Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Pests, Weeds, etc.]

Impact

<Current status>

[Pests and Diseases]

○ The distribution areas of the southern green stink bug and the golden apple snail have expanded from parts of the southwestern warm regions to parts of the Kanto region.

[Weeds]

○ Some weeds have expanded their distribution areas northwards because of successful overwintering.

○ Expansion of the distribution area of invasive weeds including invasive alien species

[Mycotoxins]

○ Temperature may influence the distribution of aflatoxin-producing fungi.

Golden apple snail

Photo: Mie Prefectural Agricultural Research Institute

Current distribution of the southern green stink bug

Source: MAFF and Pest forecasting information by each Prefecture (Oct. 2018)

<Future prediction>

[Pest]

○ Changes in the composition of pests and natural enemies in paddy fields, increase in damage due to an increase in the number of generations per year, and possibility of changes in the overseas situation of migratory pests

○ Possibility of increasing difficulty in pest control due to an increase in the amount of occurrence and changes in seasonal occurrence.

[Diseases]

○ Increase of rice sheath blight under high CO_2 conditions

[Weeds]

○ Possible expansion of established area and agricultural damage in some species

[Mycotoxin]

○ Concerns about increasing density of mycotoxin-producing fungi in the soil

healthy infected

rice sheath blight

Photo: Kyushu-Okinawa Agricultural Research Center, NARO

Source: Central Agricultural Research Center, NARO

Countermeasures

Implementation of countermeasures

[Pests and Diseases]

○Understand the situation of occurrence and damage of pests and review the plants and animals designated as harmful speciesthrough the pest forecasting service.

○Establishment of a pest control system that responds to climate change

○Review and revision of import quarantine, pest risk analysis (PRA), and measures based on the results of PRA to prevent introduction of pests and diseases from overseas

○Domestic quarantine, invasion alert survey and control of invasive pests

[Mycotoxin]

○Investigating occurrence data

○Formulate and disseminate safety improvement measures in cooperation with producers, and verify their effectiveness after a certain period of time.

Research and Development

[Pests and Diseases]

○Development of technology for monitoring changes in the dispersal of long-distance migratory insect pests from overseas and technology for predicting changes in their distribution areas in Japan.

○ Development of prediction techniques for the entry and occurrence of transboundary pests such as planthoppers and cutworms

○ Development of a support system for control of the golden apple snail

[Weeds]

○ Development of management techniques for invasive weeds that cause agricultural damage

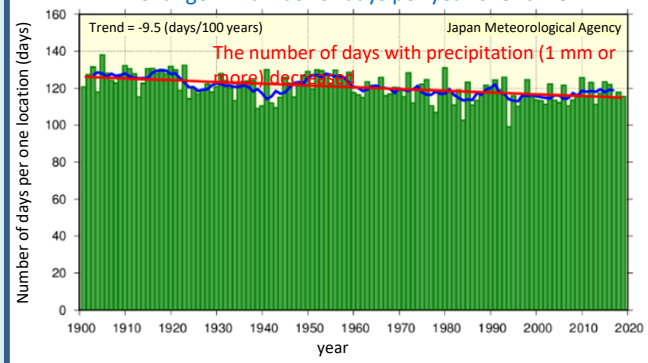
Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Agricultural Production Infrastructure]

Impact

<Current status>

- ○ Short, heavy rains occur frequently, while droughts due to light rainfall also occur.
- ○ In response to high temperatures, changes in the timing of rice planting, changes in water management, etc., will affect water demand.

Daily precipitation of 1.0 mm or more
Change in number of days per year over time



Source: Japan Meteorological Agency

Coping with high temperatures and Impact on water demand (example)

○ Late planting of rice
Postponement of irrigation period
○ Daytime deep water and nighttime drop water management
→Increase in the amount of water used

Extension of waterlogging period
→Increase in the amount of water used

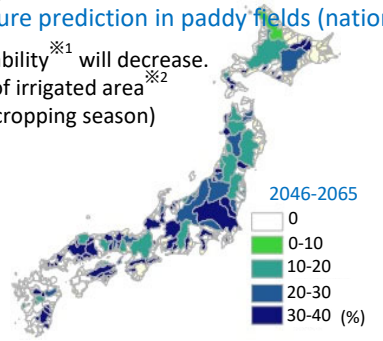
Source: Institute of Rural Engineering, NARO

<Future prediction>

- ○ Decrease in snowmelt runoff volume, affecting water intake at agricultural water utilization facilities
- ○ Increased risk of waterlogging damage to farmland due to increased rainfall intensity
- ○ The number of days without rainfall has increased, affecting the recovery of reservoir storage capacity.

Example of future prediction in paddy fields (nationwide)

Water availability※1 will decrease.
Proportion of irrigated area※2
(during the cropping season)



※1 Sufficiency ratio: Amount of water supplied / amount of water required
※ 2 Total irrigated land in the basin between 2046 and 2065
Percentage of districts with lower fill rates relative to the number of districts

Source: Rural Engineering Research Division, NARO

Waterlogging damage to farmland caused by torrential rain

Countermeasures

Drought prevention measures	Measures against waterlogging, etc.
○Efficient securing and utilization of agricultural water through an appropriate combination of hard and soft measures ・Reduction of water consumption through automation of water management and use of pipelines, etc. ・Effective use of existing water sources through changes in the operation of reservoirs and agricultural dams	○Maintaining and improving of disaster prevention and mitigation functions in rural areas through an appropriate combination of hard and soft measures. ・Promotion of the prevention of waterlogging damage to farmland by improving drainage pump stations and drainage channels. ・Grasp facilities and areas that are highly vulnerable to waterlogging, and conduct risk assessments such as developing hazard maps. ・Promotion of the formulation of business continuity plans by facility managers. ・Implementation of efficient countermeasures by effectively using existing facilities and utilizing the functions of local communities.

○Prediction and assessment of medium- to long-term impacts based on new scientific findings
○Establishing an impact assessment method and clarifying the rationale for developing facilities based on future prediction

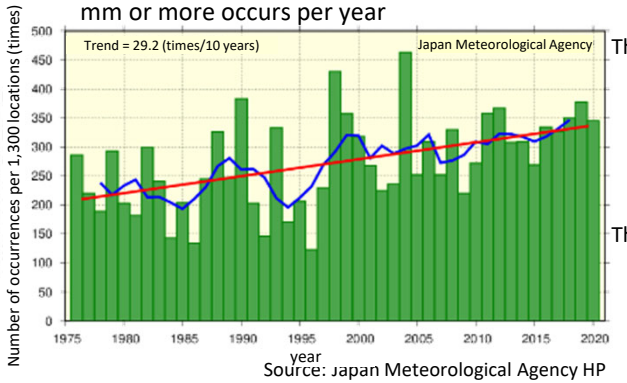
Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Mountainous Disaster and Forest Conservation Works and Forest Road Facilities]

Impact

<Current status>

- ○ Concentrated torrential rainfall caused by the formation of linear precipitation zones triggers multiple surface collapses and mudslides.
- ○ Driftwood disasters occur frequently when collapsed sediment flows downstream, engulfing standing trees and sediment in the vicinity of the stream, causing a large amount of driftwood.

■ Number of times an hourly precipitation of 50 mm or more occurs per year



Source: Japan Meteorological Agency HP

■ Severe mountain disasters caused by torrential rains

The outbreak of simultaneous collapses

Heavy rainfall in July, 2018 (Hiroshima, Japan)

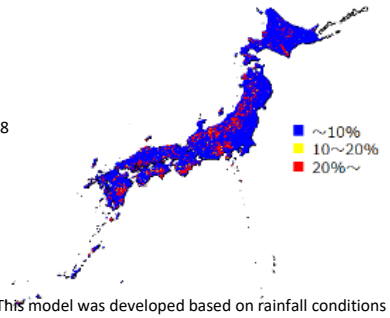
The occurrence of severe driftwood disasters

July, 2017 Devastated northern Kyushu (Fukuoka, Japan)

<Future prediction>

- ○ Increase in the frequency of heavy rainfall due to climate change, and increase in the number of simultaneous collapses of hillside slopes and mudslides due to increased localized heavy rainfall
- ○ Increased risk of damage from storm surges, tidal waves and tsunamis, and increased coastal erosion trends

■ Slope Failure Probability (2081-2100)



※This model was developed based on rainfall conditions and disaster records in one area. It is necessary to verify the rainfall conditions and disaster records for a wide area in the future.

Source: Integrated Report on Climate Change Observation, Prediction and Impact Assessment 2018

■ 1/25-year probability with uncertainty
Projected future changes in storm

※ Storm surge anomaly (rise and fall of sea level due to storm surge) with a probability of occurrence of 1/25 years (4% annually)

Source: Integrated Report on Climate Change Observation, Prediction and Impact Assessment 2018

Countermeasures

Implementation of countermeasures, research and development, etc.

[Increased risk of occurrence of mountain disasters]

- ○Promotion of mountain control measures and forest improvement based on the "Five-Year Acceleration Plan for Disaster Prevention, Disaster Mitigation, and Building National Resilience" and other measures
- ○Development of forest road facilities in consideration of the increased frequency of torrential rains.

(Response to changes in the form of disasters such as river flooding)

- ○Promote efforts to improve and conserve forests in the upper reaches of rivers, etc., in cooperation with efforts for watershed flood control.
- ○Reduce the risk of driftwood disasters by installing driftwood-catching dams, conducting forest maintenance such as thinning to promote the development of root systems, cutting down dangerous trees in mountain streams, and changing forest types with consideration for the stream ecosystem.
- ○Control of sediment runoff through the careful placement of erosion control dams.

[Increased risk from storm surges, tidal waves and tsunamis]

- ○Strengthen development of coastal disaster prevention forests to protect against tsunami and wind damage.

[Research and development, etc.]

- ○Study to improve the accuracy of identifying high-risk areas for mountain disasters by using laser surveying, etc.
- ○Study on the development of facilities to cope with disaster risks and forest management utilizing the disaster prevention and mitigation functions of forests.

Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Planted Forests]

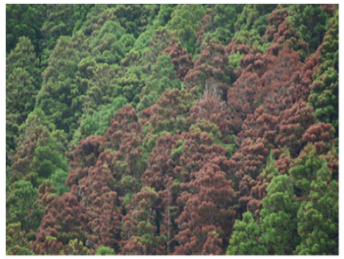
Impact

<Current status>

○ It has been reported that cedar forests are declining due to increased water stress caused by the drying of the atmosphere in some areas.

○ It has been reported that high temperatures increase the risk of forest pests and diseases.

※Since factors other than temperature can also affect damage, careful verification of the current impact is needed.



Withering cedar trees due to drought

Vectors of pine wilt disease (Bursaphelenchus xylophilus)

<Future prediction>

○Vulnerability of planted cedar forests may increase in areas with low rainfall

○There are examples of studies that predict an increase in the distribution of forest pests and diseases

Decreased growth and death of trees due to increased temperatures, dryness, and weather damage

Occurrence in areas where pine beetle damage has not been seen in the past, such as high latitudes and high elevations

Research and study on the impact of climate change on the forest and forestry sectors is needed.

Countermeasures

Research and Development

○Assessment of climate change impact prediction and adaptation measures for forestry

○Continue monitoring of forest damage

Long-term monitoring of plantation forest growth

Pine wood nematode disease monitoring study sites

Implementation of countermeasures

○Evaluate the adaptability of plantation trees by conducting wide-area planting tests of seeds and seedlings of major plantation tree species from different origins.

○Control of forest pests shall be continued in cooperation with prefectures, etc. based on the Law for the Control of Forest Pests in order to prevent the spread of forest pests

Responding to Climate Change. Promotion of variety development

Prevention of infection (chemical spraying)

Felling and extermination (fumigation treatment)

Measures against pine weevil damage

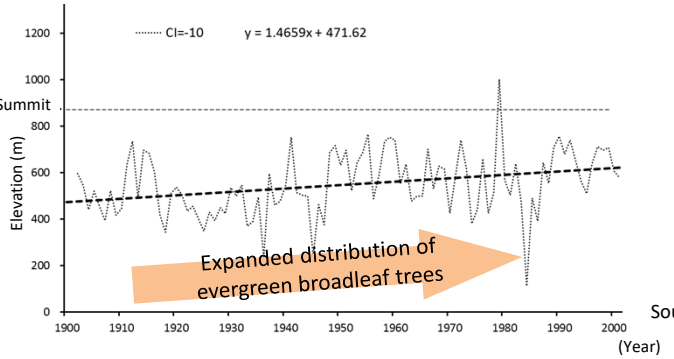
Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Natural Forest]

Impact

<Current status>

○ There are areas where deciduous broadleaf trees are likely to have been replaced by evergreen broadleaf trees due to rising temperatures.

■ The upper limit of the potential vertical distribution of evergreen broadleaf forests



Source: FFPRI

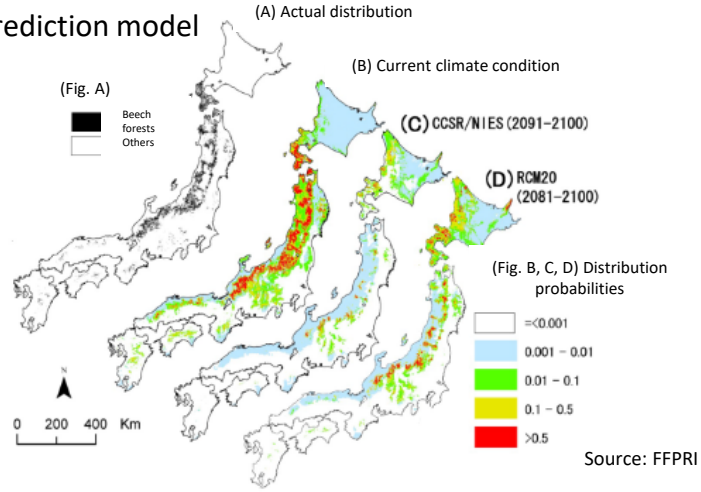
The upper elevation of the warm-temperate evergreen broad-leaved forest zone on Mt. Tsukuba has increased by 147 m over the past 100 years*.

※ Estimating the distribution limit elevation of evergreen broad-leaved trees using climate data for the past 100 years

<Future prediction>

○ It has been reported that the distribution area of some cool-temperate species decreases and that of some warm-temperate species increases.

■ Distribution prediction model for beech forests



Source: FFPRI

The probability of beech distribution in 2081-2100 decreases when the temperature rises 4.9° C above the present level (C) or 2.9° C above the present level (D).

Countermeasures

Implementation of countermeasures

○Promote appropriate conservation and management through ongoing monitoring surveys and other measures in "protected forests" and "green corridors" in state-owned forests.

A black bear in the Green Corridor

Protected forests that are properly protected and managed

Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Non-Timber Forest Products (Mushrooms, etc.)]

Impact

<Current status>

○ Increase in temperature during the summer, resulting in the outbreak of pathogenic bacteria and a decrease in the amount of shiitake mushroom bodies (mushrooms) produced

Hedgerow infected with pathogen

■ **More reports of damage caused by Hypocreia spp. in Kyushu**

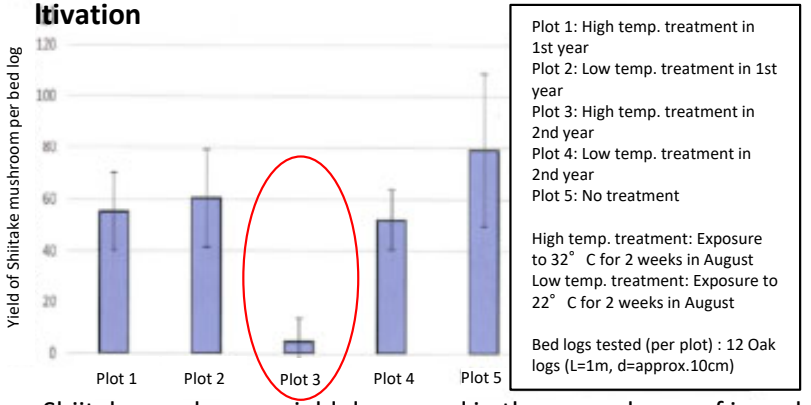
Source: Kyusyu Research Center, FFPRI

<Future prediction>

○ Decrease in outbreaks of pathogenic fungi and the amount of shiitake mushroom bodies (mushrooms) due to rising temperatures in the summer

○ Impact of rising temperatures in winter on log cultivation

■ **Impacts of temperature treatment in summer on shiitake ltivation**



Shiitake mushroom yield decreased in the second year of inoculation in the test area under high temperature

Vertical line: Standard deviation, * Yield: Dry weight (g) Source: Kyusyu Research Center, FFPRI

Countermeasures

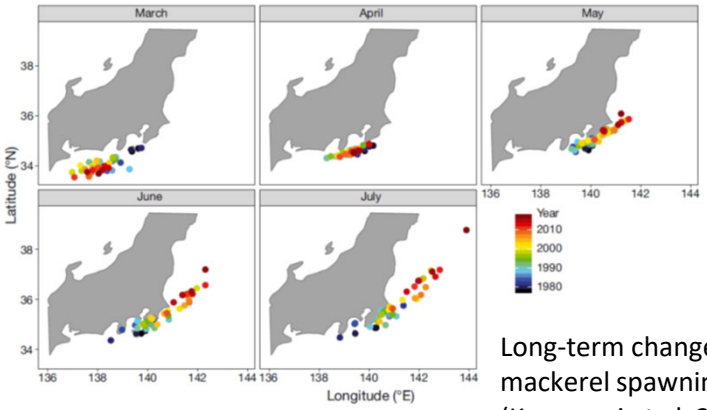
Understanding of the impact	Research and Development
○ Estimation of damage caused by pathogens and infection routes	○ Study of cultivation method to suppress temperature rise in the field
○ Occurrence of damage caused by the mushroom fly	○ Promote the development, demonstration, and dissemination of cultivation techniques and varieties of shiitake adapted to a warming climate.
○ Yield in high temperature environment in summer	
○ Promote accumulation of data on outbreaks of pathogens, yield, etc.	

Outline of the Climate Change Adaptation Plan of the Ministry of Agriculture, Forestry and Fisheries [Marine Fisheries]

Impact

<Current status>

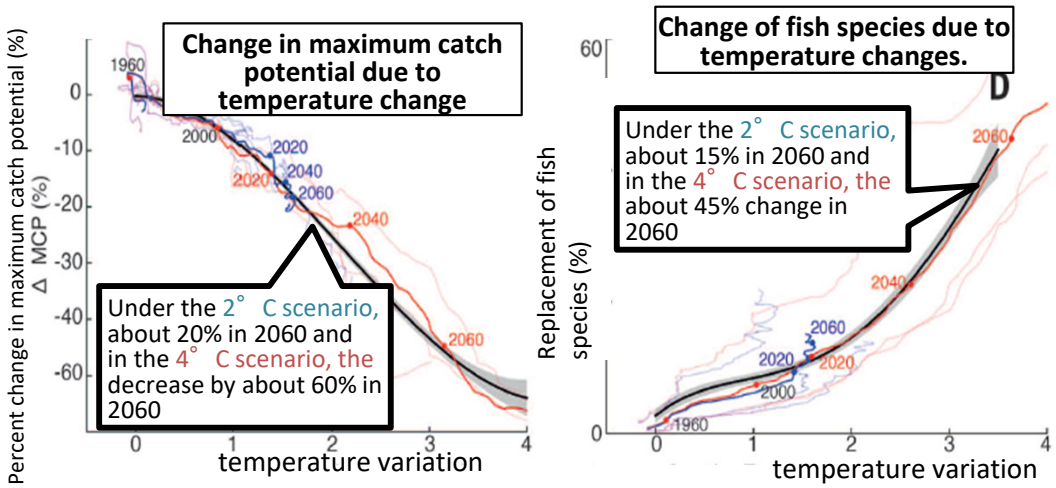
- ○Northward shift of mackerel spawning grounds and extension of spawning period
- ○Increase in catches of yellowtail and Spanish mackerel
- ○Decrease in return rates of chum salmon
- ○Decrease in recruitment and survival of Japanese flying squid
- ○Offshore shift of fishing grounds and spawning grounds for saury
- ○Decrease in pollock recruitment
- ○In some areas, the processing and distribution industries have been affected by the above changes.



Long-term changes in estimated mackerel spawning grounds (Kanamori et al. 2019)

<Future prediction>

- ○ Decrease in global potential maximum catch
- ○ The following forecasts have been reported for the waters around Japan
  - ・Decrease in the distribution area of salmon and trout
  - ・Offshore shift to high seas of Pacific saury fishing grounds
  - ・The sparse distribution is expanding and size of Japanese flying squid is decreasing in the Japan Sea.
  - ・ Northward shifts of adult Japanese anchovy distribution and high survival area of juvenile anchovy
  - ・ Northward shifts of yellowtail distribution and changes in their wintering area



*Prepared by Fisheries Agency from Cheung et al. (2016).

Countermeasures

adaptation plan

[Migratory fish]

○Necessity to properly assess the impact of environmental changes in promoting resource management based on scientific stock assessment

○For this purpose, marine environmental surveys will be utilized to improve the accuracy of predicting fishing grounds and stock assessment results, which will lead to promote measures for adaptive fisheries production in response to environmental changes.

[Target species for multiplication]

○Development of release methods for juvenile salmon and other fish in consideration of marine environmental changes.

[Fishing environment]

○Identification of factors affecting harmful algal blooms and countermeasures based on real-time information from various coastal observations

Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Marine Aquaculture]

Impact

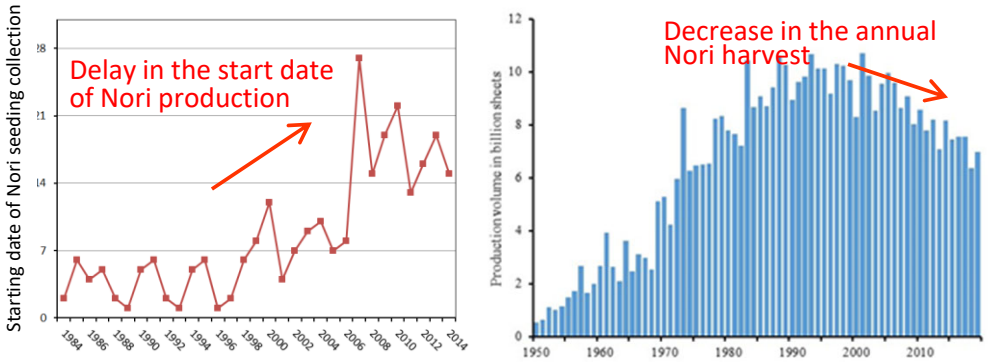
<Current status>

○Increase in mass death of scallop and oyster, and changes in their amount of production in various regions

○Decrease in annual harvest of cultivated laver due to delays of seeding periods

○Identification of northward shift of harmful algal bloom, and occurrence of warm-water species in cold regions and their acceleration

○Delay harvest timing of nori and their unstable amount of production due to high water temperature in autumn



Note: Factors other than global warming may have contributed to the delay in the start of production and the change in yield.

<Future prediction>

○ In yellowtail aquaculture, mortality will increase in summer and growth rates will increase in autumn and winter.

○ In red sea bream aquaculture, growth rate will decrease, and risk of infectious diseases will increase.

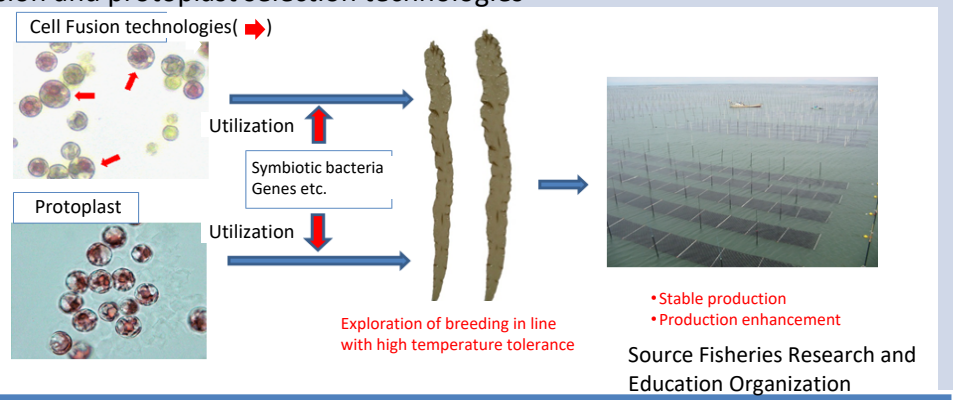
○ The suitable areas for yellowtail, tiger puffer, and flatfish cultivation will move northward, and some areas will become unsuitable for cultivation.

○ Ocean acidification is expected to affect mollusks and echinoderms that have calcium carbonate skeletons and shells. Acidification of the oceans will affect mollusks and echinoderms with calcium carbonate skeletons and shells, and other sensitive aquaculture species.

○ Harmful algal blooms related to rising sea temperatures are expected to increase the risk of bivalve die-offs.

Examples of Initiatives

○ Development of breeding materials for Nori and other species with high water temperature tolerance using novel breeding technologies such as cell fusion and protoplast selection technologies



Source Fisheries Research and Education Organization

Countermeasures

adaptation plan

[Red Tide]

○Continuation of research on the relevance of climate change

○Understand the physiological and ecological characteristics of harmful algae, and develop prediction and prevent technologies for harmful algal blooms.

[Growth, Disease Control]

○Development aquaculture varieties with high water temperature tolerance, etc.

○Develop countermeasure technologies for fish and shellfish diseases that occur at high temperatures and create guidelines for countermeasures against diseases that are feared to invade Japan.

[Ocean Acidification]

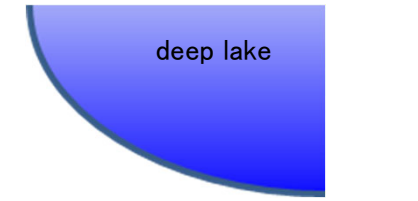
○Development countermeasure technologies based on predictions of the impact of acidification on bivalve aquaculture, etc.

Outline of the Ministry of Agriculture, Forestry and Fisheries Climate Change Adaptation Plan [Inland Fisheries and Aquaculture]

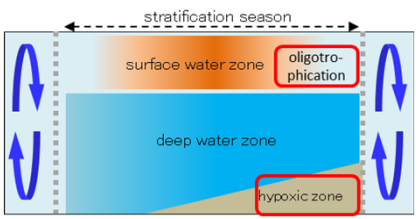
Impact

<Current status>

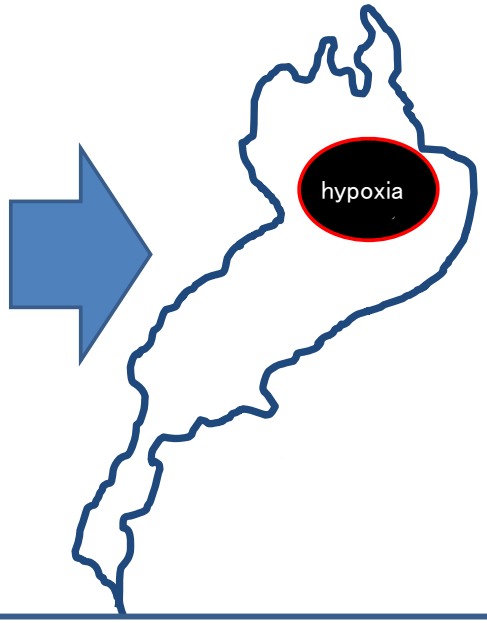
○ Impacts on inland fisheries and aquaculture are not yet apparent.
○ However, in some lakes and marshes, the warm winter has weakened the circulation of lake water, resulting in a decrease in dissolved oxygen at the bottom of the lake and a tendency toward anoxia.
○ High mortality of Japanese pond smelt due to high lake water temperature



hypoxia at the bottom of lake



Hypoxia causes die-offs of fish and decreases habitat area

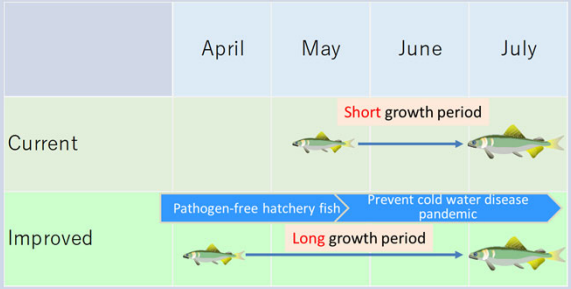


<Future prediction>

○ Habitat contraction of cold-water fish (larger contraction especially in rivers in Honshu)
○ Decrease in catches of Japanese pond smelt due to high water temperature in lakes
○ Earlier run-up of ayu (sweetfish) and reduction in the number of run-ups due to rising water temperatures in the ocean and rivers

Examples of Initiatives

○Study of release methods with changes in the run-up of ayu
○Maximize the effect of hatchery release for juvenile ayu of the appropriate growth stage and time.



Countermeasures

adaptation plan

[Understanding the impact]
○Assess environmental changes in rivers and lakes and their impact on habitats for important resources
○Collect information on disease caused by high water temperature
[Growth, Disease Control]
○Development of technologies for hatchery release and prey plankton production, etc., for the advancement of feeding and releasing techniques for Japanese pond smelt.
○Analyze the impact of rising water temperature on the run-up, run-down, and growth of ayu fish, and develop effective discharge methods.
○Research on the characteristics and pathogenic factors of pathogens originating from high water temperature, and development of technology for control measures