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YSLME

RMC

Status of Fish Vaccine Development in Korea

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Contents

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Aquaculture Production in Korea (2007)

Production of Marine Aquaculture

- **Fish: 97,663 M/T (7%)**
- **Shell fish: 478,646 M/T**
- **Seaweed: 792,953 M/T(60%)**
- **Crustacea: 1,321 M/T**
- **Other : 15,221 M/T**

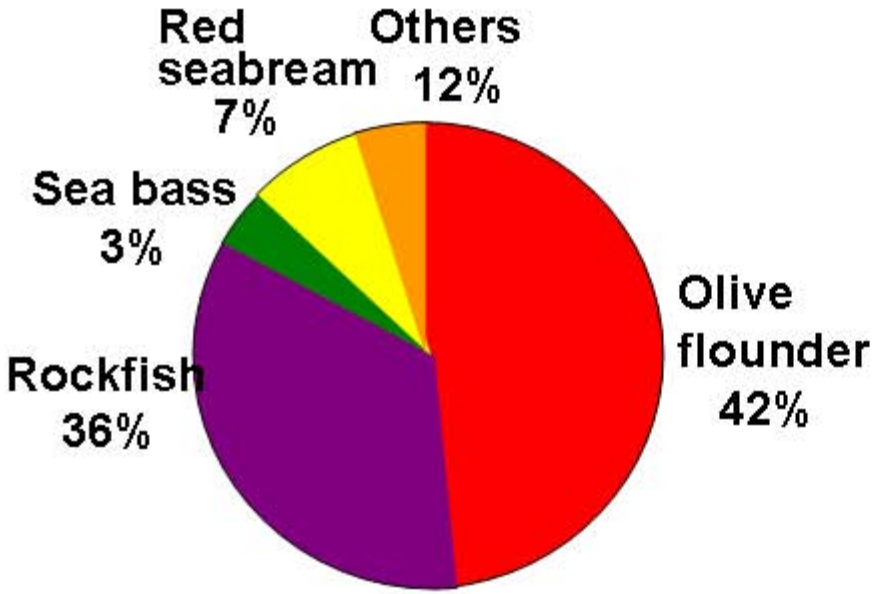
Production of Inland Aquaculture

- **Fish: 23,424 M/T**
- **Shell fish: 1,813 M/T**
- **Crustacea: 177 M/T**
- **Other: 132 M/T**

Data: MIFFAF

Aquaculture Production in Korea (2007)

Production of Marine Cultured Fish



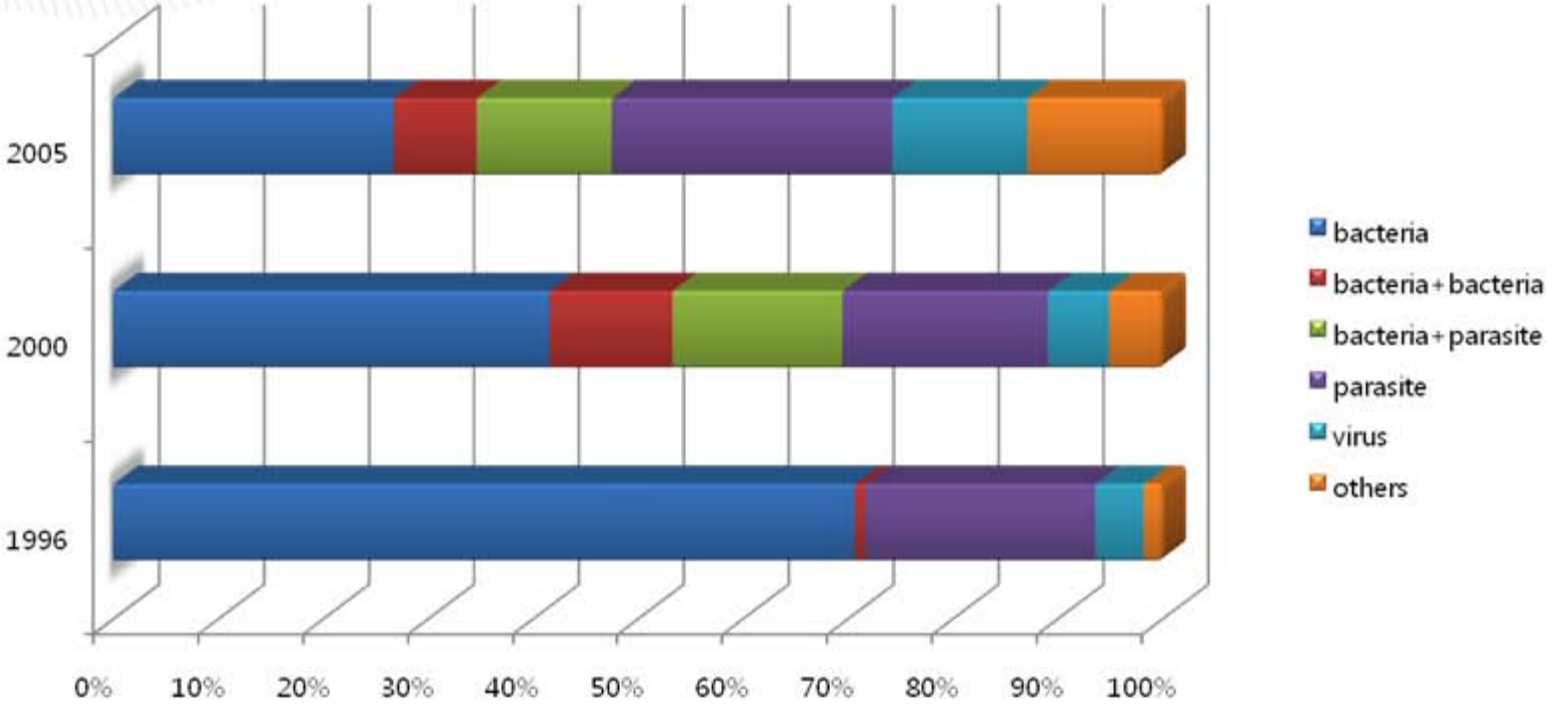
M/T

Total	97,663
Olive flounder	41,171
Rock fish	35,564
Red seabream	7,213
Sea bass	2,361
Other	11,354

Data: MIFFAF

Status of fish disease in Korea

Fish Disease Pattern in Korea



In the 1990's, losses due to disease were about 5% but this has now increased to about 20%. Major infection causes change from bacterial problems to complex problems.

Status of fish disease in Korea

Major infectious diseases of marine cultured fish

Disease	Causative agent	Affected species
Red seabream iridoviral disease (RSIVD)	Iridovirus (RSIV)	Red sea bream, Rock bream, flounder
Viral nervous necrosis (VNN)	Nodavirus (VNNV)	Several fishes
Viral hemorrhagic septicemia (VHS) virus infection	VHSV	Olive flounder
Vibriosis	*Vibrio harveyi*, *V. ichthyoenteri*	Olive flounder
Streptococosis	*Streptococcus iniae*, *S. parauberis*	Olive flounder
Edwardsiellosis	*Edwardsiella tarda*	Olive flounder
Scuticociellosis	*Uronema marinum*	Olive flounder
White spot disease	*Cryptocaryon irritans*	Olive flounder

Necessity of vaccine development

Disease Control

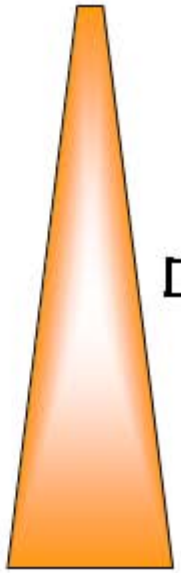
- Rapid detection of pathogens and control by antibiotics
- Good husbandry
- Prevention of disease by vaccination

Vaccines

- Major area for growth in aquaculture
- Reduce the need for antibiotics and chemicals
- Save costs
- Reduce problems with antibiotic resistance
- Reduce concerns over residue levels and environmental impacts
- Control significant diseases

Types of Vaccine

- Inactivated whole cell
- Adjuvanted
- Sub-unit
- Recombinant
- Live attenuated
- Synthetic (peptide)
- DNA vaccines



Development cost

The first commercial vaccine were licenced in the USA in 1970's against enteric redmouth disease, vibriosis and furunculosis

Liscenced Vaccines for Fish

Enteric Redmouth (ERM)

Vibrio anguillarum

Furunculosis

Vibrio salmonicida

Vibriosis/Furunculosis

Vibriosis/Furunculosis/Coldwater Vibriosis/*Moritella viscosa*

Vibriosis/Furunculosis/Coldwater Vibriosis/*Moritella viscosa*/ IPN Virus

Vibriosis for cod

IPN Virus

ISA Virus

Warmwater *Vibrio* spp

Pasteurella

Pasteurella/Vibriosis

SVC virus *Lactococcus garvieae/Streptococcus iniae*

Koi Herpes Virus

Aeromonas hydrophila

Carp Erythrodermatitis/Ulcer disease

Piscirickettsia salmonis

Flavobacterium psychrophilum

Nodavirus

Pancreas Disease Virus

Edwardsiella ictaluri

Status of Fish Vaccine Development

Developed Vaccines for Fish in Korea

Vaccine	Fish	Method	Status
Inactivated Edwardsiella	Flounder	Immersion	Commercially available
Inactivated Iridovirus	Sea breams	Injection	Technique was transferred into commercial co. in 2002
Inactivated Streptococcus	Flounder	Injection	Commercially available
Inactivated Strepto +Edward	Flounder	Injection	Under developing
Recombinant Iridovirus	Sea breams Flounder	Injection	Technique was transferred into commercial co. in 2006

Red sea bream Iridoviral Disease

Red sea bream Iridoviral Disease (RSIVD)

- Over 30 cultured and wild fish hosts including:

  Red sea bream, olive flounder, Sea bream, Barramundi, Japanese sea bass, Largemouth bass, Northern bluefin tuna,
  Several grouper species, Golden striped amberjack

- Regions affected include:

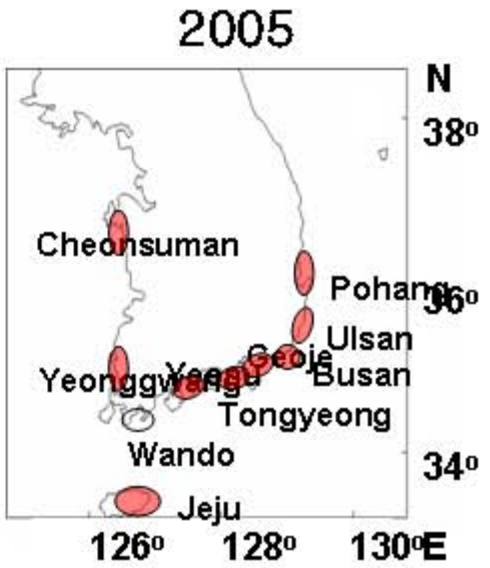
  Japan, Korea, Taiwan, Singapore

- Diagnosis

  Has been isolated in cell culture.
  PCR commonly used for direct identification or confirmation. FAT used for direct identification

- Control

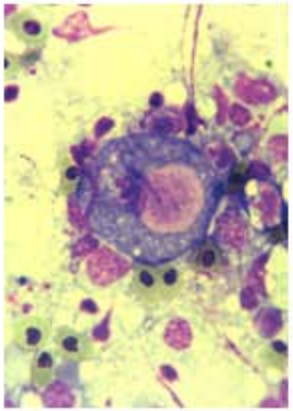
  Inactivated vaccine commercially available
  DNA vaccines have been developed and are being evaluated

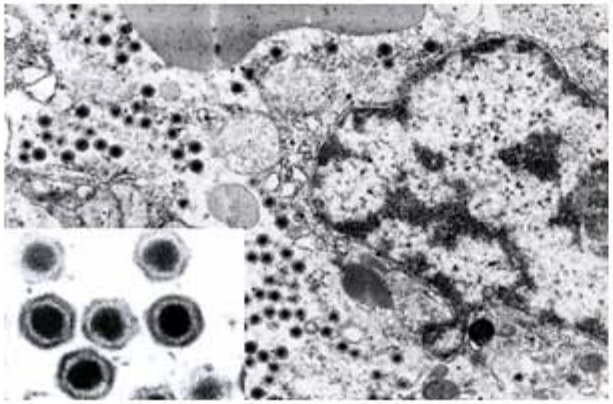


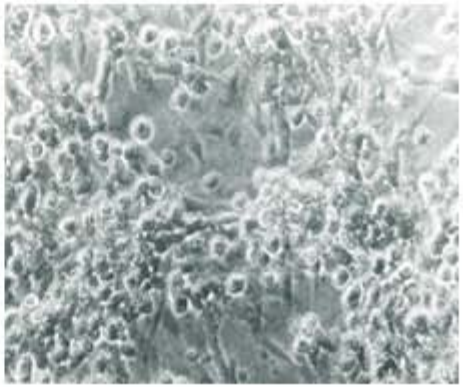
Red sea bream Iridoviral Disease

Red sea bream Iridoviral Disease (RSIVD)

- Causes low to high mortality.
- Highly infectious.
- Affects a wide range of food fish.
- Severe anaemia, haemorrhages in gills, enlarged spleen.
- Histology: enlarged cells

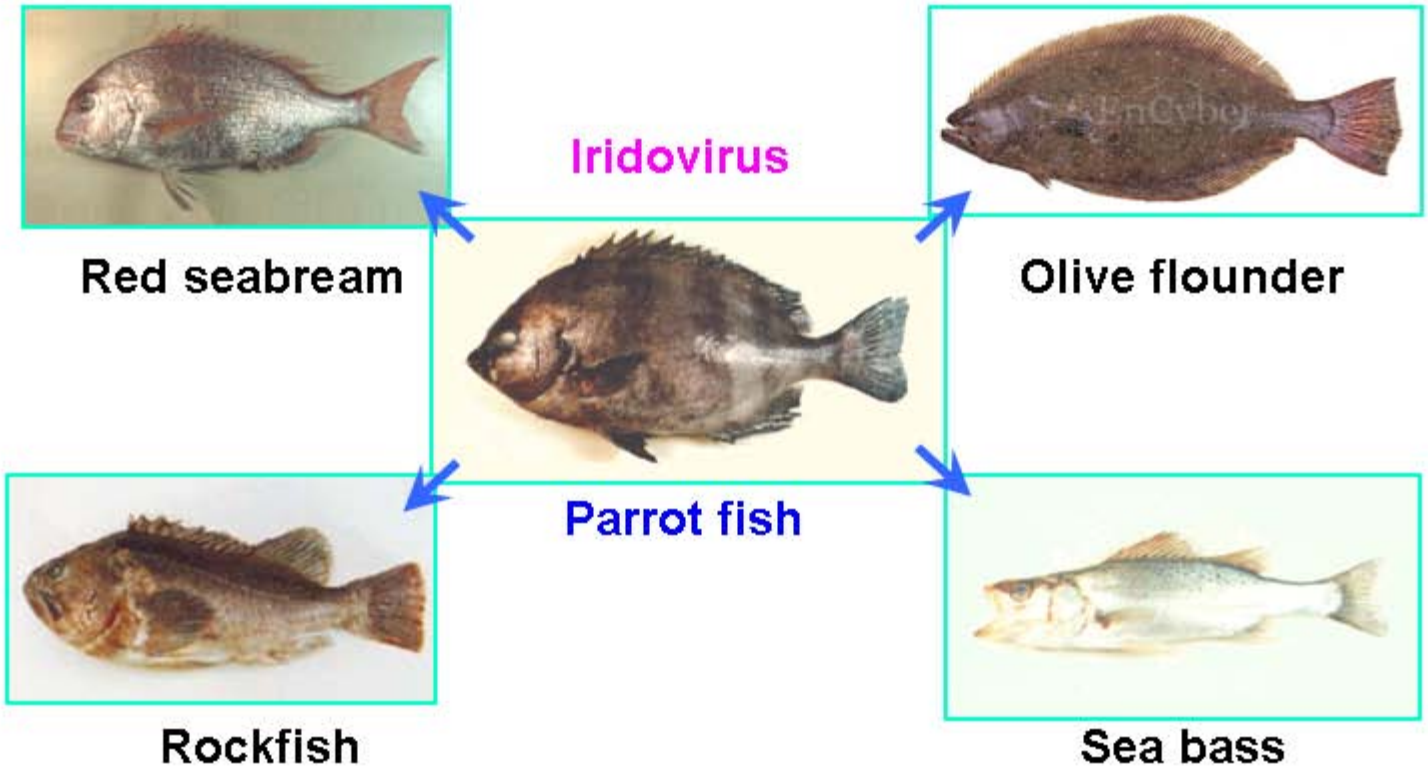






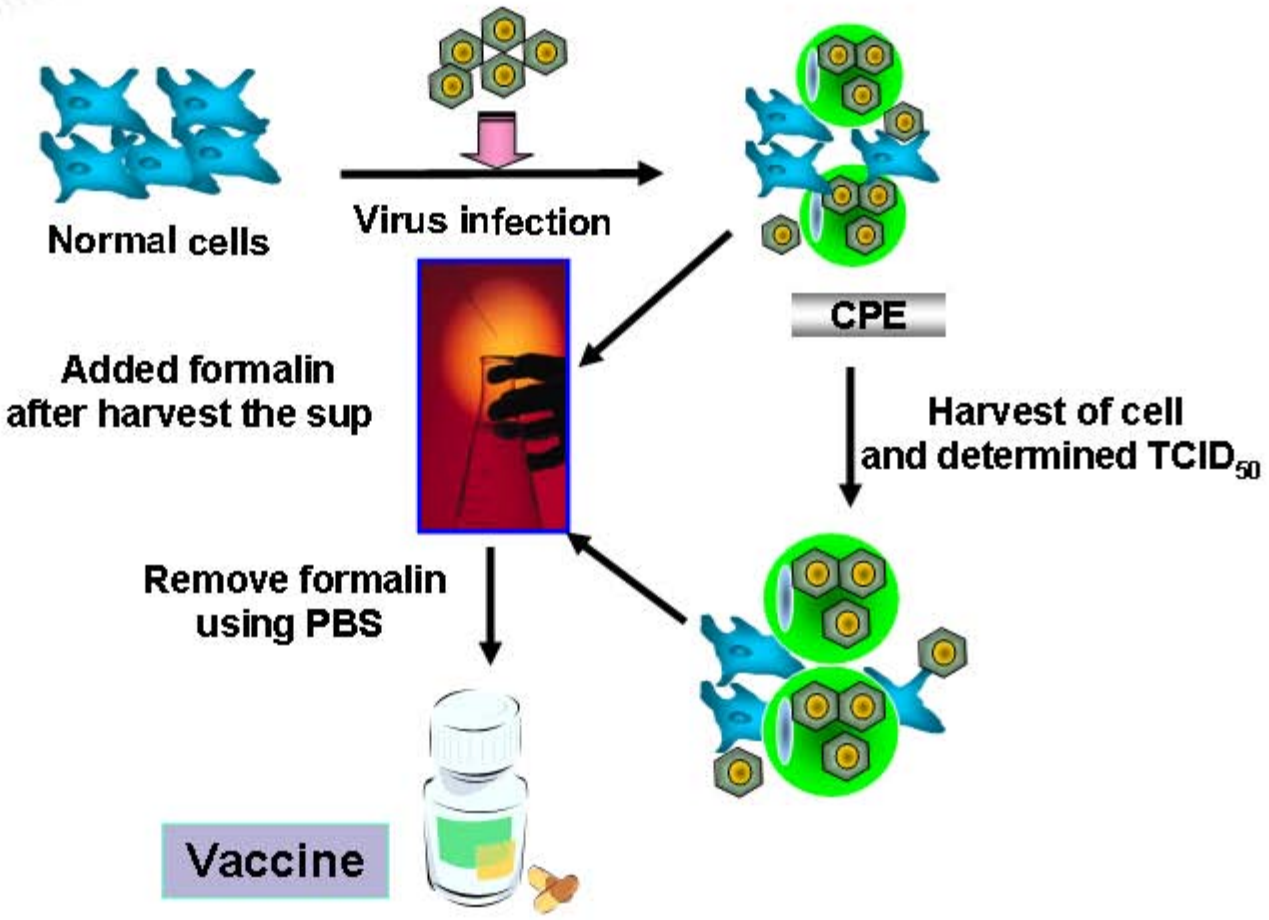
Red sea bream Iridoviral Disease

Spread to Other Species



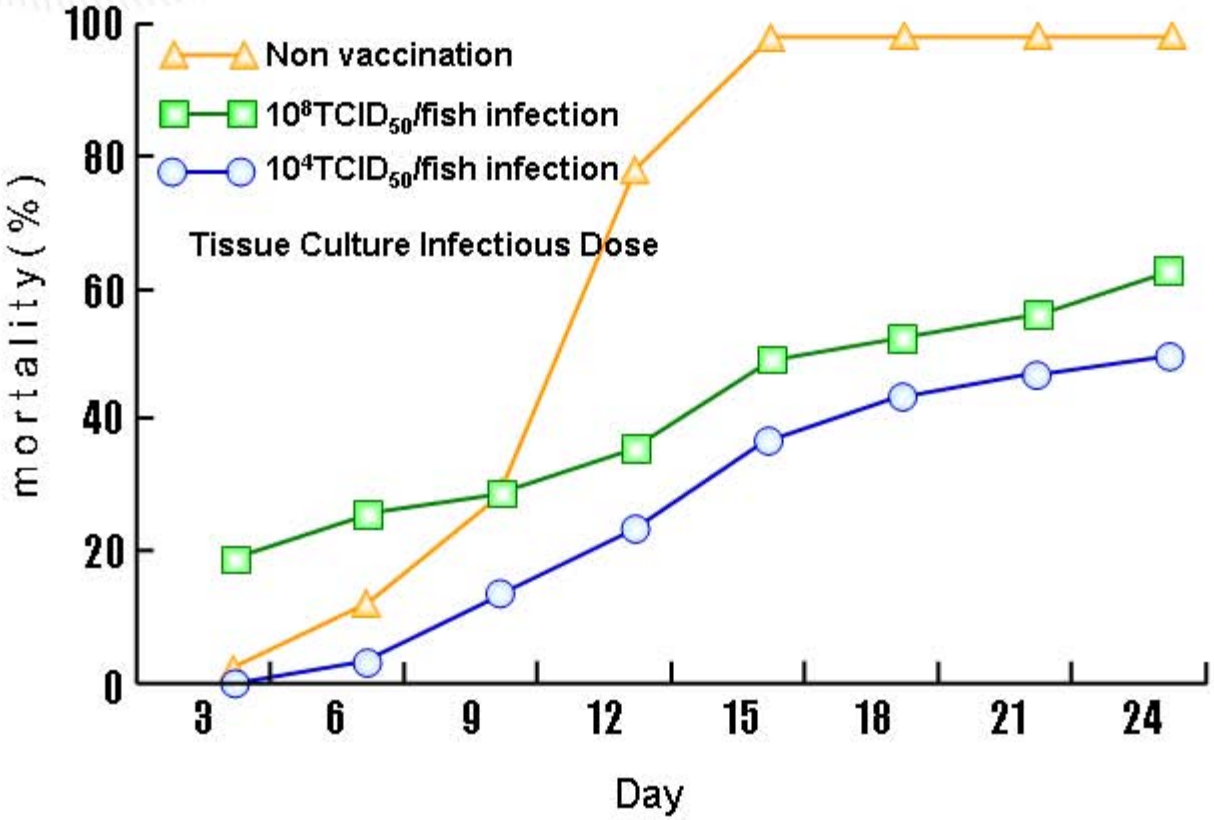
Red sea bream Iridoviral Disease

Process of Inactivated Iridovirus Vaccine



Red sea bream Iridoviral Disease

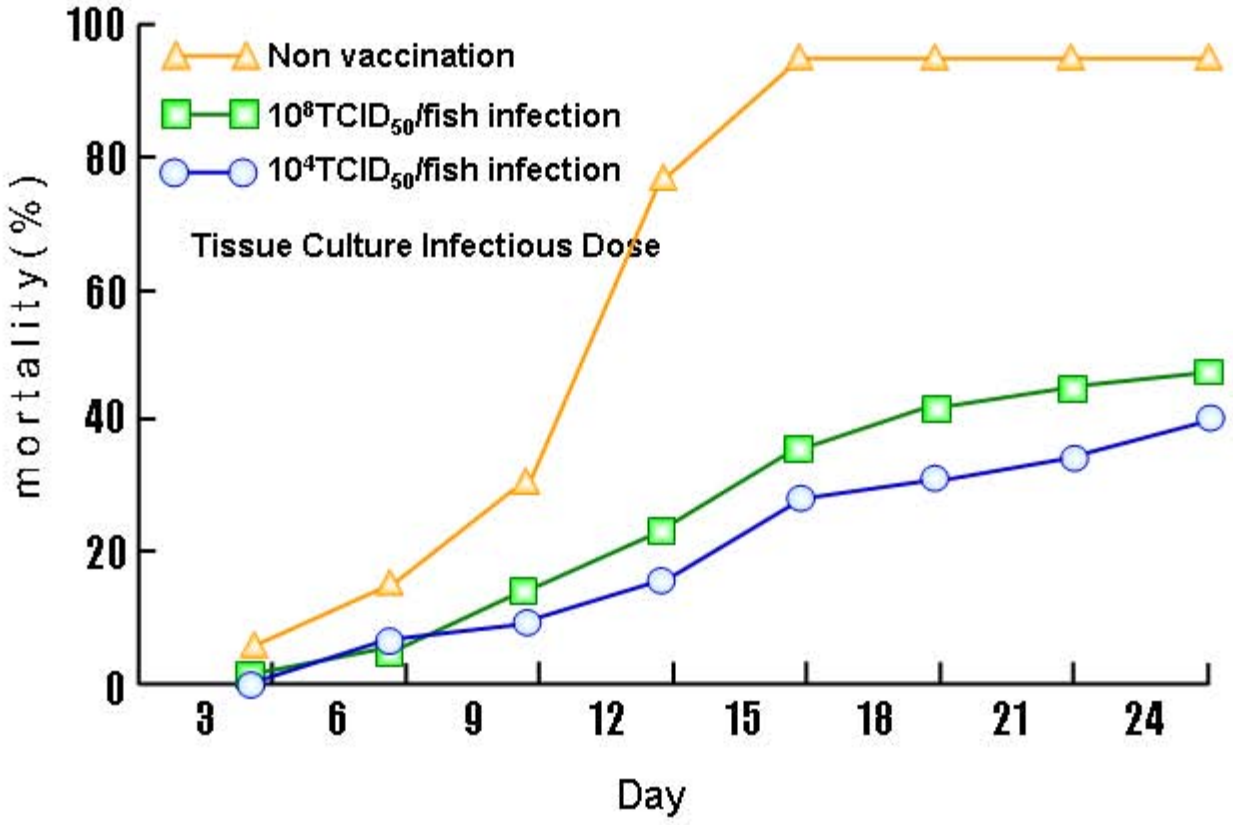
Cumulative Mortality of Iridovirus Vaccine by Concentration



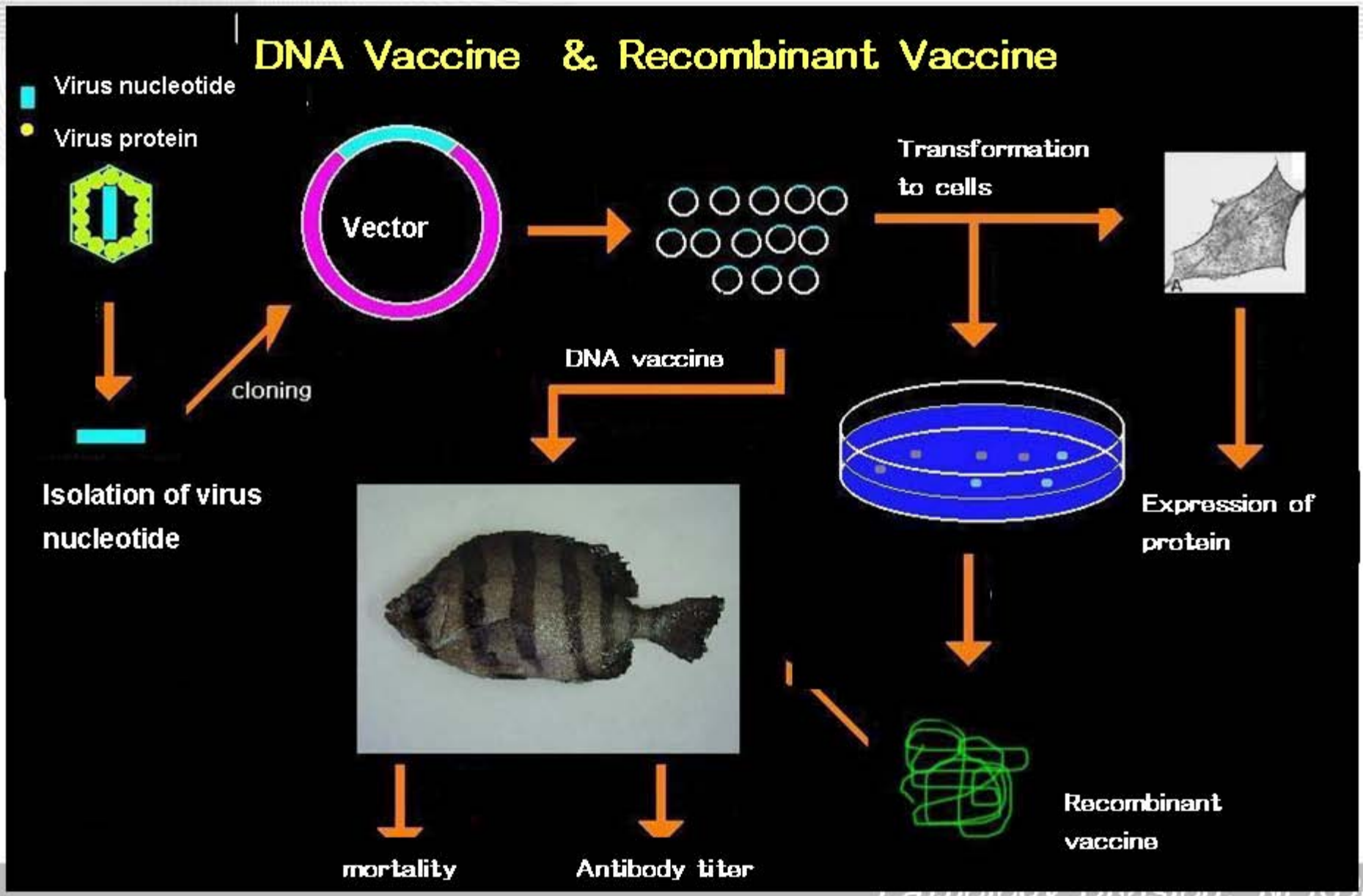
Inactivated iridovirus vaccine was injected to parrot fish,
Challenged with live iridovirus

Red sea bream Iridoviral Disease

Cumulative Mortality of 2nd Vaccination of Iridovirus



Red sea bream Iridoviral Disease



The Problems of Virus Vaccine Development

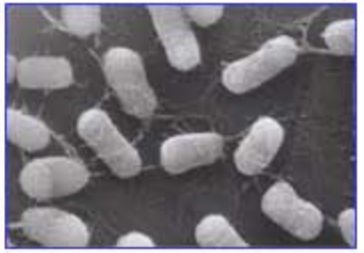
- Selection of host cell line
- Purification of virus
- Safety issues of genetically modified organisms
- Decision of the time of vaccination

Plans of Virus Vaccine Development

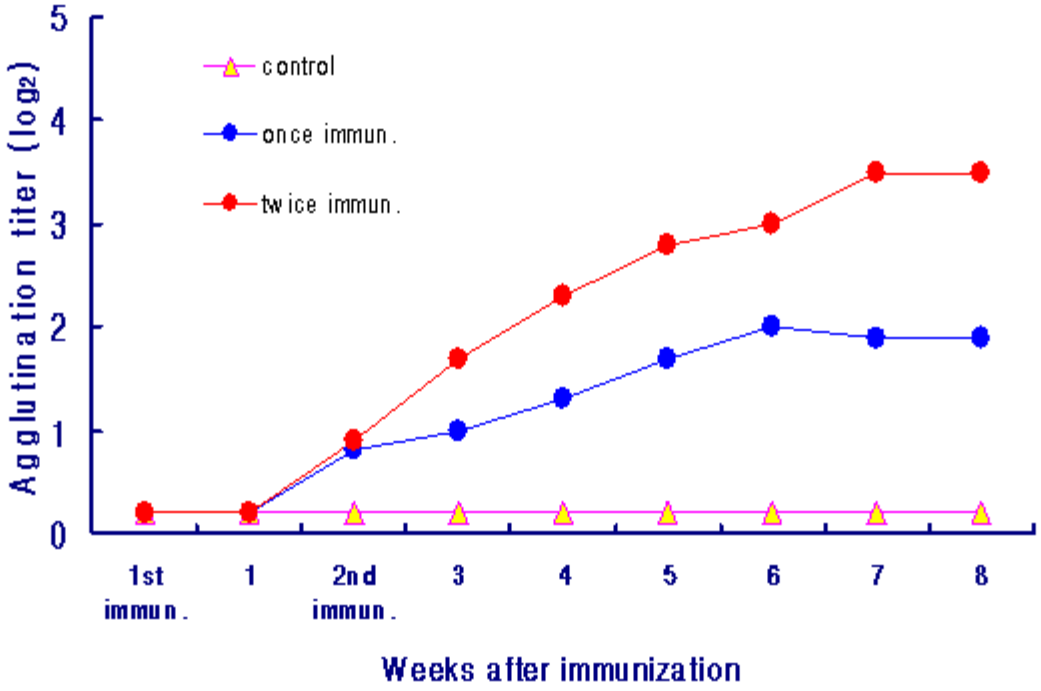
- VHSV: Olive flounder
- Nodavirus: Olive flounder, Grouper, Sea bass
- KHV: Colored carp
- SVC: Carp

Edwardsiellosis

- **Pathogen**: *Edwardsiella tarda*
- **Target organism**:
  Flounder, red sea bream
- **Outbreak period:**
  All the year round
  Caused by chronic
  High cumulative mortality
- **Symptom**:
  Expanded abdomen, rupture,
  Darkness, ascites, exophthalmia



Efficacy of the Immune System to Vaccination



Agglutination titer after vaccination

Cumulative mortality of vaccinated olive flounder infected with *Edwardsiella tarda*

Vaccination	Number of fish Immunized and challenged	Dose of challenged (cells/fish)	Number of fish died	RPS (%)
1st	10	7.1×10^4	2	50
	10	7.1×10^5	5	17
	10	7.1×10^6	8	11
	10	7.1×10^7	9	10
2nd*	10	7.1×10^4	1	75
	10	7.1×10^5	1	83
	10	7.1×10^6	3	67
	10	7.1×10^7	5	50
Control**	10	7.1×10^4	4	
	10	7.1×10^5	6	
	10	7.1×10^6	9	
	10	7.1×10^7	10	

* Second immunization was practiced at 2 weeks after first immunization

** Unimmunized

Edwardsiellosis

Mortality of olive flounder with after challenged virulent *Edwardsiella tarda* at week 4 after immunization by fish size

Fish size (body weight)	Number of fish immunized and challenged	Dose of challenged (cells/fish)	Number of fish died	Mortality (%)
1.2g	10	6.9×10^{4}	2	20
	10	6.9×10^{5}	4	40
	10	6.9×10^{6}	6	60
	10	6.9×10^{7}	9	90
6.5g	10	6.9×10^{4}	3	30
	10	6.9×10^{5}	3	30
	10	6.9×10^{6}	7	70
	10	6.9×10^{7}	8	80

Efficacy of immersion vaccination against *Edwardsiella tarda* on the cultured olive flounder

	Number of tested fish	Monthly mortality								Cumulative mortality	RPS (%)
		4	5	6	7	8	9	10	11		
Vaccination	5,000*	5	7	0	7	19	15	0	10	63	94.4
Control	5,000	10	5	2	36	643	318	75	38	1,127	

* Average body weight : 1.2g (4～5㎝)

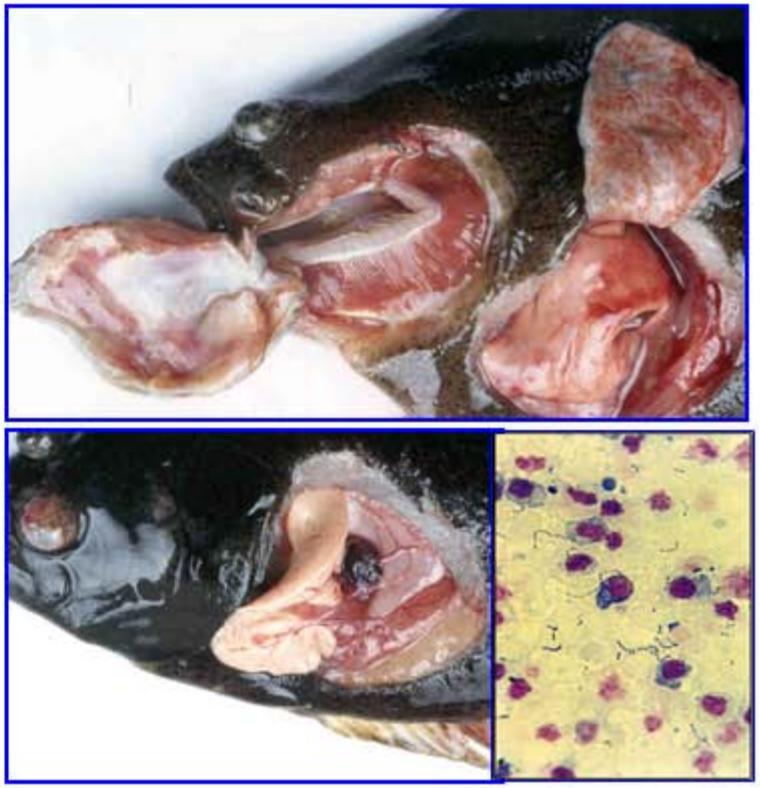
Streptococcosis

- **Pathogen**: *Streptococcus iniae,*
  S. parauberis,
  Lactococcus garvieae

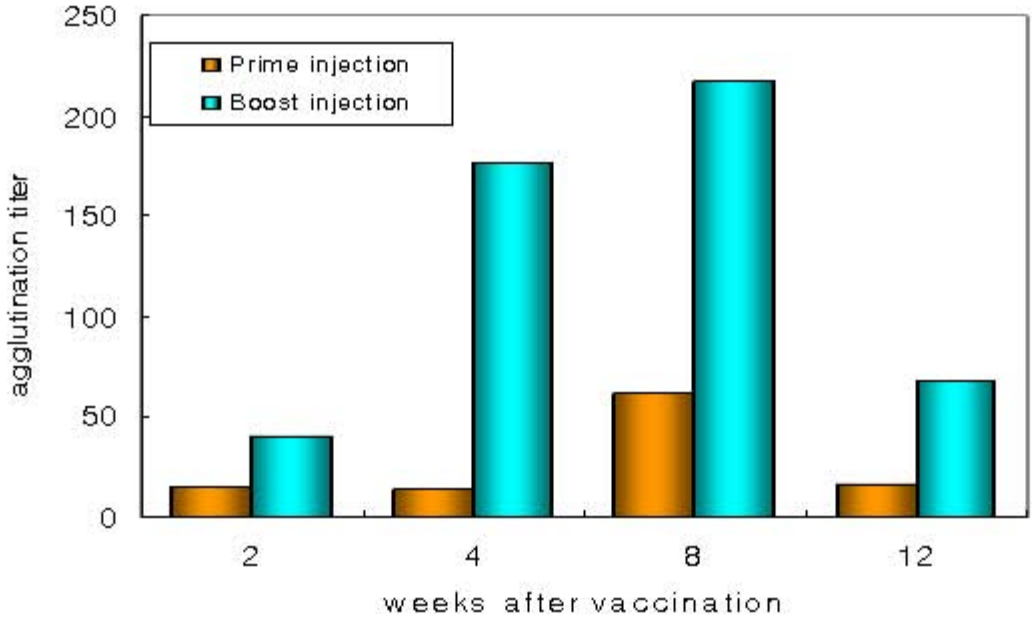
- **Target species**: Flounder, Rock fish,
  Yellow tail, Red sea bream

- **Outbreak**: High temp. season (July-Nov)

- **Symptom**:
  Haemorrhages within the opecular cavity, abdomen and internal organs, ascites, enlargement of the spleen, bloody spot inside of the opercula and peritoneum

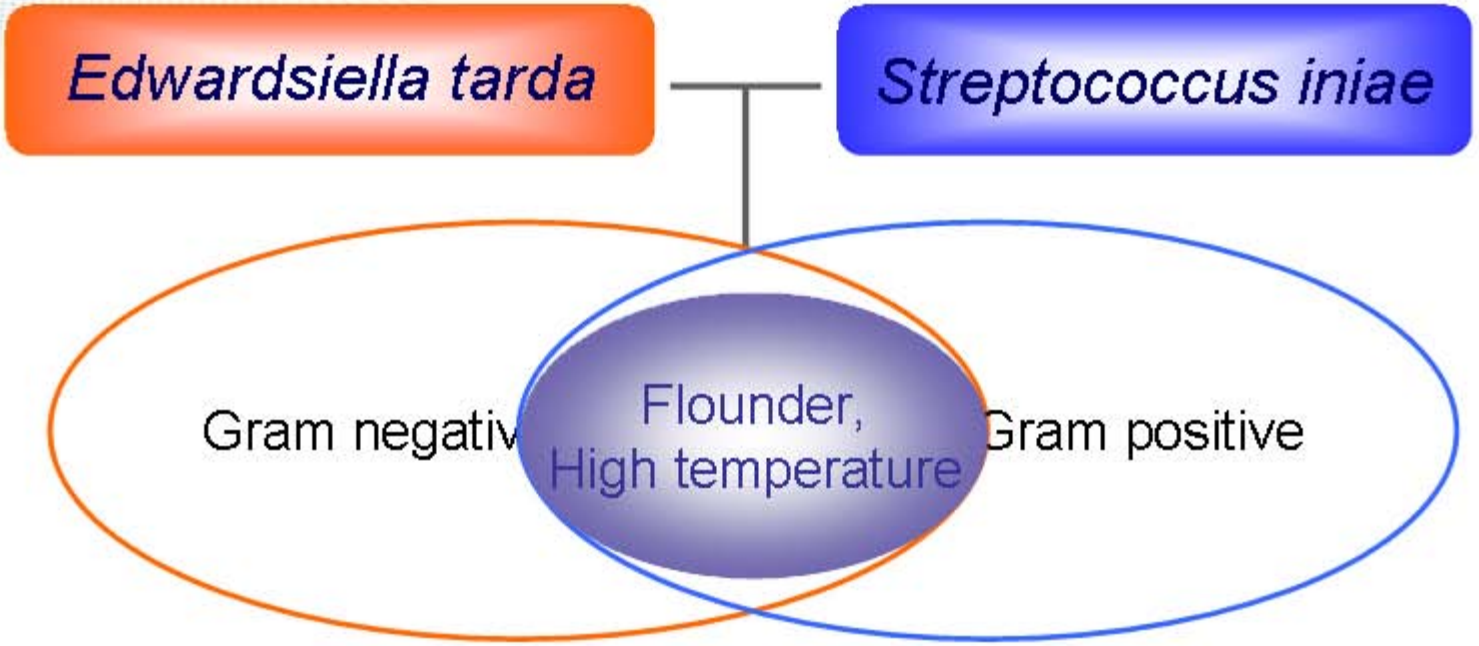


Maintain stability and high defense preserved after 15 months



Change of agglutination titer after 15months

Mixed Vaccine (Edwardsiellosis+ Streptococcosis)



The onset of the disease / single infection, mixed infection

Fish Bacteria Vaccine

Selection of Bacterial Strains for Mixed Vaccine




Isolation of the pathogen in pure culture

Characterization of pathogen

- Biochemical and genetic characterization
- Serological and antigenic studies
- Charactrization of virulence factors




Vaccine formulation

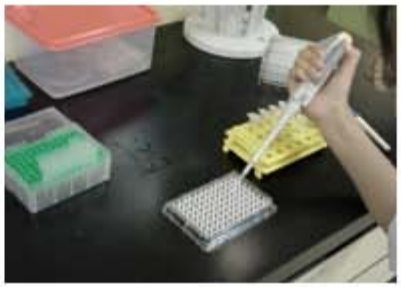
Evaluation of the efficacy

Fish Bacteria Vaccine

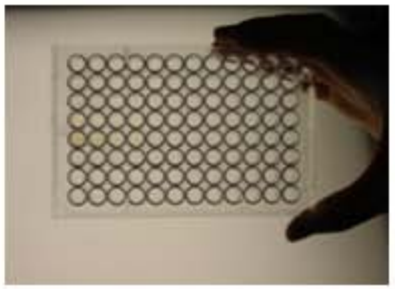
Efficacy of Immune Induction Using Mixed Vaccine

Vaccination

Serum separation



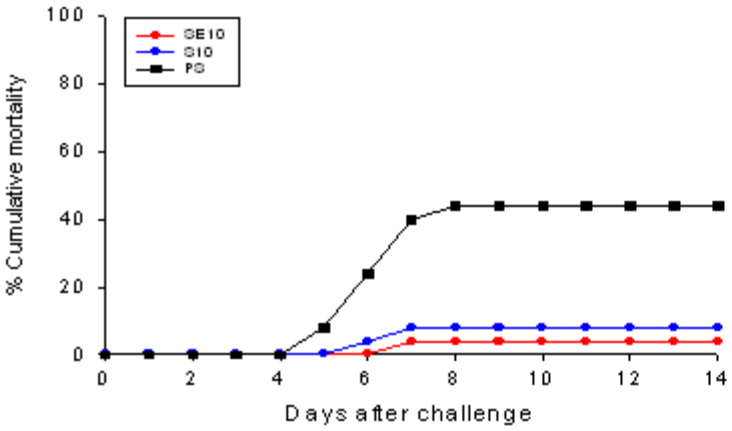
Formation of antibodies to pathogens



Validation of the Superior Efficacy of Bacteria Mixed Vaccine

- the protection of two kinds for the disease is acquired just one time vaccination
- Relative survival rate of mixed vaccine is higher than that of single vaccine in 9-21%
- Immune effects of a short period of time is expected without additional inoculation

(A)



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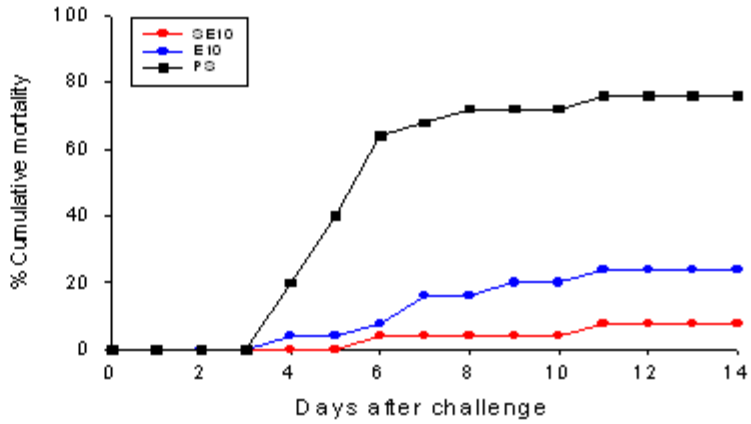


연쇄+에드와드 혼합백신의 단독 및 혼합투여 후 *S. iniae* 와 *E. tarda* 에 대한 누적폐사율

History and Vision of Fish Vaccine

- Vaccine program
- Oil-based vaccine
- Polyvalent vaccine(*E.tarda*+*S.parauberis*+ *V.harvey*
- Mixed vaccine(*Edwardsiella tarda* + *Streptococcus iniae*)
- Recombinant vaccine(Iridovirus)
- Injection vaccine(*Streptococcus iniae*)
- Immersion vaccine(*Edwardsiella tarda*)

Research Trends in Korea

Present

Treatment by antibiotics

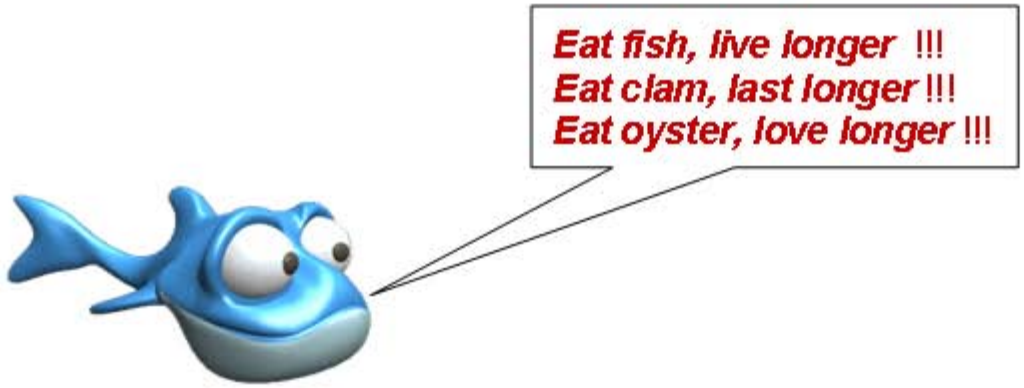
[problems]

- Increased antibiotics resistance bacteria
- Food safety threats by residual antibiotics
- Mixed infection
- Viral disease

Future

Focus on prevention

- Highly efficacy vaccine development
- Development of immunostimulants
- Standardization of diagnostic methods
- Development of disinfection protocols



Thank you for your attention

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