Causative agent, symptoms and treatment for disease affecting *Lates calcarifer*

DISEASE	AGENT	TYPE	SYMPTOM	TREATMENT
Viral nervous necrosis (VNN)	*Lates calcarifer* encephalitis virus– a betanodavirus	Virus	Pale or dark colouration; erratic swimming behaviour; spiral swimming; bloating; 'fainting'; extensive vacuolation of the brain & spinal cord; generally encountered during hatchery phase	Screening of broodstock; low larval rearing densities; optimal larval nutrition; improved broodstock nutrition; improved hatchery hygiene
Lymphocystis	Lymphocystis virus	Virus	Wart-like growths on skin & fins; generally only fatal if infection severe & associated with very poor environmental conditions	Removal of infected fish; improved environment
Vibriosis	*Vibrio harveyi*; *Vibrio* spp.	Bacteria	Marine fish with darkening; lethargy; anorexia; reddened ulcerations on body; reddened abdominal fluid; associated with nursery systems, poor environment & skin trauma	Improved environment; antibiotic treatment
Bacterial haemorrhagic septicaemia	*Aeromonas hydrophila*; *A. sobria*; *A. caviae*; *Pseudomonas* sp.	Bacteria	Freshwater fish with irregular reddened skin ulcerations; lethargy; anorexia; reddened abdominal fluid; pale gills; associated with poor environment & skin trauma	Improved environment; antibiotic treatment
Integumentary bacteriosis	*Aeromonas sobria*; *Aeromonas hydrophila*; *Vibrio harveyi*; *Vibrio alginolyticus*	Bacteria	Irregular reddened skin ulcerations; loss of scales; associated with poor environment & skin trauma	Improved environment; increased water exchange
Streptococcosis	*Streptococcus iniae*	Bacterium	Darkened fish; anorexia; pale gills; reddened abdominal fluid; reddened abdominal organs & inner wall	Antibiotic treatment; vaccination

Columnaris disease	*Flavobacterium columnare*; *Flavobacterium johnsoniae*; & *Flavobacterium* sp. (gliding forms) in freshwater *Tenacibaculum marinimum* in seawater	Bacteria	Pale skin patches on dorsal surface behind dorsal fin & on caudal peduncle; lethargy; most commonly occurs in nursery phase; in older juveniles a mouth form with erosion of skin around upper & lower jaws has been seen; associated with overstocking, tank rearing, poor hygiene & skin trauma	Treatment in potassium permanganate or copper baths may help in early disease; antibiotic treatment
Bacterial gill disease	Various bacteria, *Flavobacterium* spp., *Cytophaga* spp.	Bacteria	Swimming at water surface; gulping; rapid opercular movement; excess mucus on gills; white patches on gills; most commonly occurs in nursery phase	Improve water quality; treatment with salinity reversal, potassium permanganate or quaternary ammonium baths; increase water exchange; reduce stocking density
Bacterial peritonitis	Various Gram-negative & Gram-positive bacteria including *V. harveyi* & *A. hydrophila*	Bacteria	Darkened fish; lethargy; swollen abdomen; adhesions & bad smelling fluid in abdomen; abdominal fistulas; more common in recirculation systems	Cull affected fish; antibiotic treatment
Bacterial enteritis	Various Gram-negative bacteria	Bacteria	Acute disease in intensive larval rearing systems; anorexia; pin heads; darkened fish & death	Cull affected larval batch
Fin and tail rot	*Aeromonas* spp.; *Pseudomonas* spp.; *Vibrio* spp.; *Flavobacterium* spp.; *Cytophaga* spp.	Bacteria	Erosion of soft tissue in fins and tail; may extend to involve entire tail & caudal peduncle	Improve environment; reduce stocking density
Epitheliocystis	Epitheliocystis organism – a *Chlamydia*	Bacterium	Swimming at water surface; rapid opercular movements; disease rare but seen in marine fish & in recirculation systems	None known

White spot	*Ichthyophthirius multifiliis* in freshwater *Cryptocaryon irritans* in marine	Protozoa	'Flashing'; rubbing skin on surfaces; anorexia; swimming at water surface; white spots on skin & fins	Treatment with salinity reversal, formalin baths or combinations; treatment in copper bath for marine fish
Chilodonelliasis	*Chilodonella* spp.; *Chilodonella hexasticha*	Protozoa	Swimming at water surface; rapid opercula movement; flared opercula; seen in poor environmental conditions & in weakened fish	Treatment with salt, formalin or potassium permanganate bath or combinations
Trichodiniasis	*Trichodina* complex spp.	Protozoa	Swimming at water surface; rapid opercular movements; excess gill mucus; typically follows cold water temperatures, high organic loads & high stocking densities	Increase water exchange; treatment with salt or formalin bath
Ichthyobodosis (costiasis)	*Ichthyobodo necator*	Protozoa	'Flashing'; rubbing skin on surfaces; opaque patches on skin; raised scales; swimming at water surface; rapid opercular movements; flared opercula	Treatment with salinity reversal; formalin or potassium permanganate bath
Piscinoodiniasis	*Piscinoodinium* sp.	Protozoa	Found in freshwater: In young fish opaque patches or a greenish discolouration of the skin; patches of skin lifting of surface & ulcers In older fish rapid opercular movements; excess gill mucus; dark green gill colour	Treatment with salt bath
Amyloodiniasis	*Amyloodinium ocellatum*	Protozoa	Found in marine conditions: In young fish opaque patches or a green discolouration of the skin; patches of skin lifting of surface & ulcers. In older fish rapid opercular movements; excess gill mucus; dark green gill colour More common in broodstock and in raceways; associated with low water temperatures or rapid drops in temperature	Treatment with freshwater, copper, formalin or hydrogen peroxide bath

Red sore disease	*Epistylis* sp.	Protozoa	Skin ulcers in freshwater pond fish; raised fluffy surface & secondary bacterial infections	Reduce organic levels in water; treatment with formalin bath
Gill fluke	*Diplectanum* sp.; *Dactylogyrus* sp.	Monogean trematodes	Rapid opercular movements; anorexia; white areas on gills	Treatment with salinity reversal, formalin, organo-phosphate or praziquantel bath
Skin fluke	*Neobenedinia mellen*i; *Gyrodactylus* spp.	Monogean trematodes	Marine fish with opaque cornea; white patches on skin; skin ulcers; associated with high salinity & cool water temperatures	Treatment in freshwater or hydrogen peroxide bath
Myxosporidiosis	*Henneguya* sp.; *Kudoa* sp.	Spore-forming protozoa	Disease uncommon but histologically spore cysts seen in gill filaments (*Henneguya* sp.) & brain (*Kudoa* sp.)	None known
Microsporidiosis	*Pleistophora* sp.	Spore-forming protozoa	Raised lumps on skin; soft white nodules in muscle	None known
Integumentary mycosis	*Saprolegnia* spp.; *Achlya* spp.	Fungi	Raised, fluffy growths on skin & fins; associated with low water temperatures & skin trauma	Salinity reversal and formalin baths; do not handle fish when water temperatures low
Branchiomycosis	*Brachiomyces* sp.; *Achlya* spp.	Fungi	Swimming at water surface; rapid opercular movements; white & red patches (mottled appearance) on gills; associated with cold water temperatures & high organic loads	No treatment known; reduce organic load & increase water exchange
Fish louse	*Argulus* sp.	Copepod	Disc-shaped parasite visible on skin; red foci; darkening	Treatment in organophosphate bath
Anchor worm	*Lernaea* sp.	Copepod	Thin body of female parasite visible on skin with small red ulcer where parasite penetrates skin	Treatment in organophosphate bath