list of all the practices that can be used to prevent contamination as presented by each group.

4. Reinforce those practices that prevent contamination during harvest and storage that are appropriate for the location.

Example of a fish farm visit evaluation form

A good way to assess the benefit of training is by visiting the fish farm and observing practices. Ideally, the evaluator will visit the fish farm before the training and several times after the training and be able to observe changes in practices that improve the fish health and safety. Completing a separate evaluation form after each visit is a good way to monitor understanding and progress. You may not be able to answer all the questions during each farm visit and some answers may change depending on the timing of the visit and the stage of the growing season.

Description of the fish farm

1. Size of fish farm (number of ponds in production) _____
2. Size of growing pond (estimated) _____
3. Fish species being cultured _____
4. Number and type of land animals on farm _____
5. Type of source water used for fish:
o well o river o rain
o Other _____

Observation of farm activities

Personal Hygiene

6. Do family members wash and dry hands after toileting?
diapering a child?
contact with animals?
- Yes No Don't Know
- Yes No Don't Know
- Yes No Don't Know
7. Do family members change clothes after working around ponds and bathe regularly?
 Yes No Don't Know
8. Are cuts, lesions and wounds covered with a glove or bandage when working in with fish?
 Yes No Don't Know
9. Are latrines available for workers?
 Yes No Don't Know
10. Is the latrine located downhill or far enough from pond to prevent contamination?
 Yes No Don't Know

Pond Site

11. Is the pond site protected from contamination with heavy metals and harmful chemicals?
 Yes No Don't Know
12. Are the weeds and trash regularly removed from around the pond site?
 Yes No Don't Know
13. Are livestock and other animals prevented from entering the pond site?
 Yes No Don't Know

Water

14. Is the source water free of heavy metals, dangerous chemicals and harmful microorganisms?
 Yes No Don't Know
15. Are there fences or other means to keep people and animals from entering the pond?
 Yes No Don't Know
16. Is faecal waste water being properly treated before adding to the pond?
 Yes No Don't Know

17. Are the chemicals and fertilizers stored away from the pond?

- Yes No Don't Know

18. Are animals penned away from the pond?

- Yes No Don't Know

19. Is the pond water used for washing animals or clothes?

- Yes No Don't Know

Fish Health

20. Was the pond stocked with healthy fish seed from a certified hatchery or reliable supplier?

- Yes No Don't Know

21. Is the stocking density appropriate for the fish species and local environmental conditions?

- Yes No Don't Know

22. Are sick and dead fish being removed daily?

- Yes No Don't Know

23. Is the use of unapproved chemicals in the pond being avoided?

- Yes No Don't Know

Harvest

24. Are fish harvested so that they are kept alive with minimal stress or cooled and kept cool?

- Yes No Don't Know

25. Is clean water being used to wash harvested fish?

- Yes No Don't Know

26. Is the harvested fish being placed in a clean container with adequate ice?

- Yes No Don't Know

27. Are sick people prevented from harvesting and handling fish?

- Yes No Don't Know

GLOSSARY:

Clean water	Water that is free from dangerous microorganisms and toxic chemicals at levels that could cause illness and/or disease.
Diapering	Removing a wet or soiled diaper from a child and replacing it with a clean diaper.
Diarrhoea	A disorder of the intestine marked by abnormally frequent and fluid evacuation of the bowels.
Excretion	The discharge or elimination of a substance, or of a waste product, via some tissue of the body and its appearance in urine, faeces, or other products normally leaving the body.
Faeces	Waste matter or excrement eliminated from humans and animals.
Food safety	All measures to ensure that food will not cause harm to the consumer when it is produced, prepared and/or consumed according to its intended use.
Foodborne disease	A general term used to describe any disease or illness caused by eating contaminated food or drink. Traditionally referred to as "food poisoning".
Groundwater	Water captured in underground reservoirs.
Latrine	A standalone apparatus or receptacle, such as a pit in the earth, designed for urination and defaecation.
Microbial contamination	The introduction of any microorganism not intentionally added to food that may compromise food safety or suitability and cause disease.
Microorganisms	Microscopic organisms such as bacteria, yeasts, moulds, viruses and parasites, which may be found in the environment, in foods and in or on animals.
Penning animals	Placing animals in a fenced or other enclosed area that limits their faeces entering the fish pond directly
Personal protective equipment	Clothing or other garment or equipment to prevent contact of substances with the wearer's body.
Refrigeration	The process of cooling (e.g. food) to delay spoilage
Risk	The severity and likelihood of harm resulting from exposure to a hazard.
Seed stock	Small, free swimming sexually immature fish produce from brood stock
Source water	Water used to fill a pond.
Stocking density	Number of fish that can be stocked in a pond at one time
Surface water	All water naturally open to the atmosphere (e.g. rivers, streams, lakes and reservoirs).
Toilet	A system equipped with plumbing and a removal mechanism in which one urinates or defaecates.
Toileting	Urinating or defaecating in an area or sanitary facility followed by wiping and hand washing.

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Five keys to safer aquaculture products to protect public health



Practice good personal hygiene

- ◆ Use toilet or latrine to urinate and defaecate
- ◆ Wash and dry hands with a clean, dry towel after toileting, diapering a child and contact with animals
- ◆ Cover cuts and sores when working around fish ponds
- ◆ Wash hands and change clothes after working around the ponds and harvesting fish

Why? Dangerous microorganisms and chemicals are found in human, animal and plant waste and infected wounds. Chemicals and dangerous microorganisms can be transferred by hands and clothing spreading contamination. Washing hands and changing clothes helps prevent the spread of contamination and decreases illness.



Clean the pond site

- ◆ Locate ponds away from latrines, livestock, and poultry
- ◆ Choose a pond site where the chance of contamination with heavy metals or other harmful chemicals is low
- ◆ Remove weeds, rubbish chemical containers and old equipment from pond site
- ◆ Keep livestock and poultry in an area that prevents access to the fish pond

Why? Dangerous microorganisms in faecal waste from people and animals can also contaminate soil, aquatic animals and fish. Heavy metal and other harmful chemicals found in soil can cause illness in fish or in people who eat the fish.



Manage water quality

- ◆ Select a water source that has a very low chance of contamination with heavy metals, other chemicals and harmful microorganisms
- ◆ Prevent people and animals, including ducks, geese and pets, from flying over, wading or swimming in ponds
- ◆ Keep rubbish, food and faecal waste removed from the home away of the pond
- ◆ Do not pen animals over the pond

Why? Chemicals and harmful microorganisms from manufacturing activities and in faecal waste from humans, animals, including wild birds can contaminate water. These chemicals and dangerous microorganisms can then be transferred to the fish causing illness in the fish or contamination of the fish meat.



Keep fish healthy

- ◆ Stock ponds to the proper density with healthy fish seed stock from a certified hatchery or reliable supplier
- ◆ Maintain stock at the proper density in the growing pond
- ◆ Remove and dispose sick and dead fish daily
- ◆ Avoid using unapproved chemicals to maintain fish health

Why? Healthy fish require healthy seed, proper stocking density and good post-stocking management practices including managing stress and disease. Adding chemicals to ponds may harm the fish, hide a disease problem and leave residues in fish meat that can be unsafe for consumers.



Use clean harvest equipment and containers

- ◆ Wash harvest containers and equipment with clean water
- ◆ Harvest fish early in the day and transport live or cool quickly
- ◆ Use clean water to wash harvested fish
- ◆ Keep harvested fish in clean containers on non porous material

Why? During harvest, fish can become contaminated by contact with sick workers or water, ice, hands, harvest equipment and containers that are not clean. Containers made of smooth, non absorbant material are easy to clean and provide fewer places for microorganisms to grow.



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