

**PRESENTATION OF A DATA BASE SYSTEM  
FOR INFORMATION ON  
AND DIAGNOSIS OF FISH DISEASES**

by

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**ABSTRACT**

A data base system is presented with detailed information on 131 fish diseases of importance to aquaculture and fisheries. About 150 macroscopic symptoms have been identified that can be used as diagnostic criteria. All diseases recorded in the system have been checked for these symptoms. In a test run with 20 diseases occurring in 26 fishes, the system was able to diagnose 17 diseases directly. The remaining three diseases could be identified to be one out of two possible diseases. On average, the use of six symptoms were necessary to achieve a reliable diagnosis. The test run supports the following hypotheses:

(a) gross signs of a disease are well suited for an initial computer-aided diagnosis, (b) modern data base systems provide a fast and easy tool to approach a quick diagnosis with acceptable level of certainty and (c) text descriptions and pictures of disease appearances taken from the literature can be successfully used to build an information and diagnosis system on fish diseases. The target user group for PC-aided identification system includes scientists, students, and administrators in the fisheries sector. The system is part of a large data base for biological data on fish and is currently being developed by the International Center for Living Aquatic Resources Management (ICLARM), Manila.

## 1 Introduction

Diseases are of increasing concern in aquaculture and fisheries. This paper presents an information system on fish diseases of current importance to aquaculture and fisheries. The system is part of a large data base for biological data on fish, which is currently developed at the International Center for Living Aquatic Resources Management (ICLARM), Manila (FROESE 1990a). Modern data bases have already proven to be suitable for identification purposes (FROESE and PAPASSISSI 1990). Their advantage over traditional identification keys, numerical methods, and expert systems is discussed in FROESE (1990b). The present study was conducted to test the following hypotheses:

Hypothesis A: Most fish diseases can be diagnosed by gross signs of the disease.

Hypothesis B: Most disease symptoms can be classified for the use in a data base system.

Hypothesis C: A fish disease information system developed from the literature can be used to assist in rapidly diagnosing fish diseases.

## 2 Materials and Methods

### 2.1 The structure of the disease form

The data base used is described in FROESE and PAPASSISSI (1990). The form developed to describe fish diseases adequately is shown in Appendix I with the Spring Viraemia of Carp (SVC) as an example. The form contains a total of about 150 disease symptoms, which have been identified to be helpful in diagnosing fish diseases. The presence of a symptom and its location on the fish can be stated by the user with "YES" or "NO" (e.g. Spots: YES, Trunk: YES). The appearance of a symptom can be specified in "choice fields" (e.g., the color of a spot, blotch or boil can be

one of the following: "light / red / dark / other"). Three long text fields allow the user to obtain detailed informations on symptoms, treatment and prophylaxis. An additional field lists the species or families in which the disease has been reported to occur.

At the top of the form is a table naming the body parts which may be affected by the disease. These very simple listings can be used in a first step of diagnosis, permitting the user to limit the number of possible diseases.

If no information is available on a particular symptom, the corresponding field is left blank. Any fields belonging to a part of the body not affected by the disease appear also blank. For example, if the field for "Viscera affected" shows a "NO", the 42 additional fields belonging to "Viscera" must remain blank and do not contain a negative statement.

## **2.2 Source of information**

The descriptions on various fish diseases included in this study were taken from major textbooks such as AMLACHER (1981), AMOS (1985), AUSTIN and AUSTIN (1987), BAUR and RAPP (1988), DUIJN (1973), KABATA (1985), MÖLLER and ANDERS (1986), POST (1983), REICHENBACH-KLINKE (1980), ROBERTS (1985), SCHÄPERCLAUS (1979), SCHLOTTFELDT and PFORTMÜLLER (1990), STERBA (1978) and UNTERGASSER (1989).

## **3 Testing the developed data base system**

### **3.1 Material used to test the system**

The diagnostic capabilities of the system were tested using 26 diseased fishes (live and dead specimens) taken from various sources (see Appendix II). Ten of these fishes had been prepared by a special technique, allowing to preserve the habitus of the fish and the disease symptoms very well (DIECKWISCH 1989).

### 3.2 Search strategy used

Diagnosis of a disease is done by entering symptoms into the empty form (see appendix I). A search run of the system results in a tentative list of possible diseases. However, entering all the symptoms prior to a search run results not in any listing of diseases, indicating that such a combination of symptoms has not been created in the data base. This usually happens if a symptom (or several symptoms) has been misclassified by the user. To prevent such errors, the following search strategy is proposed:

- Step 1 Enter with a "YES" or "NO" message which behavior or part of body is affected by disease. If not certain about criteria entry, the field is left blank. The first search is run with the limited information entered. If no disease list results from the first run, the entered symptoms should be re-examined. Otherwise proceed with step 2.
- Step 2 Go to the part of the form that deals with the part of body or behavior that is most obviously affected by disease. Enter the symptoms which are identified with certainty. Start the second search run. If the result does not provide a disease list, check the accuracy of entered symptoms again. Otherwise proceed with step 3.
- Step 3 If the resulting list from step 1 and 2 offer more than five choices of possible diseases listed, return to Step 2 and enter additional **symptoms**. If there are five or fewer possible diseases, compare the complete description of ~~the~~ diseases with the symptoms identified on your fish (see Appendix I as an example of a complete description of SVC).
- Step 4 Go through the cited literature for a final check on the diagnosis made.

This suggested search strategy was also used to test the system.

## 4 Results

The results of the test run are listed in Appendix II. They can be summarized as follows:

- Of the 20 fish diseases tested, 17 were diagnosed directly. The others were identified with some uncertainty with the system offering one of two possible choices. How these cases can be handled to derive at a final decision is described below.
- The number of symptoms to be identified and entered into the form in order to complete the diagnosis varied between 11 in the worst case and 3 in the best example. On average, 6 symptoms were needed for diagnosis.
- All symptoms used in the test run were external gross signs of the disease in question.

The three cases where the system was unable to identify one disease and offered options to distinguish between two possible diseases can be further handled in the following manner:

1. Alternatives suggested in case one were:  
*Leptocotyle* infestation or Epitheliocystis.  
Consulting the literature it becomes clear that a microscopic examination of the white spots would reveal the monogenean trematode *Leptocotyle minor* in *Leptocotyle* infestation, whereas the white spots in Epitheliocystis are caused by bacteria (ROBERTS 1985). Often, the information in the pertinent literature is sufficiently assisting in the decision process. Otherwise the fish would have been examined directly.
2. Alternatives suggested in case two were:  
Nematode infestation or Plistophora disease 1.

Preparation of the blotches would reveal larval stages of a nematode in Nematode infestation, whereas the microscopic examination of the cysts in Plistophora disease 1 would reveal different stages of spores of *Plistophora spec.* (MÖLLER and ANDERS 1986). This information can be derived from the literature or checked on the fish directly.

3. Alternatives suggested in case three were:  
X-cell tumor or Tumor of the skin.  
A distinction between these two diseases is only possible with histopathological methods.

## 5 Conclusion

The results of the test support the postulated **hypotheses**: Gross signs of a disease are well suited for a preliminary diagnosis of most fish diseases. The classification and implementation of these symptoms in a modern data base system provide a fast and easy first approach to diagnosis. The results show that descriptions and pictures from the literature can be successfully used to build up the information and diagnosis system.

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## 7 Appendix I

Printout of the form used for diagnosis of fish diseases. As an example, the form contains data for the Spring Viraemia of Carp (SVC). Blank fields are underlined>.

DisCode : 00017 Main Ref.: 10006

Disease I : virus disease

Disease II : SVC Pic: \_\_\_\_\_

Other names : Spring Viraemia of Carp, Dropsy, Acute Dropsy, Chronic Dropsy

Caus. agent : Rhabdovirus carpio

Behavior or part of body affected by disease

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 Skin and/or fins : yes                      Anus : yes  
 Gills : yes                                  Swimming behavior : yes  
 Eyes : yes                                  Other behavior : yes  
 Belly : yes                                 Other symptoms : no  
 Viscera : yes

SKIN AND/OR FINS

-----  
 Aberrant color: yes    aberrant coating: no    aberrant mucus production: no

Symptom	Color	Position				
-----						
Spots : yes	red	head : ___	dorsal : no	dorsal fin: no	caudal fin : no	
		trunk: yes	ventral: yes	anal fin : no	paired fins: no	
		tail : no				
Blotches:yes	red	head : ___	dorsal : no	dorsal fin: no	caudal fin : no	
		trunk: yes	ventral: yes	anal fin : no	paired fins: no	
		tail : no				
Boils : no		head : ___	dorsal : ___	dorsal fin: ___	caudal fin : ___	
		trunk: ___	ventral: ___	anal fin : ___	paired fins: ___	
		tail : ___				
Ulcer : no		head : ___	dorsal : ___	dorsal fin: ___	caudal fin : ___	
		trunk: ___	ventral: ___	anal fin : ___	paired fins: ___	
		tail : ___				
Objects:no		head : ___	dorsal : ___	dorsal fin: ___	caudal fin : ___	
		trunk: ___	ventral: ___	anal fin : ___	paired fins: ___	
		tail : ___				
Fins :red base				dorsal fin: no	caudal fin : no	
				anal fin : no	paired fins: yes	

GILLS

-----  
 Aberrant color: yes    pale/ whitish  
 Spots : yes    red  
 Knots : no  
 Blotches : no  
 Coating : no  
 Gills frayed : more or less normal  
 Objects : none

EYES

-----  
 Milky color : no  
 Spots : red  
 Appearance : exophthalmus



BELLY

Shape of belly : distended  
 Lumen with fluid: yes  
 Worms : none

ANUS

Anus protruding : yes  
 Anus red : yes  
 Objects : filament like  
 Exudates unusual: yes

VISCERA

Organ	affected	size	appearance	blotches	color	knots	color
Liver	:	_____	_____	_____	_____	_____	_____
Spleen	:	_____	_____	_____	_____	_____	_____
Kidney	: yes	normal	other	yes	red/bloody	no	_____
Swim bladder:	yes	normal	other	yes	red/bloody	no	_____
Intestine	: yes	normal	inflamed	yes	red/bloody	no	_____
Other organs:	yes	normal	_____	yes	red/bloody	no	_____
All organs	: yes		pasted	_____	_____	_____	_____

OTHER SYMPTOMS

Scales bristling : \_\_\_\_\_  
 Loss of scales : \_\_\_\_\_  
 Skeleton deformation: \_\_\_\_\_  
 Reduced growth rate : \_\_\_\_\_  
 Loss of weight : \_\_\_\_\_

MORTALITY AND SEASONALITY

Mortality : medium (10% - 30 %)  
 Seasonality : Spring: yes Summer: \_\_\_\_\_  
 Autumn: \_\_\_\_\_ Winter: \_\_\_\_\_

Swimming behavior

Unusual activity : yes sluggish / lethargic  
 Loss of balance : yes  
 Unusual swimming motions : \_\_\_\_\_  
 Head pointing up or down : no  
 Scraping on objects : no  
 Jumping out of water : no

Other behavior

Fins clamped or stretched: no  
 Fish near bottom : yes  
 Fish near surface : no  
 Fish near inlet or outlet: yes  
 Loss of appetite : \_\_\_\_\_  
 Spreading of operculum : no  
 Unusual ventilation : yes fast: no slow: yes flat: no heavy: yes  
 Gasping at surface : no

Fish affected:

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Cyprinidae

Symptoms:

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Swollen reddish abdomen, pale gills (hemorrhages), exophthalmus and red eyes, inner organs pasted and inflamed, anus red and protruding, pseudo-faeces; lethargy, heavy ventilation.

Treatment:

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Antibiotic treatment may reduce the mortality rate by reducing secondary bacterial infection. Good nutritional status appears to result in lower losses.

Prophylaxis:

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No known means of preventing infection other than by avoiding virus, e.g., maintenance of disease-free stocks, with strict restriction on introduction of new stock unless from impeccable sources.

## 8 Appendix II

Record of several diagnostic sessions. The table shows the diagnosed diseases, the combination of symptoms used, and the resulting number of possible diseases. The test was conducted with live and dead fish. Live fish have been marked as "l.", dead fish as "d.", and prepared fish as "prep.". When two different stages of the same disease appeared on the list of possible diseases, they were counted as one. The final number of possible diseases was then put in parentheses.

Disease / Species	Symptoms used	No. of possible diseases
Black spot disease 3 <i>Trisopterus luscus</i> , l.	Skin and/or fins affected: YES Eyes affected: YES Spots: YES Spots color: DARK Blotches: NO	126 34 17 2 1
Cauliflower disease <i>Anguilla anguilla</i> , prep.	Skin and/or fins affected: YES Gills affected: NO Eyes affected: NO Objects: OTHER OBJECTS Fish affected: "Anguillidae"	125 77 64 4 1
Columnaris disease (m.) <i>Salmo gairdneri</i> , d.	Skin and/or fins affected: YES Gills affected: YES Eyes affected: NO Ulcer: YES Ulcer color: LIGHT	126 49 28 8 1

Columnaris disease (ornamental) <i>Megalomphodus megalopterus</i> , l.	Skin and/or fins affected: YES Eyes affected: NO Spots: YES Spots color: LIGHT Blotches: YES Blotches color: LIGHT Aberrant color: NO Symptoms: NOT = "** larval stage is located in the muscle tissue**"	126 92 30 10 4 3 2 1
Fin-rot disease (e.) <i>Barbus arulius</i> , l.	Skin and/or fins affected: YES Gills affected: NO Eyes affected: NO Fins: WHITE MARGINS AND FRAYED Spots: NO	126 77 64 2 1
Infectious ascitis (ornamental) <i>Labeo bicolor</i> , l.	Belly affected: YES Eyes affected: YES Shape of belly: DISTENDED Appearance of eyes: EXOPHTHALMUS Scales bristling: YES Fish near surface: YES	37 19 16 15 4 1
Injuries caused by capture <i>Pleuronectes platessa</i> , d. <i>Limanda limanda</i> , d. <i>Pollachius pollachius</i> , l.	Skin and/or fins affected: YES Gills affected: NO Anus affected: NO Blotches: YES Blotches color: RED Fins: FRAYED	126 77 67 30 6 1
Leptocotyle infestation <i>Squalus acanthias</i> , l. <u>other possible disease:</u> Epitheliocystis	Skin and/or fins affected: YES Eyes affected: NO Spots: YES Spots color: LIGHT Spots position: ALL POSITIONS Blotches: NO Boils: NO	126 92 30 10 6 4 2
Lernaeocera infestation (l.) <i>Merlangius merlangus</i> , prep. <i>Gadus morhua</i> , prep. <u>other possible disease:</u> Lernaeocera infestation (e.)	Skin and/or fins affected: NO Gills affected: YES Objects on gills: OTHER OBJECTS	53 24 2 (1)
Lymphocystis 1 <i>Limanda limanda</i> , prep.	Skin and/or fins affected: YES Eyes affected: NO Boils: YES Boils color: LIGHT Boils position: ALL POSITIONS Spots: YES Aberrant coating: NO	126 92 30 18 4 2 1

Lymphocystis 2	Skin and/or fins affected: YES	126
<i>Platichthys flesus</i> , prep.	Eyes affected: NO	92
	Boils: YES	31
	Boils color: DARK	3
	Boils position: ALL POSITIONS	1
Nematode infestation	Skin and/or fins affected: YES	126
<i>Osmerus eperlanus</i> , prep.	Eyes affected: NO	92
<u>other possible disease:</u>	Gills affected: NO	65
Plistophora disease 1	Blotches: YES	32
	Blotches color: LIGHT	16
	Blotches position: TRUNK and DORSAL	12
	Ulcers: NO	7
	Spots: NO	5
	Symptoms: "* larval stage is located in the muscle tissue*"	2
Saprolegnia infestation	Skin and/or fins affected: YES	126
(l.)	Gills affected: YES	49
<i>Salmo gairdneri</i> , l.	Objects: COTTON-LIKE	2
	Objects position: ALL FINS	1
Spawning papillomata	Skin and/or fins affected: YES	126
<i>Osmerus eperlanus</i> , d.	Gills affected: NO	77
<i>Osmerus eperlanus</i> , prep.	Eyes: NO	65
	Boils: YES	24
	Boils color: LIGHT	14
	Boils position: ALL FINS	3
	Spots: NO	2
	Species affected: "*Osmeridae*"	1
Trichodina infestation	Skin and/or fins affected: YES	126
<i>Carassius auratus</i> , l.	Eyes affected: NO	92
	Aberrant coating: YES	7
	Aberrant mucus production: YES	4
	Spots: NO	3
	Blotches: NO	1
Tumor of the thyroid	Gills affected: YES	73
<i>Haplochromis spec.</i> , l.	Knots on gills: YES	6
	Knots color: RED	1
Ulcer 2	Skin and/or fins affected: YES	126
<i>Gadus morhua</i> , d.	Gills affected: NO	77
<i>Liparis liparis</i> , prep.	Eyes affected: NO	65
<i>Solea solea</i> , prep.	Ulcer: YES	27
	Ulcer color: RED	20
	Ulcer position: TRUNK	16
	Spots: NO	11
	Boils: NO	7
	Objects: NO	5

	Fins: MORE OR LESS NORMAL	2
	Symptoms: NOT = "* light blotches*"	1
Vibriosis (chronic)	Skin and/or fins affected: YES	126
<i>Coregonus oxyrinchus</i> , l.	Ulcer: YES	44
	Ulcer color: LIGHT	4
	Ulcer position: TRUNK and TAIL	3
	Boils: NO	2
	Symptoms: NOT = "* destruction of tissue along the lateral line *"	1
White spot disease	Skin and/or fins affected: YES	126
<i>Carassius auratus</i> , l.	Eyes affected: YES	34
	Spots: YES	17
	Spots color: LIGHT	2
	Aberrant coating: NO	1
X-cell tumor	Skin and/or fins affected: YES	126
<i>Acanthogobius flavimanus</i> ., prep.	Gills affected: NO	77
<u>other possible disease:</u>	Objects on skin: OTHER	4
Tumor of the skin	Disease I: NOT = "parasitic infestation"	3
	Species affected: NOT = "*Anguillidae*"	2