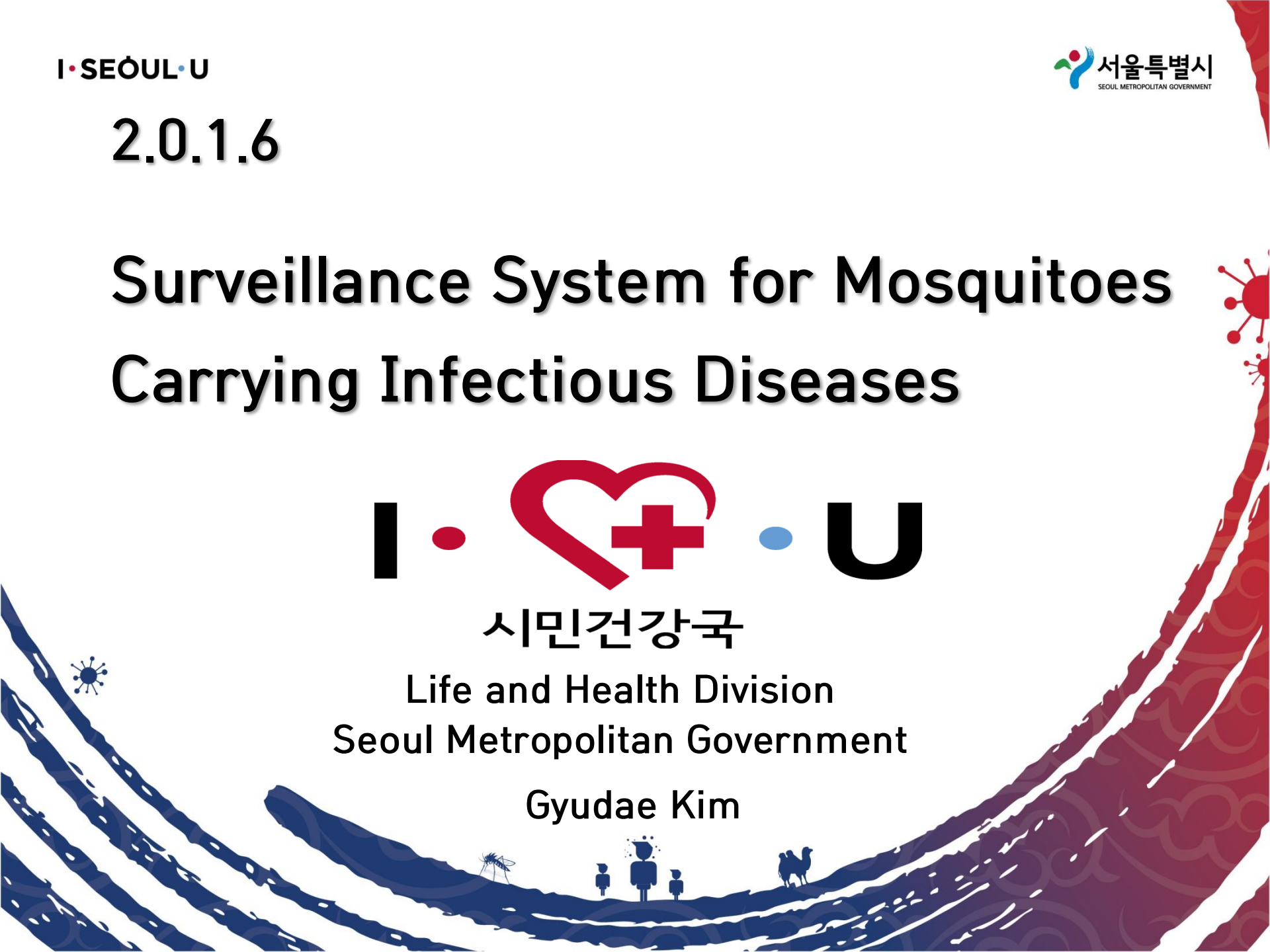서울특별시
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2.0.1.6

Surveillance System for Mosquitoes Carrying Infectious Diseases

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시민건강국

Life and Health Division
Seoul Metropolitan Government

Gyudae Kim

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Ⅰ. INCIDENCES OF MOSQUITO-BORNE INFECTIOUS DISEASES

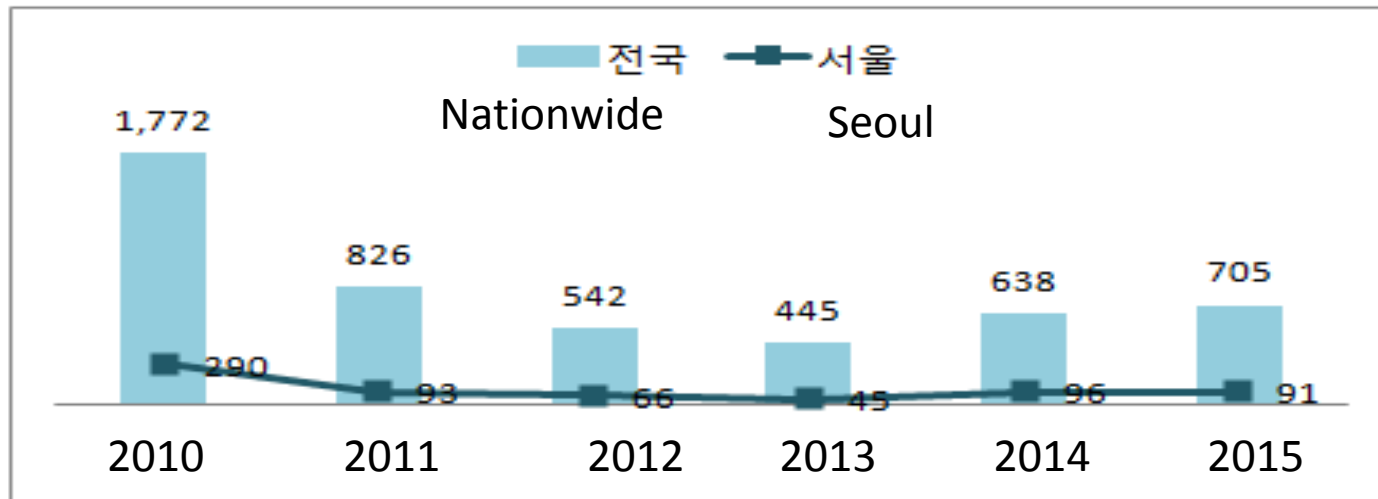# Ⅰ. Incidences of Mosquito-Borne Infectious Diseases

● **Malaria**

➢ **Vector: *Anopheles sinensis*, etc.**

➢ **Route of infection**

 - Gyeonggi-do Province (Paju City, Yeoncheon County, etc.) in
   Korea and Cheorwon County in Gangwon –do Province in Korea as
   well as persons who have travelled to risk areas overseas such as Africa

➢ **Infection ratio: Domestic – 86%, imported – 14%**

Anopheles sinensis

Nationwide   Seoul

전국   서울

	2010	2011	2012	2013	2014	2015
Nationwide	1,772	826	542	445	638	705
Seoul	290	93	66	45	96	91

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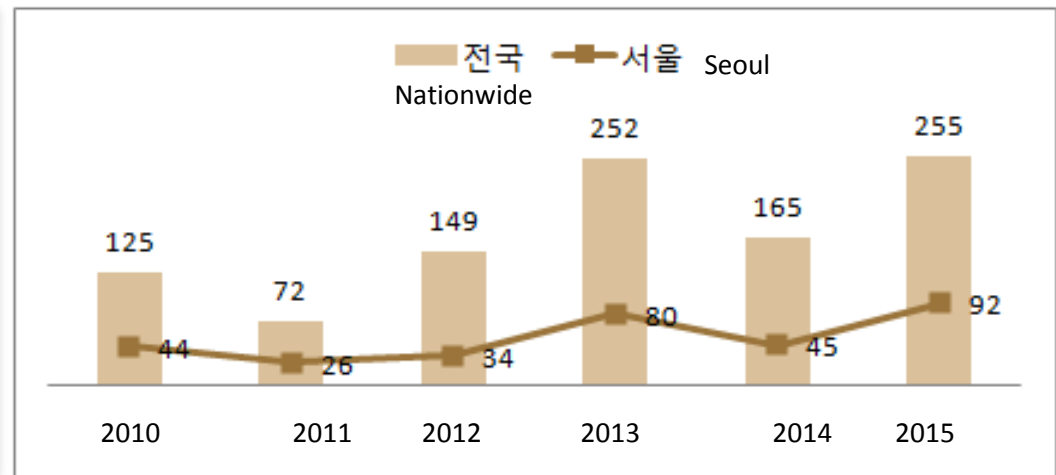# I. Incidences of Mosquito-Borne Infectious Diseases

● Japanese encephalitis

> **Vector mosquito: *Culex tritaeniorhynchus***

> **Route of infection: Infected within Korea**

> **Infection ratio: Domestic – 100% (28 in Seoul)**

Culex tritaeniorhynchus

전국 ▬ 서울

Nationwide   Seoul

Year	2010	2011	2012	2013	2014	2015
Nationwide (전국)	26	3	20	14	26	40
Seoul (서울)	3	0	3	1	11	10
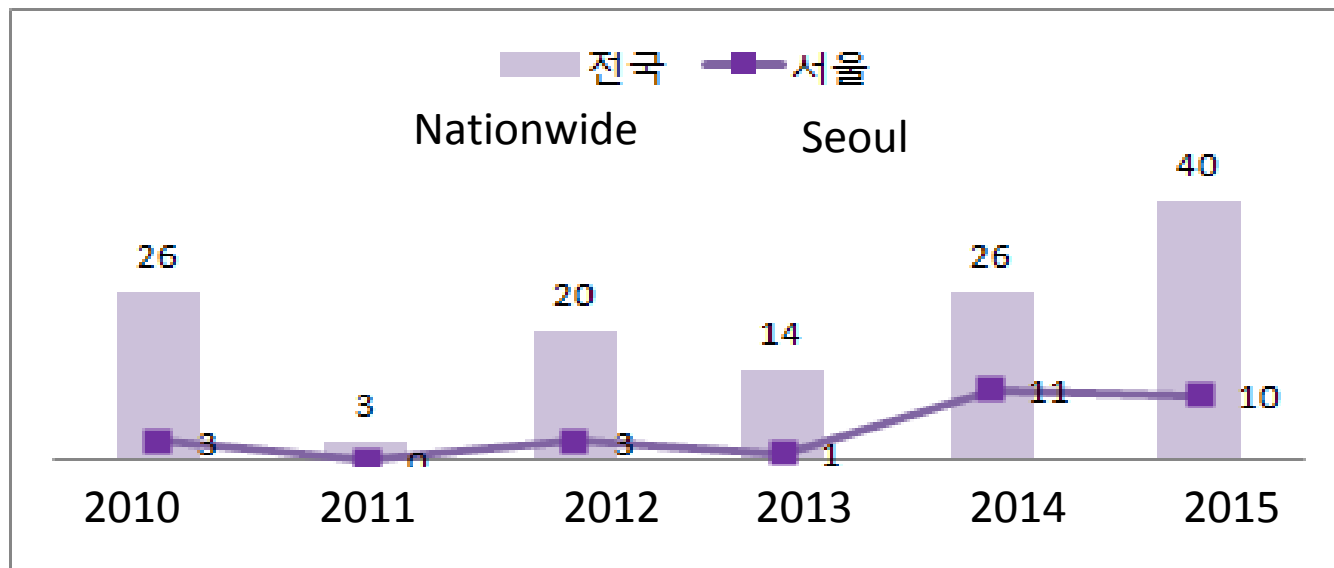
Ⅰ. Incidences of Mosquito-Borne Infectious Diseases

● **Dengue fever**

➢ **Vector: *Aedes albopictus***

➢ **Route of infection: Imported cases who have recently traveled overseas, such as the Philippines, Thailand or other Southeast Asian countries**

➢ **Infection ratio: Imported cases – 100% (321 in total)**

Aedes albopictus

전국 Nationwide 서울 Seoul

	2010	2011	2012	2013	2014	2015
Nationwide	125	72	149	252	165	255
Seoul	44	26	34	80	45	92

Ⅰ. Incidences of Mosquito-Born Infectious Diseases

● Chikungunya fever

- ➤ **Vector: *Aedes albopictus***
- ➤ **Route of infection: First imported case reported in Seoul (2015, a citizen with a history of travelling to India)**
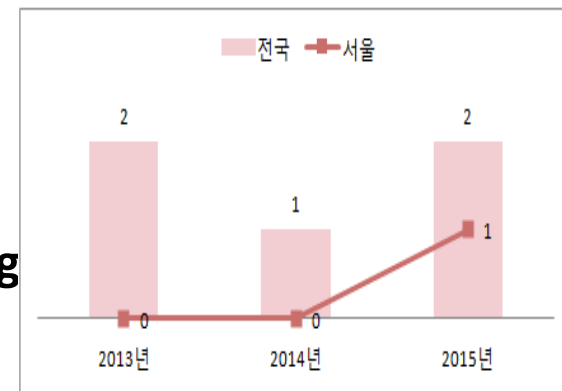
● Zika virus infection

- ➤ **Vector: *Aedes albopictus***
- ➤ **Route of Inspection: First imported case reported in Seoul**

   (2016, *2nd case in Korea)

  - First case (March 22, Brazil)

   *2nd case (April 27, Philippines), *3rd (April 29, Philippines, no symptoms), 4th (May 7, Viet Nam) and 5th (May 11, Philippines)

II. SEOUL METROPOLITAN GOVERNMENT'S MOSQUITO SURVEILLANCE SYSTEM

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Ⅱ. SMG's Mosquito Surveillance System

● **Black light traps and digital (mosquito) monitoring systems (DMS) are in place to monitor mosquitoes carrying major infectious diseases.**

54 units — Black light traps

Community health centers collect mosquitoes once a week. Analysis and feedback by the Institute of Health and Environment (IHE)

50 units — Digital Monitoring Systems

DMS automatically measures mosquito populations on a daily basis. DMS data is used for mosquito control activities as well as the Mosquito Forecast System.
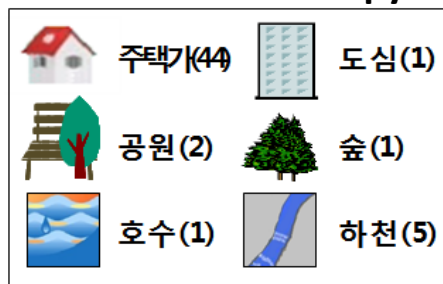
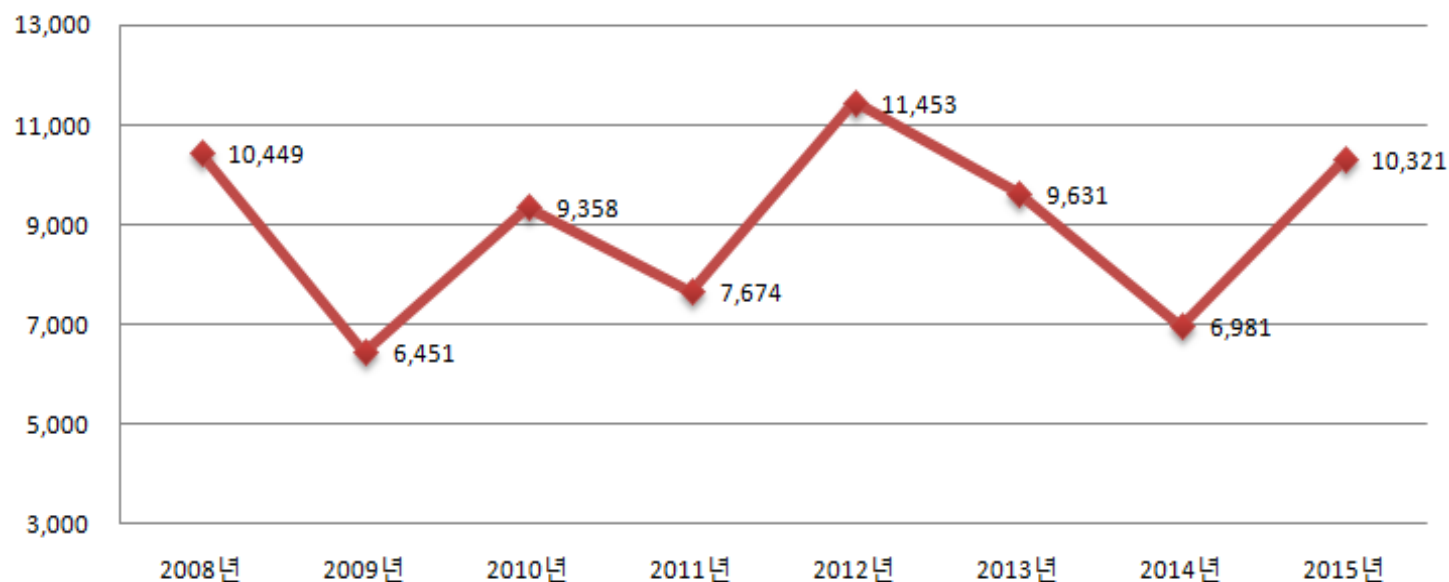● **Black light traps installed in Seoul (54 in total)**

- Two units in each autonomous district

(※ Three units in Eunpyeong-gu and four in Jung-gu)

Ⅱ. SMG's Mosquito Surveillance System

● Number of individual mosquitoes collected in black light traps (2008–2015)

→ The total population size in 2015 was 10,321, an increase of 47.8% compared to that of 2014.

* **Black light trap:** Lighting designed to attract and capture mosquitoes (Two to four units are installed in each district, amounting to 54 in total). Mosquitoes are collected and analyzed once a week from April through November.

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● **Species of mosquitoes captured in black light traps (past three years)**

➢ **Among 14 species of mosquitoes living within Seoul, the dominant one is "*Culex pipiens pallens*" (93%).**

➢ ***Aedes albopictus* (0.04%) are also living in Korea, but there have been no reports of any virus being detected from them.**

Year	Total	*Culex pipiens pallens* (West Nile fever)	*Anopheles* species (Malaria)	*Culex tritaeniorhynchus* (Japanese encephalitis)	*Aedes albopictus* (Deng fever, Zika fever, chikungunya fever)	Others
2013	9,631	9,249	29	–	–	353
2014	6,891	6,467	43	–	10	371
2015	10,321	9,315	59	–	–	947

* **Others: *Ochlerotatus koreicus, Aedes vexans nipponii, Ochlerotatus dorsalis, Ochlerotatus togoi, Anopheles (Anopheles) pullus M. Yamada, Culex orientalis, Culex vagans, Culex bitaeniorhynchus and Armigeres subalbatus***

● **Digital mosquito Monitoring System (DMS)**

Operation duration	April 6, 2015–October 31, 2015
Number of units in operation	50 units (two per district)
Operating system	

First operation started in 2015

Methods of operation

Monitor mosquito populations in each district (automatically every day)

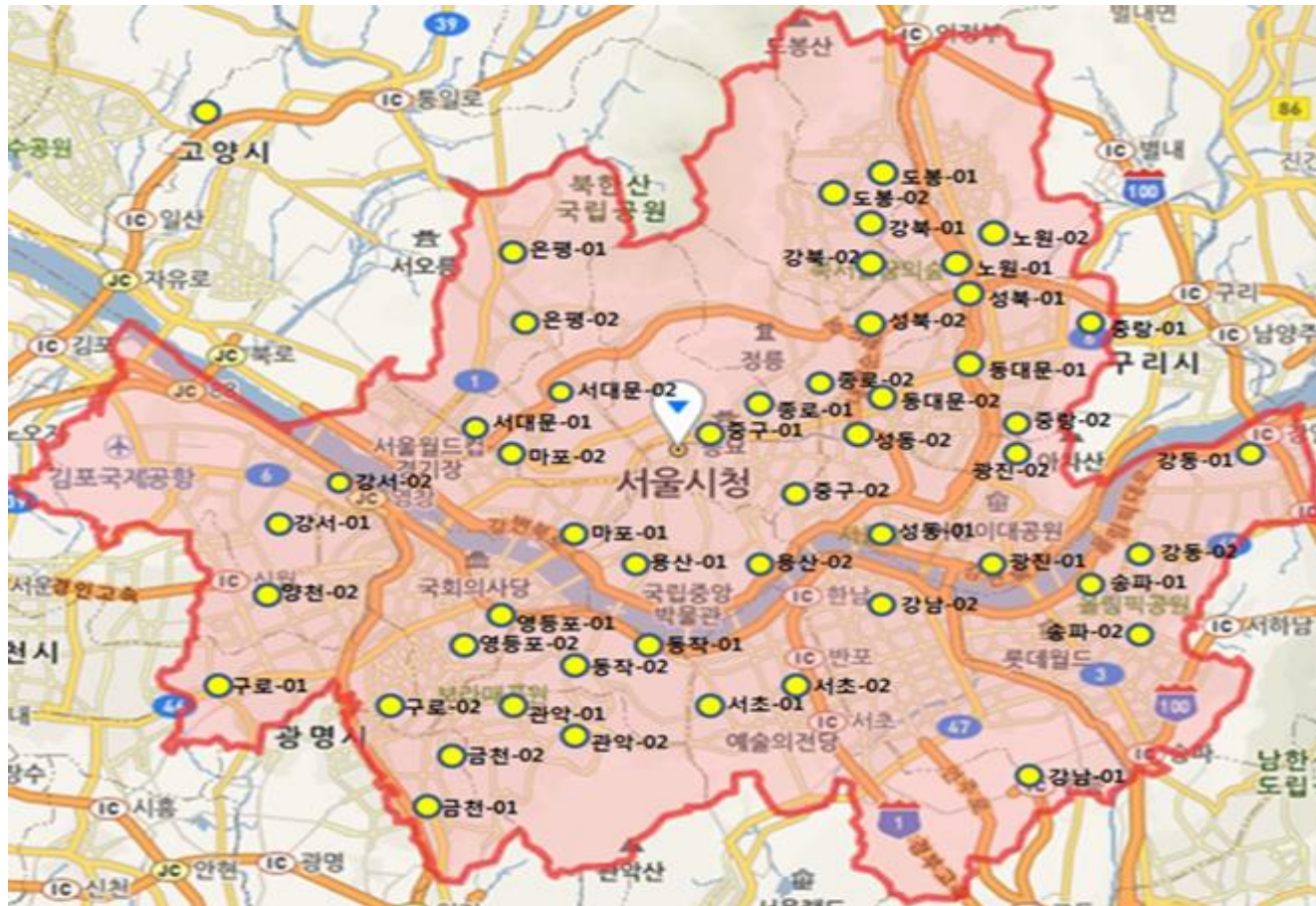Collate all measurement data and analyze accumulated data

Uses of data

Run an accurate mosquito forecasting system using DMS-collected mosquito data

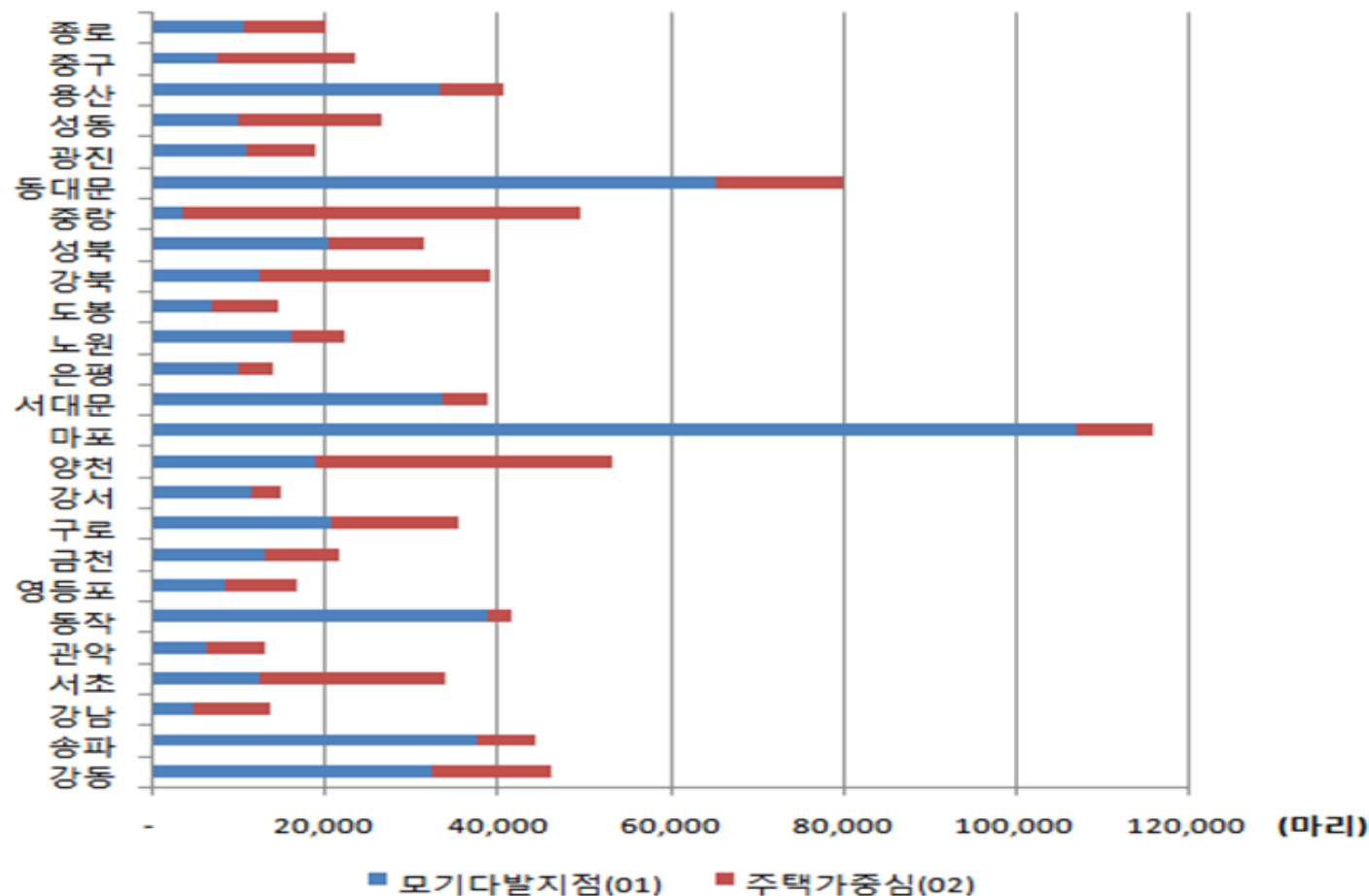Validate control measures and measure effectiveness (adult/larval, smoke/fogging)

● **DMS installation locations**

● **DMS mosquito collection results (2015)**

(As of April 6, 2015 – October 31, 2015)

Ⅱ. SMG's Mosquito Surveillance System

- **Mosquito surveillance data is available for sharing on the Seoul City website (where black light trap and DMS status reports are posted).**

생활보건

생활보건소식

생활보건정책

메르스(MERS)
  메르스(MERS)란
  서울시 대책
  메르스 신고하기

모기예보
  오늘의 모기예보
  모기예보제란
  모기예방법
  모기감시자료

생활보건사업
  공중위생
  감염병
  환경성질환 예방관리
  결핵 예방관리
  먹는 샘물 안전관리
  암환자 지원
  에이즈예방관리
  예방접종
  공중화장실위생 관리

생활보건시설

생활보건자료실

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모기감시자료

2016년 서울시 유문등 채집모기 현황(54개소)

※ 매주 월요일 업데이트

채집일	빨간집모기	작은빨간집모기	가중국·중국얼룩날개모기	흰줄숲모기	기타*	계
4월 3주	7	0	0	0	0	7
4월 4주	40	0	0	0	6	46
5월 1주	35	0	0	0	8	43
5월 2주	109	0	0	0	18	127
총계	191	0	0	0	32	223

*기타 : 반점날개집모기, 동양집모기, 줄다리집모기, 잿빛얼룩날개모기, 등줄숲모기, 한국숲모기, 토고숲모기, 금빛숲모기, 큰검정들모기 등

2016년 서울시 디지털 모기측정기(DMS) 채집모기수 현황(50개소)

※ 매주 월요일 업데이트

● 4월

일	월	화	수	목	금	토
	4/18	4/19	4/20	4/21	4/22	4/23
	187	260	921	1,049	1,293	741
4/24	4/25	4/26	4/27	4/28	4/29	4/30

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III. STRENGTHEN SURVEILLANCE ON *AEDES ALBOPICTUS* TO RESPOND TO THE ZIKA VIRUS
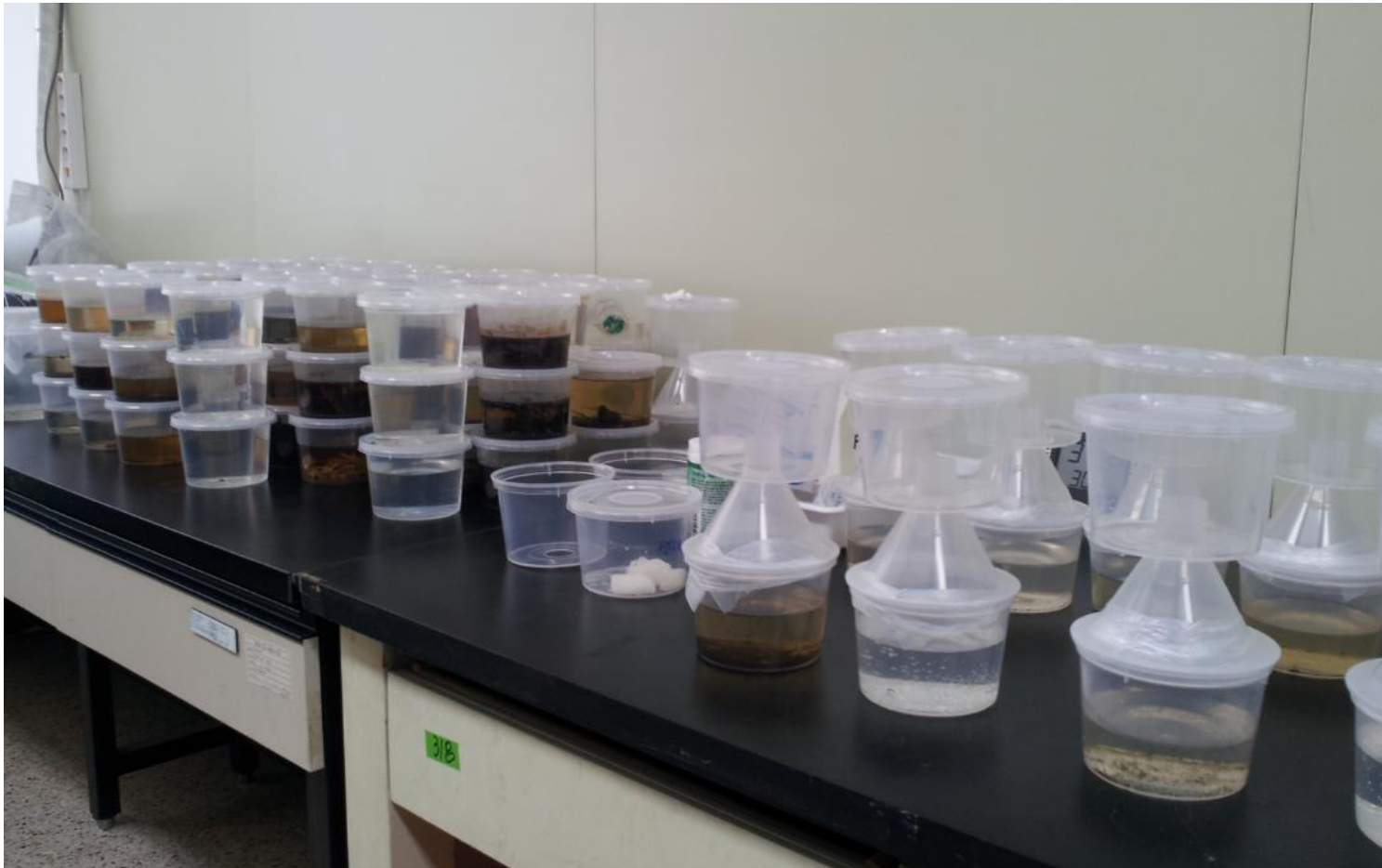
III. Strengthen Mosquito Surveillance Against Zika Virus

● **Project for monitoring overwintering *Aedes Albopictus* eggs (Zika virus vector)**

➢ **Collection and hatching inspection period: March 21-30, March 22-April 15**

➢ **Collection method: Collect artificial containers and humus soil where overwintering mosquito eggs are likely to exist.**

➢ **Collection sites: 21 in total including forests and residential areas near forests**

 - **Locations where *Aedes albopictus* have been found for the past three years (7), forest areas such as mountains and parks (11) and *Ochlerotatus-koreicus*-prone *areas* (3)**

Ⅲ. Strengthen Mosquito Surveillance Against Zika Virus

● **Overwintering eggs of Zika-virus-carrying *Aedes albopictus* are cultured (IHE).**

Ⅲ. Strengthen Mosquito Surveillance Against Zika Virus

● **Mosquito larvae and virus test (IHE)**

III. Strengthen Mosquito Surveillance Against Zika Virus

● Test results: *"Aedes albopictus"* hatched in 6 (app. 6%) out of 102 samples (no virus detected)

Collecting organization	Collection site (surroundings)	Object where found	Sample collection	Adult emergence	Virus (3 species)
Gangbuk-gu CHC	Hill near a residential area	Thrown-away cans		*Aedes albopictus:* 2	ND
Dobong-gu CHC	Waste tire yard in a residential area	Humus in a waste tire		*Aedes albopictus:* 1	ND
Eunpyeong-gu CHC	Mountain at the back of an apartment complex	Earth and other matter in waste tires		*Aedes albopictus:* 27	ND
	Mountain at the back of an apartment complex	Earth, etc. in a Styrofoam dipper		*Aedes albopictus:* 7	ND
Gwanak-gu CHC	Surroundings of the entrance to a hill	Water in a watering pot that lies neglected		*Aedes albopictus:* 11	ND
IHE	Near a temple in Daemosan Mountain	Humus in an artificial container		*Aedes albopictus:* 7	ND

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CHC: Community Health Center
IHE: Institute of Health and Environment
ND: Not detected

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Ⅲ. Strengthen Mosquito Surveillance Against Zika Virus

● **Preventive early control through surveillance on overwintering *Aedes* eggs**

➢ **Environmental clean-up and integrated control for the areas where the species are found**

Ⅲ. Strengthen Mosquito Surveillance Against Zika Virus

● **Additional surveillance using DMS and *Aedes* traps**

➢ **Operational duration: April 19, 2016 – October 31 (seven months)**
➢ **Target areas: 13 in total* (focusing on forests, parks, mountains, flood pumping stations, and residential areas)**

연번	채집기관	감시지점	장비연번	DMS 및 트랩 장소	검사방법
1	보건소	중랑구	7-1	중랑구 망우동 산30-7 중랑캠핑숲	매주1회 (화요일) DMS 채집모기 보건환경 연구원에 의뢰 ※유문등 병행
2		도봉구	10-1	도봉구 해등로 3길 48-11 초안산근린공원	
3		강서구	16-1	강서구 초록마을로 15길 12 봉제산근린공원	
4		구로구	17-1	구로구 오리로 1197 금강수목원아파트	
5		강남구	23-1	강남구 세곡로 166-1 세곡빗물펌프장	
6		송파구	24-1	송파구 신천동 21 몽촌펌프장	
7		강동구	25-1	강동구 아리수로 78길 43-12 동명그린공원	
8	보건환경 연구원	북한산		북한산 일대	매주1회 보건환경 연구원 자체수거
9		관악산		관악산 공원 일대	
10		고덕수변 생태공원		고덕 수변 생태공원 일대	
11		난지천공원,노을공원		난지천공원, 노을공원 일대	
12		양재시민의숲		양재시민의숲 일대	
13		서울숲공원		서울숲공원 일대	

* 흰줄숲모기 월동알 조사결과, 발생지 포함하여 선정

Ⅲ. Strengthen Mosquito Surveillance Against Zika Virus

● **Strengthen mosquito surveillance using DMS units and traps**

➢ **Study method**

· **Community health centers send mosquitoes collected using the DMS to the IHE for analysis once a week.**

· **IHE performs further surveillance on larvae and adults by setting traps in forest areas such as mountains and parks.**

· **If an analysis of collected mosquitoes detects an Aedes mosquito and a pathogen inside of its body, the SMG strengthens control activities.**

Ⅳ. SEOUL METROPOLITAN GOVERNMENT'S MOSQUITO FORECAST SYSTEM

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IV. SMG's Mosquito Forecast System

- **What is Mosquito Forecast System?**

  This daily mosquito forecast service determines the mosquito activity index (MAI) in various areas of Seoul and provides Seoul citizens with guidance on how to act in each stage of mosquito occurrence

  Mosquito forecast?!

- **Process for the implementation of the Mosquito Forecast System**

  ➢ **Introduced as part of the eco-friendly mosquito control plan to ensure healthy coexistence between humans and the ecosystem**

*모기예보 시범사업	모기예보 도입 운영	서울전역 DMS설치	모기예보 산식보정	모기예보 운영
'13.10월	'14~'15	'15년	'16.3월	'16. 5월
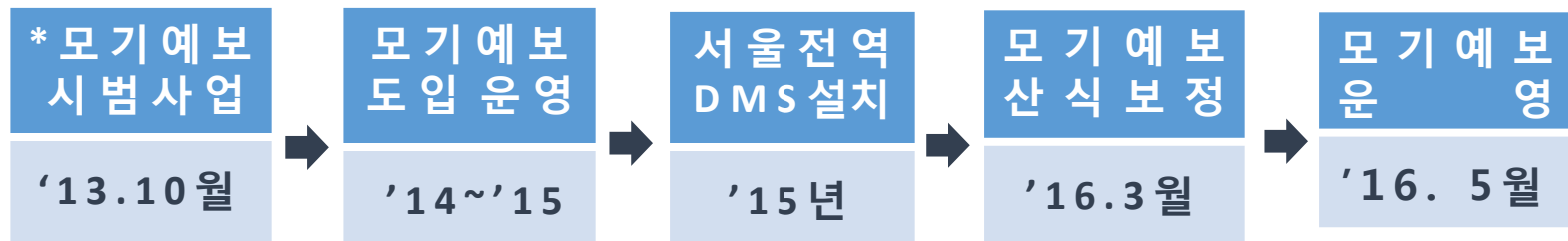
  * Developed for the first time in 2013

  A formula for calculating the number of mosquitoes was developed using the DMS in Yeongdeungpo-gu (12 units) and weather factors. After that, a pilot project was implemented.

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IV. SMG's Mosquito Forecast System

● **Process for developing the Mosquito Forecast System**

➢ **Understand patterns of data based on descriptive statistics (average and standard deviation) for the data collected from 25 DMS units**

➢ **Select meteorological variables for the forecasting formula based on relationships between meteorological variables and data**

➢ **Select an appropriate forecasting formula model after incorporating days of growth and exploring delayed effects.**

※ Outsourcing of the development (2013) and update (2016) of mosquito forecasting formulas

- Research team: Ho Kim and Sun-young Kim (health statistics) and Sung-il Cho (health science) of Seoul National University, Yeong-cheol Yang (insects) of Eulji University, and Hun-bok Lee (ecology) of Seoul Women's University

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IV. SMG's Mosquito Forecast System

● **Mosquito Forecast System: Stage Definitions**

Stage 1 (Pleasant) [MAI: 0–250]	Stage 2 (Attention) [MAI: 251–500]	Stage 3 (Caution) [MAI: 501–750]	Stage 4 (Unpleasant) [MAI: 751–1,000]

➢Stage 1 [Pleasant]: No mosquito larval habitats. Little mosquito activity

➢Stage 2 [Attention]: Mosquito larval habitats – 20% or lower. *Mosquitoes poised to attack during outdoor activity: 1-2

➢Stage 3 [Caution]: Mosquito larval habitats – 20% to 50%. *Mosquitoes poised to attack during outdoor activity: 3-4. Mosquitoes invading a house spotted overnight in a dense residential area (filled with detached houses): 2-4

➢Stage 4 [Unpleasant]: Mosquito larval habitats – 50% or higher. *Mosquitoes poised to attack during outdoor activity: 5 or more. Mosquitoes invading a house in a dense residential area (filled with houses): 5-10

*Poised to attack: It is based on the assumption that a subject stays stationery at one spot for 10 to 15 minutes after exercise at night.

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IV. SMG's Mosquito Forecast System

● **Key points of the Action Tips for Citizens at each stage of the Mosquito Forecast System**

➢ **Alerts are issued for four different stages: The higher the stage is, the more likely mosquitoes are to appear.**

1	2	3	4
Pleasant [MAI : 0–250]	**Attention** [MAI : 251–500]	**Caution** [MAI : 501–750]	**Unpleasant** [MAI: 751–1,000]
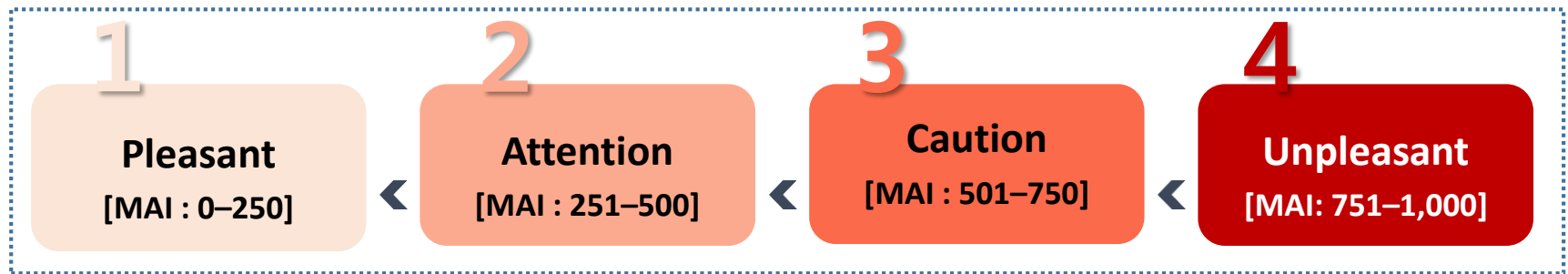
▪**Stage 1 [Pleasant]: Observe mosquito larval habitats. Install window screens to block points of entry for mosquitoes**

▪**Stage 2 [Attention]: Check and repair window screens and septic tanks for any leaks. Remove any stagnant water from empty cans or containers in the surroundings.**

▪**Stage 3 [Caution]: Use repellants during hiking or other outdoor activities. Use mosquito nets. Eliminate larvae in the surroundings.**

▪**Stage 4 [Unpleasant]: Refrain from activity at night. Spray mosquitocide around the house entrance. Report actively to the community health center.**

IV. SMG's Mosquito Forecast System

● **"Mosquito Forecast System" (http://health.seoul.go.kr/mosquito)**

➢ **Operation period: May 1, 2016–October 31 (six months)**

➢ **Forecasting method: Daily forecasts as well as a code of conduct are posted in the Seoul City website.**

·**Websites of Seoul Metropolitan Government, 25 community health centers, Centers for Infectious Disease Control and Korea Meteorological Administration are linked together.**

·**YTN TV broadcasts (text displaying mosquito forecasts in real time on the Weather and Life channel)**

·**Spread mosquito forecasts through SNS such as Seoul city KakaoStory and send text messages**

IV. SMG's Mosquito Forecast System

● **Daily forecasts under the Mosquito Forecast System**

IV. SMG's Mosquito Forecast System

● Updated mosquito forecast data

IV. SMG's Mosquito Forecast System

- **Media coverage of the Mosquito Forecast System**

260 news broadcasts on KBS, MBC, etc.

Thank you